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Balancing research for new risk factors and action for the prevention of chronic diseases

Robert Beaglehole and Rod Jackson

Nutritional epidemiology is notoriously complex and the results difficult to interpret. The scientific literature is replete with contradictory and unconfirmed findings. The lay literature is even more confusing. Coronary heart disease (CHD) epidemiology began seriously over fifty years ago, and from the beginning the pattern of diet was identified as a key risk factor operating through blood lipid levels. Although the original diet heart hypothesis is now considered simplistic, the field has developed enormously.

Despite the confusion generated by different results from different study designs, a consensus has emerged around the main nutritional determinants of the modern CHD epidemics. Evidence from a variety of scientific disciplines confirms that diets with a high unsaturated to saturated fat ratio, and high in whole grains, fruits and vegetables – a typical Mediterranean diet – protect against CHD. Differences of scientific opinion still exist on the roles of total fat intake, and saturated and trans saturated fats. However, there is no doubt that an improved diet, regular physical activity and nonsmoking will prevent the majority of new CHD events in New Zealand, other similar countries, and probably in developing countries as well.

Of equal importance is the evidence that these risk factors, along with an excessive total caloric intake, are responsible for a significant burden from other chronic diseases, including Type 2 diabetes.

This compelling evidence base is critical to health policy in New Zealand, given our high burden of CHD and other cardiovascular disease. This high burden continues despite the impressive declines in death rates over the last three decades. These diseases also remain responsible for a large part of the ethnic and socioeconomic inequalities in health in New Zealand. Two questions arise. How much effort should now be directed into further research into the aetiology of CHD, and how can we more fully implement existing knowledge?

Laugesen and Elliott are clearly of the opinion that more aetiological research is required. Their paper in this issue presents evidence on the possible role of cow milk A1 β-casein in the aetiology of CHD and Type 1 diabetes. The authors are to be congratulated on the way they have followed up earlier work in this area because of the importance of the dairy industry and the relatively high content of A1 β-casein in New Zealand milk. On the basis of the strong correlations found between per capita consumption of A1 β-casein and milk protein and national CHD rates, and of A1 with Type 1 diabetes, the authors suggest the need for further animal research and clinical trials of A1-free versus ‘ordinary’ milk.

How should we respond to this paper and its suggested research agenda? It is important to point out that the authors note the general limitations of the research design. Correlations at the population level tell us nothing about the diets of
individuals who get CHD and those who do not; the epidemiological literature has many examples of this ecological fallacy. Questions can also be raised about the inclusion criteria for the countries (only 20 “healthcare-affluent” countries out of 36 likely to be in this category), the validity of the basic data upon which the conclusions are based, and the justification for the five-year time lags – an earlier paper used a ten-year period. The authors appreciate that the ecological study design is only a starting point for the generation of hypotheses. It would be prudent, however, to suggest other observational study designs before embarking on the difficult, complex and expensive clinical trials, even if they could be designed and implemented satisfactorily. Further animal studies alone will never be sufficient for public policy decisions.

An important question concerns the nature of further chronic disease research, given existing knowledge and the shortage of research resources. The research likely to have the most immediate impact on improving population health and reducing inequalities in New Zealand, will be directed towards identifying policies and programmes that implement existing knowledge. In the short term, the greatest gains are likely to come from ensuring that all New Zealanders at very high risk of cardiovascular disease receive the appropriate long-term management (lipid and blood pressure reduction, smoking cessation therapy), with the goal of substantially reducing the individual risks of disease. If these relatively cost-effective therapies were available equitably, they could significantly and quickly reduce ethnic inequalities in chronic disease outcomes. Of course, this strategy will do little to reduce the long-term burden of chronic disease; only the population approach to primary prevention has this potential. Despite progress over recent decades, much more could be done to fully implement this strategy in New Zealand. This will require further concentrated effort, guided by the New Zealand Health Strategy, and involve effective partnerships among government, nongovernmental organisations and civil society more generally.

The attraction of the A1/A2 hypothesis is the simplicity of the potential public health intervention, if the authors are proved correct. It would be reasonably straightforward to change New Zealand dairy herds to produce only A2 milk. The intervention would require no change in behaviour by New Zealanders and could be implemented with little personal difficulty for substantial health gain. For these reasons, we encourage Laugesen and Elliott to pursue this research. However, this research should not be at the expense of policy and programmatic research and must not distract us from the pressing need to act now upon what we already know.

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References:


Fortification of food with folic acid and the prevention of neural tube defects

Carol Bower

It is now over 10 years since the publication of the randomized controlled trials confirming the reduction in risk of neural tube defects in the offspring of women taking periconceptional supplements containing folic acid.\(^1\)

Health promotion campaigns have been conducted in many countries to inform women of the link between folate and neural tube defects, and to encourage them to increase their periconceptional folate intake by either dietary means or with a folic acid supplement (or both). Results of these efforts have been remarkably similar, achieving maxima of around 60–80% of women knowing about the link between folate and neural tube defects and about 20–50% of women taking periconceptional folic acid supplements.\(^2,3\)

Because health promotion campaigns alone do not seem to reach all women, and because many pregnancies are unplanned (55% in one New Zealand study\(^4\)), achieving a high proportion of women taking periconceptional folic acid supplementation may be unattainable. Thus, fortification of a staple food with folic acid has been advocated, and voluntary fortification was approved in Australia and New Zealand in 1995. The paper by Green et al in this issue\(^5\) examines the effect of fortified foods on the intake of folate in women of childbearing age in New Zealand, and concludes that current voluntary fortification is inadequate in achieving the public health response required to prevent neural tube defects. Their careful analysis and modelling of several options of fortifying milk, flour or bread, leads to a recommendation of mandatory fortification of bread at 150 µg folic acid per 50g serve. This would have the effect of most women (~60%) obtaining 200 µg daily or more, whilst limiting high intakes to only a small proportion of particular segments of the population, such as the elderly.

Voluntary fortification retains an individual’s right to choose whether or not to consume folate-fortified food, but the main reason for fortification in the first instance is to ensure that women unaware of their need for increased folate can still obtain sufficient amounts to prevent neural tube defects in their offspring. It seems unlikely, therefore, that such women would know to choose folate-fortified food. Voluntary fortification also places the onus on the manufacturer to determine whether or not to fortify. Whilst manufacturers may be willing to add folic acid to their products (and many already have, especially breakfast cereal manufacturers), it seems shaky ground indeed to allow public health policy to be dependent on the whim of market forces.

In New Zealand, the prevalence of neural tube defects in the late 1970s and early 1980s was close to 2/1000,\(^6,7\) similar to the rates in several Australian states at that time.\(^8,9\) However, the New Zealand rate appears to have fallen gradually\(^10\) to around 1/1000 in 2000 (22 livebirths and 32 terminations of pregnancy).\(^5\) Australia-wide data from the National Perinatal Statistics Unit show a similar gradual decline in neural
tube defects, but terminations in this data set are known to be incompletely reported.\textsuperscript{11} Australian state birth defects registers (South Australia, Victoria and Western Australia) with close to complete ascertainment (including terminations of pregnancy), report a steady rate of neural tube defects (1.6–2.0 per 1000) until 1996, with a 35–45\% fall in prevalence from 1996 onwards.\textsuperscript{3,12,13} All three states have seen the benefit of health promotion strategies in improving women’s and health professionals’ knowledge and practice and, of course, all have been exposed to voluntary fortification.

Whether the more gradual fall in neural tube defects in New Zealand is related to folate is not clear, but an important potential reason to exclude is the under-counting of terminations of pregnancy. As methods of prenatal screening and diagnosis have improved, most pregnancies with neural tube defects are now diagnosed prenatally and the pregnancy terminated, and so it is critical to count both terminations and births when evaluating the role of folate in their prevention.

Green et al advocate monitoring the effect of mandatory fortification using the measurement of red cell folate in population samples, as they say that it may take some time before a fall in neural tube defect can be detected with confidence.\textsuperscript{5} Whilst red cell folate monitoring is a good interim measure, monitoring neural tube defects is also important and likely to provide valuable outcome measures in a relatively short time frame. Based on the estimate by Green et al\textsuperscript{5} of 60\% women getting $\geq$200 µg folate daily if breads were fortified at 150 µg/50 g, and assuming a 42\% reduction in neural tube defects amongst these women,\textsuperscript{14} we would expect a 25\% fall in neural tube defect over all births in New Zealand, or 13 babies a year spared the devastating consequences of a neural tube defect. A fall of this magnitude would be able to be detected as a difference from the present rate of ~1/1000 at the 5\% level of significance, after only three years of full implementation of mandatory fortification. Such an evaluation, of course, is predicated on complete and consistent ascertainment of neural tube defects before, during, and after the intervention.

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\textbf{References:}


Continuous reassessment, and hopefully improvement

Frank Frizelle, Editor

At this time of year, one is inclined to look back and assess how one might better move forward. The NZMJ has been electronic since 2 July 2002. We have received 169 articles since going electronic, accepted 46 and rejected 16, while 107 are still undergoing review or revision. There have been times when a submitted original article has been reviewed by two referees and the editorial staff and accepted within a week; however there are many more instances when things take longer. The mean time from acceptance to publication currently stands at 38 days. As the new order settles, we expect this time to diminish. The impact factor\(^1\) of the NZMJ over the last few years is shown in the following table.\(^2,3\)

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<td>0.545</td>
<td>0.647</td>
<td>0.733</td>
<td>0.758</td>
<td>0.773</td>
<td>0.631</td>
<td>1.202</td>
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Since the change of medium, there have been moves afoot to change what we publish. In this issue, there are a number of such changes that have made it into the Journal. We introduce three new features.

“This Issue in the Journal” is a column that briefly outlines (80 words, four sentences) the original articles in plain English. The authors write this themselves. It is recognised that though the original articles represent the “science” in the Journal, they can be the least interesting part for many readers. Others are interested to know what the articles say, but are unwilling or unable to wade through the jargon even of the tightly formatted but often difficult to follow abstract, let alone the article itself. Other journals (the BMJ, The Lancet, and the New England Journal of Medicine, for example), have found the concept of a plain English summary helpful to readers.

“Medical Images” is also launched in this issue. This feature will be under the direction of Professor Tim Buckenham, Professor of Radiology in Christchurch. The image published this week is of a watch found at endoscopy in a patient’s stomach.\(^4\) We would be interested to review any medical image submitted electronically in the normal manner. A brief caption is required as well.

The Journal has published case reports for many years (and will continue to do so), and these have been much liked by readers. An example of a conventional case report is provided in this week’s issue by Wakeman et al.\(^5\) There is, however, a role for briefer reports. As with traditional case reports, they should highlight interesting cases that have a message, be well written and well referenced. They should be 600 words maximum (plus a table, figure or image). The Journal will call this new feature “Case Notes”. We have two examples in this issue and I am hoping to expand the section to three or four items per issue.
There are two other areas that are not touched upon in this issue, but that I would hope to see appearing soon. Firstly, articles covering New Zealand audit data. Many reports are written for various groups such as ACC, HDC etc, but the data quoted are usually not relevant to New Zealand. The outcome of patients treated in many New Zealand centres doesn’t match that of the best centres in the world, nor would one expect it too, due to case mix, case volumes, resources and many other influencing factors. Many New Zealand centres produce good audit data and outcome results that are relevant to New Zealand. These data are vital to allow benchmarking for practices around New Zealand and to let us all know how outcomes of healthcare practices in New Zealand really compare.

The second area that I would like to see developed is in regard to what is best called “dusty”, or perhaps “dead”, research. Many doctors begin masters or doctorate-level research, and give up due to pressures of clinical work, home life or changes in direction. Their research, though often complete, is never published or submitted as a thesis. Others, having obtained their higher degree, find that they are sick of their thesis topic by the time it is accepted. When they eventually feel able to come back to writing papers, many find they are unable to get their research published. The NZMJ will undertake to publish this research if the methodology is good, and the papers well written. I hope to have an example in the next issue.

I had stated that it was my aim to reduce publication of the NZMJ to once a month, like The Medical Journal of Australia. After discussion with the management board we are agreed to publish 20 editions a year. This means twice a month, except for the months of December, January, February and March.

We are hoping to survey readers’ views about all the developments to the Journal over the last 12 months midway through 2003. If you have any questions that you think we should consider, please submit.

We are always happy to hear from our readers at sarah.webb@cdhb.govt.nz

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**References:**


Estimated folic acid intakes from simulated fortification of the New Zealand food supply

Tim Green, Rebecca Newton and Diane Bourn

Abstract

**Aim** To identify a folic acid food fortification programme that will maximise the percentage of women of child-bearing age receiving at least 400 µg folic acid/day, the amount shown to reduce the risk of neural tube defect-affected pregnancies, while not putting population groups at risk of excessive intakes.

**Methods** 1997 New Zealand National Nutrition Survey data and a computer modelling programme were used to estimate folic acid intakes from simulated fortification scenarios.

**Results** Breads fortified with folic acid at 150 µg/50 g, white flour at 100 µg/35 g and liquid milk at 200 µg/200 ml, were found to be the best fortification scenarios. Thirty one percent, 21% and 18% of women of child-bearing age received ≥400 µg folic acid/day from the fortification of bread, white flour and milk respectively.

**Conclusions** The most effective scenario for folic acid fortification is bread fortified at 150 µg/50 g. However, it is impossible to fortify food at a level that ensures the majority of women of child-bearing age receive more than 400 µg folic acid/day without exposing some people to excessive amounts of folic acid. The current public health message encouraging women to select folic acid fortified foods and take folic acid supplements, needs to continue.

Folic acid consumption during the periconceptional period may reduce a woman’s risk of having a neural tube defect (NTD) affected pregnancy by greater than 50%. The minimum effective dose of folic acid required to prevent NTDs is not known with any certainty. However, a recent public health campaign in China indicated that a supplement of 400 µg folic acid/day was highly effective. The New Zealand Ministry of Health recommends that all women planning a pregnancy take a daily 800 µg folic acid supplement, starting four weeks before conception and continuing through to the twelfth week of pregnancy. This recommendation, however, will not greatly reduce the incidence of NTDs, since a Christchurch study found that only 17% of women take folic acid supplements during the periconceptional period.

Folic acid fortification of food is a potentially effective means of increasing folic acid intakes of most women throughout their child-bearing years, because the nutrient is supplied in a continuous and passive manner. In reaching the target population, however, others in the population are exposed to increased amounts of folic acid. There is concern that excessive folic acid intakes could mask vitamin B₁₂ deficiency, delaying diagnosis and allowing possible progression of neurological damage. This is of particular concern in the elderly, who are at greatest risk of vitamin B₁₂ deficiency. Accordingly, the Institute of Medicine in the US has estimated Tolerable Upper
Intake Levels (TUILs) for folic acid of 800 µg/day for 14–18 year olds, and 1000 µg/day for those aged 19 years and over.\textsuperscript{8}

Voluntary fortification of selected foods with folic acid (savoury biscuits, breakfast cereals, breads, cereal flours, pasta, fruit and vegetable juices, soy beverages, yeast extracts) up to a maximum claim of 50% of the recommended dietary intake (RDI; the RDI for folate is 200 µg/day for persons age 15 years and over\textsuperscript{9}) for folate per reference quantity, has been permitted in New Zealand since January 1996.\textsuperscript{10} However, we have estimated that as of August 2000, voluntary fortification has resulted in a median increase in folic acid intake for women of child-bearing age of only 17µg/day.\textsuperscript{11} A mandatory folic acid fortification programme may be needed in New Zealand if there is to be a meaningful increase in folic acid intakes and hence a reduction in the incidence of NTDs. Recent data from the US indicate that there has been a 19% reduction in NTD birth prevalence since 1998, coinciding with the implementation of mandatory folic acid fortification of grain products.\textsuperscript{12} Before embarking on such an option in New Zealand, it is important that the potential impact of fortification on folic acid intakes be evaluated. The objective of this study was to evaluate simulated fortification scenarios. The optimal fortification scenario would maximise the proportion of women of child-bearing age with intakes of at least 400 µg folic acid/day while not putting population groups at an unacceptable risk of excessive intakes.

**Methods**

The 1997 New Zealand National Nutrition Survey (NNS), based on a nationally representative sample of 4636 persons aged 15 years and over, provides the most recent national food consumption data as well as information about dietary supplement use.\textsuperscript{13,14} A computer assisted 24-hour diet recall was used to collect food consumption data. Food consumption and dietary supplement intake data were used to estimate folic acid intakes from simulated fortification scenarios. We report intakes of folic acid only, because it is the form of folate that has been conclusively found to reduce the risk of NTDs. Folic acid, the synthetic form of folate, is added to foods and is used in dietary supplements. Folate is the generic term referring to both naturally occurring folate and folic acid. Breads, white flour and liquid milk (including whole, low-fat and flavoured) were selected as potential food vehicles for folic acid fortification, since these foods were consumed by more than 80% of women of child-bearing age (15–49years) in the NNS. Ready-to-eat breakfast cereals, rice, savoury biscuits, maize flour, pasta, dried milks, yoykarts, fruit and vegetable juices, and soy beverages were considered, but discarded because during the period covered by the 24-hour diet recall they were consumed by less than 30% of women of child-bearing age.\textsuperscript{11} Four fortification levels were used to examine the effect of fortifying the selected food vehicles on folic acid intakes: 25% (50 µg), 50% (100 µg), 75% (150 µg), and 100% (200 µg) of the RDI for folate per reference quantity of food. Reference quantities were obtained from the new Joint Food Standards Code.\textsuperscript{15} To be consistent with the Code's specifications, the fortification levels used in this report refer to total folate content. The natural folate content of a food, therefore, was considered when determining the amount of added folic acid for a particular fortification level. DIAMOND, a computer programme developed by ANZFA (Australia NZ Food Authority, now known as Food Standards Australia New Zealand),\textsuperscript{16} was applied to the NNS data to estimate folic acid intakes under the simulated fortification scenarios. The DIAMOND programme enables a food or ingredient to be traced throughout the food supply. Hence if folic acid is added to flour, the resulting folic acid in foods containing flour (such as breads, cakes, pies and biscuits), is also included in the estimated folic acid intakes. Twelve fortification scenarios were modelled using the DIAMOND programme; three food vehicles each fortified at four levels. Folic acid intakes from dietary supplements were added to the individual folic acid intakes for each fortification scenario to yield total folic acid intakes.
Fortification scenarios involving two foods such as breads and liquid milk, were investigated. Since it is considered unlikely that two staple foods would be fortified, these data are not presented here.

The Statistical Package for the Social Sciences (version 6.1.1 for MacIntosh, Chicago; SPSS Inc; 1995) was used to provide medians and distributions for folic acid intakes, as well as percentages of persons above certain cut-off values (ie, TUILs and the target intake for preventing NTDs ). Results were weighted using factors supplied with the NNS data that were designed to provide results representative of the New Zealand population.

**Results**

Estimated folic acid intakes and the percentage of women of child-bearing age consuming specified amounts of folic acid from fortified foods and dietary supplements under simulated fortification scenarios, are presented in Table 1.

<table>
<thead>
<tr>
<th>Fortification scenario</th>
<th>Median intake ug/day (25–75th)†</th>
<th>Percentage of women (15–49 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0–199 (ug/day)</td>
<td>200–399 (ug/day)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>=400 (ug/day)</td>
</tr>
<tr>
<td><strong>Breads</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White flour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 ug/50 g</td>
<td>74.4 (32.1–133.9)</td>
<td>85.6</td>
</tr>
<tr>
<td>100 ug/50 g</td>
<td>178.2 (82.1–300.1)</td>
<td>54.6</td>
</tr>
<tr>
<td>150 ug/50 g</td>
<td>278.4 (131.3–449.8)</td>
<td>39.7</td>
</tr>
<tr>
<td>200 ug/50 g</td>
<td>371.1 (181.7–600.0)</td>
<td>26.3</td>
</tr>
<tr>
<td>Liquid milk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 ug/200 ml</td>
<td>74.4 (20.4–169.1)</td>
<td>79.5</td>
</tr>
<tr>
<td>100 ug/200 ml</td>
<td>115.6 (31.6–257.3)</td>
<td>65.7</td>
</tr>
<tr>
<td>150 ug/200 ml</td>
<td>149.9 (42.6–328.3)</td>
<td>57.3</td>
</tr>
<tr>
<td>200 ug/200 ml</td>
<td>156.8 (42.9–333.5)</td>
<td>55.9</td>
</tr>
</tbody>
</table>

Values are population-weighted estimates
†Percentiles

At the highest level of fortification, it was estimated that 47%, 56% and 18% of women of child-bearing age would receive folic acid intakes =400 µg/day from breads, white flour and liquid milk, respectively. However, to facilitate the selection of the most effective scenario it was decided that it would be desirable if less than 5% of the general population was exposed to folic acid intakes greater than the TUIL, which is in line with that used by the Australian National Health and Medical Research Council. The percentage of participants with intakes above the TUIL for the general population and for women and men by age group, are presented in Table 2.
Table 2. Percentage of the New Zealand population, and women and men by age group, receiving folic acid intakes above the Tolerable Upper Intake Levels (TUILs), from fortified foods and dietary supplements, under simulated fortification scenarios*

<table>
<thead>
<tr>
<th>Fortification vehicle</th>
<th>Fortification level</th>
<th>General population (% &gt; TUIL)†</th>
<th>15–49 years</th>
<th>=50 years</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Females (% &gt; TUIL)</td>
<td>Males (% &gt; TUIL)</td>
<td>Females (% &gt; TUIL)</td>
</tr>
<tr>
<td>Breads</td>
<td>50 ug/50 g</td>
<td>0.2</td>
<td>0.4</td>
<td>0.1</td>
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<tr>
<td></td>
<td>100 ug/50 g</td>
<td>0.9</td>
<td>0.9</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>150 ug/50 g</td>
<td>3.9</td>
<td>2.5</td>
<td>7.7</td>
</tr>
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<td></td>
<td>200 ug/50 g</td>
<td>10.8</td>
<td>7.7</td>
<td>20.0</td>
</tr>
<tr>
<td>White flour</td>
<td>50 ug/35 g</td>
<td>0.5</td>
<td>0.9</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>100 ug/35 g</td>
<td>2.1</td>
<td>2.4</td>
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<td></td>
<td>150 ug/35 g</td>
<td>6.8</td>
<td>5.5</td>
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<tr>
<td></td>
<td>200 ug/35 g</td>
<td>14.3</td>
<td>11.5</td>
<td>25.9</td>
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<tr>
<td>Liquid milk</td>
<td>50 ug/200 ml</td>
<td>0.3</td>
<td>0.6</td>
<td>0.1</td>
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<tr>
<td></td>
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<td>2.5</td>
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<tr>
<td></td>
<td>200 ug/200 ml</td>
<td>2.2</td>
<td>3.2</td>
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</tr>
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</table>

*Values are population-weighted estimates
†TUIL = Tolerable Upper Intake Level; TUIL for 14–18 years is 800 µg folic acid/day and 1000 µg/day for 19 years and over; levels may be overestimated as they are not adjusted for within-person variation.

Of the bread fortification scenarios, fortification at 150 µg folate/50 g resulted in 31% of women of child-bearing age receiving folic acid intakes =400 µg/day (Table 1), while 3.9% of the general population were estimated to have intakes over the TUIL (Table 2). It is of interest that 7.7% of males aged 15–49 years had intakes over the TUIL for this fortification scenario (Table 2).

For white flour, the fortification level of 100 µg folate/35 g flour resulted in 21% of women of child-bearing age receiving folic acid intakes =400 µg/day, while only 2.1% of the general population had folic acid intakes over the TUIL. Of males aged 15–49 years, 3.6% had folic acid intakes over the TUIL for this fortification scenario.

For liquid milk, the fortification level of 200 µg folate/200 ml milk resulted in 18.4% of women of child-bearing age receiving folic acid intakes =400 µg/day. Only 2.2% of the general population were estimated to have folic acid intakes over the TUIL. Three percent of males aged 15–49 years had intakes over the TUIL for this fortification scenario.

Discussion

Based on dietary modelling work using DIAMOND, breads, white flour and liquid milk fortified at 75% (150 µg/50 g), 50% (100 µg/35 g), and 100% (200 µg/200 ml), of the RDI for folate per reference quantity, respectively, were found to be the most suitable fortification scenarios. None of these proposed scenarios expose more than 2% of older persons (>50 years) to folic acid intakes greater than the TUIL. However, if breads were fortified at 150 µg/50 g, over 7% of males aged 15–49 years would exceed their TUIL. It should be noted that for those aged 14–18 years, the percentage...
exceeding their TUIL may be even higher because the TUIL for this age group is set at 800 µg/day folic acid to account for the smaller average body size.\textsuperscript{5} 

Our findings suggest that it is impossible to fortify food at a level that ensures that the majority of women in the target group will consume ≥400 µg folic acid/day without more than 5% in the population being exposed to folic acid in amounts in excess of the TUIL. At best, our modelling indicates that 31% of the target population (breads fortified at 150 µg/50 g) will receive ≥400 µg/day folic acid without excessively high intakes by segments of the non-target population. However, nearly all women in the target group receive some folic acid from all fortification scenarios. The question remains - are amounts less than 400 µg/day of folic acid effective in reducing NTDs? Recommendations for women to receive 400 µg around the time of conception are based on trials in which 400 µg is the smallest dose used.\textsuperscript{2} The minimum amount of folic acid required to prevent NTDs will never be known with certainty because further randomised trials are unethical. However, using results from a case-control study, it was found that the risk of having a child with an NTD was associated with red blood cell folate levels in a continuous and dose-dependent manner.\textsuperscript{18} Therefore, any strategy that increases red blood cell folate in women of child-bearing age should reduce the number of NTD-affected births. In another study, in which red blood cell folate was measured, the investigators predicted that at doses of 100, 200, and 400 µg folic acid/day, there would be a corresponding reduction in NTD risk of 20%, 42% and 47%, respectively.\textsuperscript{19} These findings suggest that 400 µg/day folic acid confers little beneficial effect over 200 µg/day. In our study, 40–60% of the target population received folic acid intakes of over 200 µg/day from each scenario: 60% for breads fortified at 150 µg/50 g, 55% for white flour fortified at 100 µg/35 g, and 44% for milk fortified at 200 µg/200 ml (Table 1).

Comparison of our fortification scenarios with those proposed or implemented in other countries is difficult because of differing methodologies. The level at which we are proposing to fortify white flour (285 µg/100g) is over twice the level currently required to be added to enriched grain products in the US (140 µg/100g).\textsuperscript{20} The US mandatory folic acid fortification policy was estimated to provide a mean additional 100 µg folic acid/day to the target population; this is under half our estimated folic acid intakes for fortified white flour (285 µg/100 g) in the target population (median folic acid is 226 µg/day for women aged 15–49 years). In the United Kingdom, the Food Standards Agency has recently recommended to the UK Department of Health that fortification should not proceed until further information becomes available on the impact of fortification on older people.\textsuperscript{21} However, in 2000, the Committee on Medical Aspects (COMA) of Food and Nutrition Policy recommended that on “scientific, medical and public health grounds”, 240 µg folic acid/100 g would be a desirable fortification level for flour, an amount that is very similar to the level we propose for mandatory fortification of flour (285 µg/100 g).\textsuperscript{22} Through dietary modelling, the UK Committee estimated that this level of flour fortification would provide, on average, an additional 201 µg/day folic acid to women aged 16–45 years which is similar to our figure of 226 µg/day.

It is important to consider the assumptions, limitations and potential sources of error in estimating folic acid intakes in this study. It was assumed that food consumption patterns and the use of folic acid supplements have not changed since the NNS. Since 1997, there have been some initiatives to increase women’s awareness of folic acid
and NTDs. In 1998, ANZFA launched a pilot project for a health claim about folate and NTDs. This was the first time in NZ that manufacturers could make statements about a nutrient and disease risk reduction on food labels. However, because the health claim has not been widely used by the NZ food industry and the main products carrying health claims are breakfast cereals, which are not widely consumed by women of child-bearing age, it is unlikely that food consumption patterns have changed in response to information about folic acid. With regard to the use of supplements containing folic acid, a Dunedin study carried out in 1999 found that 18% of women of child-bearing age were regularly taking them, a level not appreciably higher than the 12.5% found in the NNS.

The folic acid intakes estimated in this study may be underestimated for several reasons. First, it is widely recognised that individuals completing a 24-hour diet recall typically under report the amount of food consumed, leading to an underestimate of nutrient intake. Secondly, manufacturers may add more folic acid than claimed on the food label. The use of overages when adding nutrients to food products is common practice in the food industry in the US. According to two US reports, the folate content of a food may be considerably higher (in some cases 200–300% higher) than that indicated on the food label.

A major limitation of the present study is that we were able only to consider dietary intake information obtained from a single 24-hour diet recall and, therefore, were unable to estimate usual intake. Median intakes are not affected significantly by adjustment for within-person variation. Intakes at the extremes of the distribution, however, tend to get ‘pulled in’ with adjustment for within-person variability. Accordingly, estimates of the number of persons exceeding the TUIL for a given scenario should be interpreted with caution, since they are likely to be overestimated. Also, we did not adjust for the effects of clustered sampling used in the NNS. Clustered sampling would tend to underestimate the true standard deviation of the population, as people from clusters are more alike than those recruited by simple random sampling.

We did not consider children under 15 years in our dietary modelling; however, since the TUIL for children (300 µg/day for 1–3 years, 400 µg/day for 4–8 years, 600 µg/day for 9–13 years) is much lower than that for adults, the risk of exceeding the upper limit in this group may be greater. In the US, Lewis et al estimated that 15–25% of children aged one to eight years had folic acid intakes exceeding their TUIL under the current US fortification programme.

Of the best three scenarios selected, liquid milk fortified at 100% is least attractive because children are frequent consumers of milk and so may be exposed to excessive amounts of folic acid. In addition, folic acid fortification of milk is not currently permitted. White flour fortification at 50% of the RDI (285 µg per 100g) is a good choice, because there are very few flour millers supplying the New Zealand market. Thus, the task of implementing and monitoring folic acid fortification of flour would be simpler than for foods with numerous manufacturers and suppliers. It would appear from the data that the optimal level of white flour fortification lies between 50% and 75% of the RDI, however, this optimal amount was not determined in this study. Breads fortified at 75% of the RDI (150 µg/50 g) provided the greatest number of the target population with at least 200 µg/day folic acid. Two main bread producers provide over 90% of the bread in New Zealand (personal communication, Allied
Foods, February 2001); therefore, as with flour, the task of implementing and monitoring fortification should be relatively simple. Fortification of bread would result in significantly fewer foods being fortified than if flour were to be fortified, thus providing more choice for consumers. Fortification at the proposed level of 75% of the RDI is currently not permitted under the Australia New Zealand Food Standards Code\textsuperscript{15} and therefore a change to the Code would be required. Overall, the most convenient and effective vehicle for fortification is probably breads at 75% of the RDI (150 µg/50 g).

Twenty two live births were affected by NTDs in 2000, a rate of 0.39/1000 live births in New Zealand (personal communication, B Borman, Ministry of Health, June 2002). In addition, 32 pregnancies affected by NTDs were terminated. Due to this low birth prevalence, it may take many years to see a reduction in NTDs. In the meantime, therefore, red blood cell folate levels should be monitored as a surrogate marker for the effect of any fortification programme on women of child-bearing age. In addition, the folic acid intakes of children and adolescent males should be regularly monitored should a fortification programme proceed. Modelling work should be performed for New Zealand children as a matter of urgency as soon as consumption data from the Children’s Nutrition Survey become available in 2003. Also, there is a need for baseline data on the prevalence of vitamin B\textsubscript{12} deficiency in a representative sample of New Zealanders.

It is unlikely that any of the fortification scenarios would prevent all of the preventable NTDs, hence it is important that medical doctors and other healthcare providers continue to encourage women of child-bearing age to increase folate intakes from foods and dietary supplements whether mandatory fortification proceeds or not.

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**References:**


Ischaemic heart disease, Type 1 diabetes, and cow milk A1 β-casein

Murray Laugesen and Robert Elliott

Abstract

**Aim** To test the correlation of per capita A1 β-casein (A1/capita) and milk protein with: 1) ischaemic heart disease (IHD) mortality; 2) Type 1 (insulin-dependent) diabetes mellitus (DM-1) incidence.

**Methods** A1/capita was estimated as the product of per capita cow milk and cream supply and its A1 β-casein content (A1/β) (calculated from herd tests and breed distribution, or from tests of commercial milk), then tested for correlation with: 1) IHD five years later in 1980, 1985, 1990 and 1995, in 20 countries which spent at least US $1000 (purchasing power parities) per capita in 1995 on healthcare; 2) DM-1 at age 0–14 years in 1990–4 (51 were surveyed by WHO DiaMond Project; 19 had A1 data). For comparison, we also correlated 77 food, and 110 nutritive supply FAO (Food and Agriculture Organization)-based measures, against IHD and DM-1.

**Results** For IHD, cow milk proteins (A1/capita, r = 0.76, p <0.001; A1/capita including cheese, r = 0.66; milk protein r = 0.60, p = 0.005) had stronger positive correlations with IHD five years later, than fat supply variables, such as the atherogenic index (r = 0.50), and myristic, the 14-carbon saturated fat (r = 0.48, p <0.05). The Hegsted scores for estimating serum cholesterol (r = 0.42); saturated fat (r = 0.37); and total dairy fat (r = 0.31) were not significant for IHD in 1995. Across the 20 countries, a 1% change in A1/capita in 1990 was associated with a 0.57% change in IHD in 1995. A1/capita correlations were stronger for male than female mortality. On multiple regression of A1/capita and other food supply variables in 1990, only A1/capita was significantly correlated with IHD in 1995.

DM-1 was correlated with supply of: A1/capita in milk and cream (r = 0.92, p <0.00001); milk and cream protein excluding cheese (r = 0.68, p <0.0001); and with A1/β in milk and cream (r = 0.47, p <0.05). Correlations were not significant for A2, B or C variants of milk β-casein. DM-1 incidence at 0–4, 5–9 and 10–14 years was equally correlated (r = 0.80, 0.81, 0.81 respectively) with milk protein supply. A 1% change in A1/capita was associated with a 1.3% change in DM-1 in the same direction.

**Conclusions** Cow A1 β-casein per capita supply in milk and cream (A1/capita) was significantly and positively correlated with IHD five years later over a 20-year period – providing an alternative hypothesis to explain the high IHD mortality rates in northern compared to southern Europe.

For DM-1, this study confirms Elliott’s 1999 correlation on 10 countries for A1/capita, but not for B β-casein/capita. Surveys of A1 β-casein consumption in two-year-old Nordic children, and some casein animal feeding experiments, confirm the A1/capita and milk protein/capita correlations. They raise the possibility that intensive
Dairy cattle breeding may have emphasised a genetic variant in milk with adverse effects in humans. Further animal research and clinical trials would be needed to compare disease risks of A1-free versus 'ordinary' milk.

In 1968, across 43 countries, Seely found that per capita milk supply (excluding butter) was highly correlated with IHD mortality rates 1 to 4 years later, and more strongly than animal fats or butter. In 1968 also, came the first dairy science review of the genetic differences in milk proteins between individual cattle and breeds. In North Europe, A1 was the predominant form of β-casein in cow milk (A1/β = 0.46–0.71) among the traditional black-and-white or red-and-white cow breeds (Red Danish, Holstein-Friesian, Ayrshire). Artificial breeding during the 1970s and 1980s made use of American Holstein bulls (typically A1/β = 0.4), often replacing indigenous cow breeds, and reducing A1 levels in North European milk. In central and southern Europe, the A1/β fraction was lower due to the dominance of Jersey, Simmental or Swiss Brown cattle (A1/β mostly <0.25), and virtually nonexistent in Guernsey cattle (A1/β = 0.01). Except for milk from the island of Guernsey, commercially-sold European-breed cow milk is an A1 β-casein and A2 β-casein mix.

Ischaemic heart disease


Fonterra Research Centre (FRC, formerly the Dairy Research Institute) scientists responded, noting that correlations found in past years between milk protein consumption and IHD across 40 countries (some high income, some low), were no longer found in the 1990s; observing any past correlation appeared to have been “serendipitous”; and that the evidence was not sufficient to warrant a change to A1-free milk.

In examining these competing claims, we have put aside the question of biological mechanisms which these authors have touched on, and confined this study to the correlations. This study of IHD is limited to healthcare-affluent countries, to reduce inter-country IHD mortality differences due to disparities in the availability of coronary care. For comparison, we also examine the correlation of other food and nutritional supply variables with IHD.

Diabetes Type 1

Diabetes Type 1 (DM-1) incidence has been increasing globally at 3% per annum. Its incidence varies by over 300-fold across 51 countries. Although knowledge of genetic predisposition has increased, the nature of the precipitating environmental factors remains elusive. Across 12 countries, milk protein per capita and DM-1 rates were highly correlated. Even when Finnish children of the same genetic susceptibility to DM-1 were compared, those consuming more than three glasses of milk daily remained at higher risk of DM-1 than those with a lower milk intake.

No one could explain why Iceland, with high milk consumption, had a lower DM-1 incidence rate than the other genetically-related Nordic countries. Genetically-
predisposed non-obese diabetic (NOD) mice developed DM-1 when fed milk from the European Bos taurus cow, but not if fed milk from the Indian Bos indicis Zebu. Fed European cow milk casein, they developed DM-1, but not if fed cow milk whey (the other main protein fraction in milk) or soya protein. When fed the A1 variant of β-casein, the mice developed DM-1, but not when fed A2 or (fully) hydrolysed A1 β-casein. (p = 0.002) Also, A1 β-casein had no effect when given with naloxone, a morphine antagonist that opposes the opioid effect of β-casomorphin-7.12 β-casomorphin-7 is a peptide formed by partial hydrolysis of A1, B or C β-casein only, the cleavage made possible by a histidine rather than a proline amino-acid at position 67 in these caseins. Milk-free cereal induced DM-1 in genetically-predisposed BB (BioBreeding Laboratories, Ottawa) rats13 and in NOD mice also. Whole casein without cereal also induced DM-1 in NOD mice; whereas A1/β in BB rats had only a small effect, suggesting that even if milk were a factor in DM-1, some DM-1 would remain due to cereals in the diet.14

In a 10-country study in 1999, Elliott found that DM-1 rates were significantly correlated with A1/capita and particularly with the combined A1 and B variants (of β-casein) per capita.1 In revisiting this study, we include nine more countries, and adjust for milk imports and their source, for the protein yield of each breed, and for the proportion of milk from other animals. We also estimate the A1/capita in the milk and cheese supply separately.

Methods

Countries selected These included all 22 countries (Tables 1 and 3) for which published A1/β cow milk data was obtainable, after: 1) excluding the Netherlands as simultaneous high imports and exports of milk precluded reliable determination of the origin of milk consumed (imports 65%; exports 85% of domestic usage in 1995); 2) for IHD only, excluding Hungary and Venezuela, as their total health expenditure was less than US $1000 per capita in 1995 (based on purchasing power parities),15 leaving for study 20 “healthcare-affluent” countries (17 of which were OECD member countries, out of 22 healthcare-affluent countries and 29, in total, in the OECD in 199515) 3) for DM-1 only, excluding countries not surveyed by WHO DiaMond Project or EURODIAB ACE (Ireland, Jersey and Guernsey), leaving 19 for study.

Milk and cream supply Milk and cream supply per capita was calculated from the nutritional statistical databases at the FAO (Food and Agricultural Organization) web site,16 as milk protein per capita in grams per day. This was calculated as [3.3% by weight of ‘milk excluding butter’ + 2.7% of cream, minus 25% of cheese]. Milk included fresh milk products – yoghurts, cream, whole and skim milk, and milk powder – but excluded cheese and butter. We subtracted goat and sheep milk production (FAO data, Italy 8%, Israel 2%, Hungary 2%). Where imported milk comprised 20% or more of domestic milk usage (Germany, Italy, Japan),17 we adjusted for the imported tonnage and the A1/β of milk in the main supplying countries, and similarly for cheese imports.

Nutritional data FAO food supply data16 (unavailable for the Channel Islands) were converted to nutritional measures using British food composition tables, from Health New Zealand’s food and nutrition database, listing values for 77 foods and 110 nutritional measures of national food supplies.18
Cow breed distributions: Iceland, Norway, Jersey, Guernsey traditionally, and Israel and Japan in recent decades, were virtually one-breed countries. For other countries, we calculated the breed distribution from governmental animal census data,¹⁹ from industry,²⁰,²¹ and otherwise from national breeding programme data.²²

A1/β and other β-casein fractions: These were estimated by breed from the dairy science literature held by the Fonterra Research Centre (FRC) for 18 countries. In addition, factory or retail milk was tested from 11 Table 1 countries during 1998–2001. Genotype estimates were based on published A1/β herd tests, for Austria,²³ Canada,²⁴ France,²⁵ Germany,²⁶ Hungary,²⁷ Japan,²⁸ New Zealand,²⁹ Nordic countries,³⁰ Switzerland,³¹ the United Kingdom,³ and the United States.³² For the new Israeli Holstein breed,³³ we assumed US Holstein averaged A1/β values from US herd test reports from 1968,³ 1971,³⁴ and 1989.³² For Italy, Professor F Addeo supplied data on 23 breeds, (personal communication, June 2000). The A1/β fractions for breeds in Ireland and the Channel Islands were those of the same breeds tested in mainland Britain. In Iceland, tests were of herds³⁰,³⁵ and of bulk milk samples.³⁰,³⁵ In the absence of recent breed estimates or market share data, we used FRC test results on milk or milk powder from Australia (average of two samples) and Venezuela (average of 17 brands). During 1998–2001, milk test results were obtained from an additional nine countries: 1) from the Nordic countries;³⁶ 2) from Canada, Italy, New Zealand, and the UK, tested by FRC. For DM-1, 1990 and 1995 A1/β data were averaged to represent the 1990–4 fraction in the national milk supply.

A1/capita in 1990 (IHD) and in 1990–4 (DM-1) was estimated thus:

\[
\text{A1/capita} = (\text{cow}%) \times (\text{milk protein supply/capita}) \times (\beta\text{-casein/cow milk protein}) \times (\text{national A1/β})
\]

Cow% is total milk production percentage minus the percentage from sheep and goat milk. Milk protein supply/capita is defined above. β-casein as a fraction of cow milk protein = 0.284.³⁶ National A1/β = sum of the percentage contribution of each breed, weighted for its percentage of the national dairy cow population,¹⁹–²² the protein content of its milk,²² and average milk yield of its cows.²²

Mortality data: WHO³⁷ and its website (www.who.int) supplied total cardiovascular disease (CVD), IHD, and cerebrovascular (stroke) mortality data for 18 countries, and Channel Islands data were supplied by their Departments of Health. The annual mortality rate per 100 000 population in the age group 35–64 years was standardised by averaging of the rates for the component three ten-year age groups, and then averaging male and female rates. A lag of five years was allowed from food supply to IHD mortality.³⁸

DM-1 incidence data: This was provided by the 1990–94 WHO DiaMond Project,¹⁰ except for Iceland and Switzerland which were surveyed by the EURODIAB ACE Study group (Table 1).³⁹ Within each country, regional incidence results were averaged. Some were national surveys (Table 1). Rates for age 0–14 years were standardised by averaging six rates: 0–4, 5–9 and 10–14 year age groups by gender.

Food variables: Over 75 food and over 100 nutritional food supply variables for 1990 for all Table 1 countries (except Venezuela due to lack of data) were obtained from FAO¹⁶ and from Health New Zealand’s food and nutrition database¹⁸ and tested for correlation against DM-1 in 1990–4.
Table 1. Supply variables in 1990 and income and ischaemic heart disease rate in 1995, 20 countries, ranked on mortality

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<th>Myristic fat C14.0</th>
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<td>2574</td>
<td>10.3</td>
<td>17.8</td>
<td>0.57</td>
<td>1.61</td>
<td>201</td>
<td>13.5</td>
<td>13.0</td>
<td>0.52</td>
<td>1.90</td>
<td>78.6</td>
</tr>
<tr>
<td>Norway</td>
<td>23 306</td>
<td>1871</td>
<td>7.8</td>
<td>18.8</td>
<td>0.72</td>
<td>1.81</td>
<td>200</td>
<td>13.8</td>
<td>15.2</td>
<td>0.46</td>
<td>1.99</td>
<td>91.1</td>
</tr>
<tr>
<td>Austria</td>
<td>21 454</td>
<td>2301</td>
<td>22.4</td>
<td>94.2</td>
<td>0.65</td>
<td>1.61</td>
<td>227</td>
<td>15.9</td>
<td>15.5</td>
<td>0.21</td>
<td>0.92</td>
<td>88.2</td>
</tr>
<tr>
<td>USA</td>
<td>27 895</td>
<td>2720</td>
<td>14.6</td>
<td>20.9</td>
<td>0.57</td>
<td>1.25</td>
<td>198</td>
<td>12.8</td>
<td>14.5</td>
<td>0.39</td>
<td>1.60</td>
<td>99.8</td>
</tr>
<tr>
<td>Finland</td>
<td>18 856</td>
<td>1933</td>
<td>16.4</td>
<td>11.9</td>
<td>0.94</td>
<td>2.02</td>
<td>211</td>
<td>14.2</td>
<td>22.8</td>
<td>0.48</td>
<td>3.11</td>
<td>113.0</td>
</tr>
<tr>
<td>NZ</td>
<td>17 051</td>
<td>1971</td>
<td>15.8</td>
<td>32.1</td>
<td>0.93</td>
<td>2.17</td>
<td>251</td>
<td>17.3</td>
<td>17.1</td>
<td>0.50</td>
<td>2.42</td>
<td>116.0</td>
</tr>
<tr>
<td>UK</td>
<td>18 630</td>
<td>2233</td>
<td>15.0</td>
<td>32.0</td>
<td>0.62</td>
<td>1.59</td>
<td>202</td>
<td>13.4</td>
<td>15.2</td>
<td>0.53</td>
<td>2.31</td>
<td>117.4</td>
</tr>
<tr>
<td>Ireland</td>
<td>18 117</td>
<td>2279</td>
<td>16.2</td>
<td>11.7</td>
<td>0.85</td>
<td>1.76</td>
<td>225</td>
<td>14.5</td>
<td>22.9</td>
<td>0.59</td>
<td>3.84</td>
<td>131.1</td>
</tr>
<tr>
<td>MEAN:</td>
<td>21 241</td>
<td>2373</td>
<td>16.2</td>
<td>53.0</td>
<td>0.71</td>
<td>1.64</td>
<td>210</td>
<td>14.2</td>
<td>13.4</td>
<td>0.40</td>
<td>1.63</td>
<td>78.4</td>
</tr>
</tbody>
</table>

* age standardised by averaging of the three ten-year age groups, with male and female rates averaged; †average, 1994–8; ‡1995; §not adjusted for purchasing power parities (PPP); NA=not available
Income Gross domestic product per capita and health expenditure data for 1995 were given in 1995 US$ in purchasing power parities, base 1995.\(^{15,40}\)

Tobacco and alcohol availability Availability of tobacco products was from tax paid data, per adult age 15 and over.\(^{41}\) Cigars were omitted as they are not as strongly related to IHD as cigarettes. Alcohol, from FAO data, was given per capita.

Correlations were tested for significance by PEPI software,\(^{42}\) and multiple regressions by Excel 2001.

Results

No significant correlation was found between 1995 per capita incomes and IHD or DM-1.

Ischaemic heart disease (Tables 1 and 2, Figure 1)

In Table 1, countries were ranked by IHD rate. The Japanese, ranked lowest for IHD (21.5), consumed the least milk and least saturated fat.

The next six countries with lowest IHD mortality were from central Europe or the Mediterranean. Their milk consumption was low (except for Switzerland), and A1/capita was also low. France (28.8) ranked second lowest overall for IHD; and Guernsey (40.7), where milk has been virtually A1-free for a century or more, ranked third lowest.

To test for possible under-diagnosis or under-classification of mortality to IHD, we also ranked countries by (total) CVD, and by CVD minus stroke. Correlation with IHD was \(r = 0.92\) for CVD, and 0.91 for CVD minus stroke. For CVD, France ranked lowest, and for CVD minus stroke, second lowest; while Switzerland ranked third lowest for both, and Guernsey ranked fourth lowest for both.

The countries of North Europe, including countries they populated (with their cattle) – North America and Australasia – filled the lower half of the table and tended to consume more milk. In the last four ranks of Table 1, countries with the highest IHD rates all have more than 2 grams of A1/capita per day in their milk supply.

Tobacco and alcohol availability In 1990, neither tobacco nor alcohol was significantly correlated with IHD five years later. Tobacco product per capita sales were highest in Switzerland, and lowest in Sweden. Alcohol availability was highest in central Europe – in Germany, Austria, France and the Channel Islands – and lowest in Japan. Table 2 shows that wine supply/capita was moderately inversely correlated with IHD.

Dietary fat factors Dietary fat factors in univariate analysis (Table 2) showed significant correlation with IHD – the atherogenic index, estimated from the configuration of six dietary fats\(^{43}\) \((r = 0.50)\); and myristic, the 14-carbon saturated fatty acid. The Hegsted score (using food supply fats to estimate population serum cholesterol), saturated fat, and dairy fat were significantly correlated with IHD in 1980 and 1985, but not in 1990 and 1995.
Table 2 Correlations of supply variables, with ischaemic heart disease five years later, 1980-95, 18 countries

<table>
<thead>
<tr>
<th>Mortality year</th>
<th>1980</th>
<th>1985</th>
<th>1990</th>
<th>1995</th>
<th>mean</th>
<th>b</th>
<th>95%CI</th>
<th>e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food, tobacco, alcohol supply 5 years prior</td>
<td>r</td>
<td>r</td>
<td>r</td>
<td>r</td>
<td>mean</td>
<td>b</td>
<td>95%CI</td>
<td>e</td>
</tr>
<tr>
<td>A1/capita supply in milk, cream g/d</td>
<td>0.81‡</td>
<td>0.76‡</td>
<td>0.82‡</td>
<td>0.76‡</td>
<td>1.8</td>
<td>25.5</td>
<td>14, 37</td>
<td>0.57</td>
</tr>
<tr>
<td>A1/capita supply in milk, cream, and cheese g/d</td>
<td>0.79‡</td>
<td>0.71‡</td>
<td>0.74‡</td>
<td>0.66†</td>
<td>2.8</td>
<td>20.6</td>
<td>8.3, 33</td>
<td>0.71</td>
</tr>
<tr>
<td>Milk protein/capita supply in milk, cream g/d</td>
<td>0.72</td>
<td>0.63†</td>
<td>0.65†</td>
<td>0.60†</td>
<td>14.7</td>
<td>3.2</td>
<td>3.1, 6.6</td>
<td>0.65</td>
</tr>
<tr>
<td>A1/ ß casein fraction, in milk, cream</td>
<td>0.30</td>
<td>0.39</td>
<td>0.43</td>
<td>0.36</td>
<td>0.43</td>
<td>100</td>
<td>-37, 236</td>
<td>0.54</td>
</tr>
<tr>
<td>Atherogenic index</td>
<td>0.73‡</td>
<td>0.67‡</td>
<td>0.54*</td>
<td>0.50*</td>
<td>0.71</td>
<td>90</td>
<td>6, 172</td>
<td>0.78</td>
</tr>
<tr>
<td>Myristic C14:0 fat %E</td>
<td>0.70</td>
<td>0.70</td>
<td>0.60</td>
<td>0.48*</td>
<td>1.6</td>
<td>64</td>
<td>1.2, 71</td>
<td>0.74</td>
</tr>
<tr>
<td>Hegsted dietary fat formula for serum cholesterol mg/dL</td>
<td>0.70</td>
<td>0.56*</td>
<td>0.44</td>
<td>0.42</td>
<td>210</td>
<td>0.47</td>
<td>0.06, 1.0</td>
<td>ns</td>
</tr>
<tr>
<td>Saturated fat %E</td>
<td>0.65‡</td>
<td>0.61†</td>
<td>0.45</td>
<td>0.37</td>
<td>14.2</td>
<td>4.6</td>
<td>-1.4, 10.6</td>
<td>ns</td>
</tr>
<tr>
<td>Dairy fat g/d</td>
<td>0.63**</td>
<td>0.62†</td>
<td>0.49</td>
<td>0.31</td>
<td>35.3</td>
<td>0.8</td>
<td>-0.5, 2.2</td>
<td>ns</td>
</tr>
<tr>
<td>Butterfat g/d</td>
<td>0.61**</td>
<td>0.53*</td>
<td>0.44</td>
<td>0.14</td>
<td>10.3</td>
<td>0.7</td>
<td>-1.8, 3.2</td>
<td>ns</td>
</tr>
<tr>
<td>Tobacco products without cigars g/adult/year</td>
<td>0.27</td>
<td>- 0.04</td>
<td>-0.38</td>
<td>-0.42</td>
<td>2380</td>
<td>-0.02</td>
<td>-0.05, 0.003</td>
<td>ns</td>
</tr>
<tr>
<td>Alcohol g/d</td>
<td>- 0.40</td>
<td>- 0.32</td>
<td>-0.29</td>
<td>-0.04</td>
<td>15.1</td>
<td>0.2</td>
<td>-3.0, -2.5</td>
<td>ns</td>
</tr>
<tr>
<td>Wine g/d</td>
<td>- 0.59†</td>
<td>- 0.55*</td>
<td>-0.53*</td>
<td>-0.50*</td>
<td>53.0</td>
<td>0.3</td>
<td>-0.5, -0.02</td>
<td>-0.17</td>
</tr>
<tr>
<td>Vegetables %E</td>
<td>- 0.57*</td>
<td>- 0.58*</td>
<td>-0.60†</td>
<td>-0.16</td>
<td>7.5</td>
<td>3.6</td>
<td>-15.0, 7.8</td>
<td>ns</td>
</tr>
<tr>
<td>Plant foods poly-unsaturated fat (PUF) %E</td>
<td>- 0.79‡</td>
<td>- 0.82 †</td>
<td>-0.74†</td>
<td>-0.53*</td>
<td>1.64</td>
<td>-43</td>
<td>-79., -6</td>
<td>-0.87</td>
</tr>
</tbody>
</table>

Table 2 countries are Table 1 countries minus Guernsey and Jersey. *p <0.05; †p<0.01; ‡p <0.001; ns=not significant; r=correlation coefficient; b=univariate regression coefficient, with 95% confidence intervals; e=elasticity=% change in IHD rate related to a 1% change in the food supply variable, estimated as b*(supply variable mean/mean of 1995 IHD rate). The mean IHD rate was 80.8 for these 18 countries in 1995.

Cow milk protein supply variables: Milk protein supply variables were all more strongly correlated with IHD five years later than any dietary fat variable in Table 2: A1/capita in milk and cream (r = 0.76, p <0.0005); A1/capita in milk, cream and cheese combined (r = 0.66); and cow milk protein per capita (r = 0.65). Across 18 countries studied over 20 years, of over 180 variables tested, A1/capita correlated most closely with IHD five years later. A 1% change in A1/capita in 1990 was associated with a 0.57% change in IHD mortality in 1995. Correlation between 1990 A1/capita and IHD in 1995 were stronger for male IHD (r = 0.83) than for female IHD (r = 0.69). Length of lag was not critical to the correlations. A1/capita in 1975, 1980, 1985 and 1990 was correlated with IHD in 1995 (r = 0.82, 0.76, 0.82, 0.76 respectively).

In 1995, A1/capita varied greatly among countries, from about 0.3 g/day in Guernsey, to 3.0 g/day in Finland. Between 1975 and 1995, the 20-country averages decreased for milk protein and for A1/capita by 14%, and remained the same for A1/ß; IHD decreased 57%. Most of the decreases occurred between 1985 and 1995, when
A1/capita decreased 13%, while IHD decreased more, by 37%. The correlation of the annual rates of change between A1/capita and IHD was not statistically significant.

**Cheese, butter and cream, and the other caseins** A1 consumed as cheese (after adjusting for imports) weakened the correlations of A1/capita in milk and cream with IHD five years later, from \( r = 0.76 \) to \( r = 0.66 \). Adding A1 in cream added approximately 1% to the strength of the correlations between milk and IHD. Butter (1.1% protein by weight), in high-consuming countries, added 3–4% to estimated A1/capita, but increased the correlation of A1/capita with DM-1 by 0.001 only, and was omitted from all tables.

Per capita supply based on the B variant \( \beta \)-casein in milk and cream, or on any combination of A1, B and C variants of \( \beta \)-casein therein, or on including the A variant of kappa-casein, or including estimates of A1 in cheese, decreased correlations with IHD.

**Figure 1. A1 \( \beta \)-casein supply (A1/capita) 1990 and ischaemic heart disease 1995, 20 countries**

\[ r = 0.76, \text{ (95% CI 0.48-0.90), } p < 0.0001. \text{ Dotted lines are the 95% confidence limits of the regression line.} \]

**Analysis** On multivariate analysis of the variables with highest univariate positive correlation with IHD in 1995 in Table 2, only A1/capita gave a significant result. When all 4 five-year periods in Table 2 were combined for estimating IHD five years
later, the only significant variables were the downward trend with time, as given by the calendar year, A1/capita, and plant polyunsaturated fat (PUF).

**Diabetes Type 1** (Tables 3 and 4, Figure 2)

Table 3 Average supply of milk protein per capita as milk or cream in 1990–4 varied more than fourfold, from 5 g/day in Japan, to 22 g/day in Finland and Sweden.

Table 3. The per capita supply of A1 \( \beta \)-casein and milk protein, 1990–94, and incidence of diabetes mellitus Type 1 at age 0–14 years, 1990–94, 19 countries

<table>
<thead>
<tr>
<th>Countries ranked on DM-1 incidence</th>
<th>DM-1 new cases</th>
<th>Milk and cream protein per capita* g/day</th>
<th>A1(\beta)-casein fraction in milk and cream supply 1990, 1995 averaged</th>
<th>A1(\beta)-casein per capita g/day</th>
<th>DM-1 annual incidence rate per 100 000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>a</td>
<td>b</td>
<td>c=</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>1768</td>
<td>21.54</td>
<td>0.48</td>
<td>2.93</td>
<td>36.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>2166</td>
<td>22.34</td>
<td>0.46</td>
<td>2.92</td>
<td>27.5</td>
</tr>
<tr>
<td>Canada</td>
<td>204</td>
<td>12.18</td>
<td>0.52</td>
<td>1.79</td>
<td>24.2</td>
</tr>
<tr>
<td>Norway</td>
<td>409</td>
<td>14.86</td>
<td>0.46</td>
<td>1.94</td>
<td>21.1</td>
</tr>
<tr>
<td>UK</td>
<td>1111</td>
<td>14.20</td>
<td>0.53</td>
<td>2.14</td>
<td>18.4</td>
</tr>
<tr>
<td>NZ</td>
<td>169</td>
<td>14.64</td>
<td>0.48</td>
<td>2.00</td>
<td>17.4</td>
</tr>
<tr>
<td>Denmark</td>
<td>177</td>
<td>9.38</td>
<td>0.48</td>
<td>1.29</td>
<td>15.5</td>
</tr>
<tr>
<td>USA</td>
<td>605</td>
<td>14.28</td>
<td>0.40</td>
<td>1.63</td>
<td>14.8</td>
</tr>
<tr>
<td>Australia</td>
<td>722</td>
<td>17.19</td>
<td>0.43</td>
<td>2.12</td>
<td>14.5</td>
</tr>
<tr>
<td>Italy</td>
<td>1637</td>
<td>9.82</td>
<td>0.44</td>
<td>1.11</td>
<td>13.7</td>
</tr>
<tr>
<td>Iceland</td>
<td>52</td>
<td>17.26</td>
<td>0.31</td>
<td>1.65</td>
<td>13.5</td>
</tr>
<tr>
<td>Germany</td>
<td>903</td>
<td>9.65</td>
<td>0.43</td>
<td>1.18</td>
<td>11.0</td>
</tr>
<tr>
<td>Austria</td>
<td>660</td>
<td>15.98</td>
<td>0.21</td>
<td>0.94</td>
<td>9.5</td>
</tr>
<tr>
<td>Hungary</td>
<td>697</td>
<td>11.34</td>
<td>0.39</td>
<td>1.25</td>
<td>9.1</td>
</tr>
<tr>
<td>France</td>
<td>709</td>
<td>9.94</td>
<td>0.36</td>
<td>1.01</td>
<td>8.5</td>
</tr>
<tr>
<td>Switzerland</td>
<td>353</td>
<td>19.87</td>
<td>0.23</td>
<td>1.27</td>
<td>7.9</td>
</tr>
<tr>
<td>Israel</td>
<td>361</td>
<td>7.50</td>
<td>0.42</td>
<td>0.90</td>
<td>6.0</td>
</tr>
<tr>
<td>Japan</td>
<td>167</td>
<td>4.83</td>
<td>0.52</td>
<td>0.73</td>
<td>1.7</td>
</tr>
<tr>
<td>Venezuela</td>
<td>43</td>
<td>5.96</td>
<td>0.30</td>
<td>0.50</td>
<td>0.13</td>
</tr>
<tr>
<td>Total or mean</td>
<td>12 913</td>
<td>13.21</td>
<td>0.42</td>
<td>1.54</td>
<td>14.3</td>
</tr>
</tbody>
</table>

*fresh milk equivalents, excluding cheese and butter, including cream and yoghurt

Note: The DM-1 surveys were carried out in 1990–3 for Australia and Japan, 1989–94 for Iceland 1991-4 for Switzerland, in all others during 1990–4. Milk supply data were averaged for the same years as the DM-1 survey in that country.

Source: WHO-DiaMond Project,\(^{30}\) for Iceland and Switzerland, EURODIAB ACE study group.\(^{39}\)

The A1/\(\beta\) fraction of milk casein varied from 0.21 in Austria to 0.53 in the UK. A1/capita supply varied sevenfold, from 0.4 g/day in Venezuela to 3.0 g/day in Finland.

From 19 countries surveyed, 12 913 new cases of DM-1 were detected, with a country annual average rate of 14.3 new cases per 100 000 children age 0–14 years (boys,
The DM-1 rate varied nearly 300-fold, from 0.13 in Venezuela to 36.5 in Finland.

The DiaMond Project surveys supplied age-specific DM-1 for 17 countries. The country-average DM-1 rate increased from 9.3 per 100 000 at 0–4 years, to 15.9 at 5–9 years, to 18.9 at 10–14 years of age.

The correlation of milk protein with DM-1 was equally high in all age groups ($r = 0.80, 0.81, 0.81$) and for 0–14 years, $r =0.82$. The correlation with A1/capita was $r = 0.91$ for boys, and $0.90$ for girls ($p < 0.001$), and equal at 0–4, 5–9, and 10–14 years of age. For the five Nordic countries, correlation was similarly high ($r = 0.91, p <0.05$).

For 51 countries surveyed, DM-1 was significantly correlated with milk supply, including cheese ($r = 0.70, p <0.001$).

Table 4. Correlations of cow proteins per capita supply with incidence of diabetes mellitus Type 1, age 0–14 years, across 19 countries, 1990–94

<table>
<thead>
<tr>
<th>Cow protein variables, 1990-94 averaged</th>
<th>Univariate regression coefficients</th>
<th>Elasticity</th>
<th>Correlation with DM-1 incidence$^5$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b</td>
<td>95% CI</td>
<td>e</td>
</tr>
<tr>
<td>A1 β-casein /capita, in milk &amp; cream</td>
<td>12.0</td>
<td>9.3, 14.7</td>
<td>1.29</td>
</tr>
<tr>
<td>A1+B casein/capita, in milk &amp; cream</td>
<td>11.1</td>
<td>7.7, 14.4</td>
<td>1.36</td>
</tr>
<tr>
<td>A1+B +C casein/capita, in milk &amp; cream</td>
<td>3.0</td>
<td>2.0, 4.0</td>
<td>1.32</td>
</tr>
<tr>
<td>A kappa-casein/capita, in milk &amp; cream</td>
<td>1.8</td>
<td>0.9, 2.7</td>
<td>1.15</td>
</tr>
<tr>
<td>Protein/capita in milk &amp; cream$^6$</td>
<td>1.20</td>
<td>0.54, 1.85</td>
<td>1.11</td>
</tr>
<tr>
<td>A1/β casein fraction, in cheese</td>
<td>47.5</td>
<td>5.0, 90.0</td>
<td>1.38</td>
</tr>
<tr>
<td>A1/β casein fraction, in milk &amp; cream</td>
<td>3.1</td>
<td>-0.2, 6.4</td>
<td>0.09</td>
</tr>
<tr>
<td>A2 β-casein /capita, milk &amp; cream</td>
<td>4.8</td>
<td>0.2, 9.5</td>
<td>0.68</td>
</tr>
<tr>
<td>A1 β-casein /capita, in cheese</td>
<td>9.2</td>
<td>0.2, 18.3</td>
<td>0.62</td>
</tr>
<tr>
<td>Protein/capita, in cheese</td>
<td>0.57</td>
<td>-0.7,1.8</td>
<td>ns</td>
</tr>
<tr>
<td>B β-casein/capita, in milk &amp; cream</td>
<td>-6.45</td>
<td>-30.1,17.2</td>
<td>ns</td>
</tr>
<tr>
<td>C β-casein/capita, in milk &amp; cream</td>
<td>-37</td>
<td>-123,48</td>
<td>ns</td>
</tr>
</tbody>
</table>

Based on Table 3.

$^*p <0.05; ^1p <0.01; ^2p <0.001, ns = not significant$

DM-1 rate standardised by averaging six age-gender groups (0–4, 5–9, and 10–14 years)

For the 17 countries surveyed by DiaMond Project

$r=0.82; b= univariate regression coefficient, with 95% confidence intervals; e=elasticity=% change in DM-1 rate related to a 1% change at the mean in the cow protein variable, estimated as b*(cow protein variable mean/mean of DM-1 rate)

Table 4 DM-1 at age 0–14 years was correlated with the quantity of milk and cream in the food supply, as measured by milk protein per capita ($r = 0.68, p <0.001$). DM-1 correlated particularly with A1/capita in the food supply in the same years ($r = 0.92, p <0.001$); but not with B and C β-casein per capita. A 1% change in A1/capita was associated with a 1.3% change (elasticity) in DM-1.

Across 75 foods and over 100 nutritive food supply variables across 18 countries, the highest positive correlation was with milk protein ($r = 0.64$), and with oats ($r = 0.70$). Latitude was significantly correlated with DM-1 ($r = 0.65, p <0.005$), but not with IHD.

None of the genotype fractions of β-casein or of kappa-casein in milk correlated significantly with DM-1, except A1/β ($r = 0.47, p <0.05$). The correlations of casein...
genotypes were significantly inter-correlated, but among single genotypes, only A1/capita markedly exceeded milk protein per capita’s correlation with DM-1. The combined A1+B, and A1+B+C per capita correlations with DM-1 were weaker than for A1/capita alone. The A variant fraction of kappa casein per capita was significantly correlated to A1/capita, and was correlated with DM-1 in the same range as total milk protein. A2 β-casein in milk protein per capita was significantly correlated with DM-1 (r = 0.47, p <0.05), but less than total milk protein (r = 0.68, p <0.01). A1 β-casein in cheese per capita was significantly correlated with DM-1 (r = 0.46, p <0.05), half the r = 0.92 value for A1 β-casein in cow milk.

Elliott et al found a correlation (r = 0.77) of A1/capita with DM-1 across 10 countries based on DM-1 surveys before 1991; in the present study, for 1990–4, across the same countries we confirmed this correlation (r = 0.84, p <0.005). For the additional nine countries in this study, r = 0.90 (p <0.001). Elliott et al found that combining per capita A1 and B β-caseins gave an improved correlation with DM-1; in this study, across the same countries, inclusion of B β-casein weakened the correlation.

Figure 2. Correlation of A1/capita (A1 β-casein in the per capita milk and cream supply) with the incidence of diabetes mellitus Type 1 at age 0–14 years of age, 1990-94, 19 countries

\[ r=0.92 \text{ (95\% CI 0.72 to 0.97) } p <0.0001; \text{ dotted lines = 95\% confidence limits of the regression line} \]
Sensitivity of the methods of estimation  The correlation of A1/capita in 1990 with IHD in 1995 varied from $r = 0.75$ for the 10 countries estimated from breed data only, to $r = 0.69$ for the 10 using both methods. This was due to the fact that the highest and lowest values were found in the former group. Correlating for any 19 countries out of 20, the $r$ value varied from 0.69 (deleting Ireland) to 0.80 (deleting Australia). Deletion of the smallest countries (Jersey, Guernsey and Iceland) made no difference. Deletion of all three countries whose individual deletions most lowered the correlation (Ireland, New Zealand and Guernsey), lowered the correlation to $r = 0.62$.

For DM-1, removal of one country at a time from the correlation with A1/capita resulted in a correlation between $r = 0.89$ and 0.94 for the remaining 18 countries. Deletion of the two highest data points in Figure 2 (Finland and Sweden), lowered the correlation to $r = 0.65$. When the analysis was confined to the 11 countries analysed by consumer milk tests and breed-based estimates, the correlation was $r = 0.69$, but the consumer milk tests were all carried out approximately five years later.

Discussion

Correlation, even when statistically significant, does not prove causation, though it may raise that possibility. This is an ecological study with the limitations implied: its main value is to focus further research, and is not by itself a basis for public policy. For example, the supply of tobacco products in Table 2 was not significantly correlated with IHD five years later. This is at variance with individual-based studies – tobacco precipitates IHD mortality in tandem with atheroma, and many high-IHD populations have reduced their tobacco and saturated fat consumption. Data aggregated at national level may, however, be an efficient means of locating effects which though small for each individual are detectable in the population mean. In addition, extreme caution is required in interpreting correlations involving dietary factors, which are often inter-correlated.

Sampling errors may have occurred, due to surveying only parts of some countries for DM-1. Testing dairy herds to characterise a national herd risked local variations. Cow registration data may have over-represented high-production breeds in characterising the national herd. A single retail milk sample may not accurately characterise a country’s milk for that year. Testing methods for A1/β vary somewhat. Japan lacked recent A1/β data. Israeli cows or milk were not tested; instead, tests of the United States Holsteins, from which the Israeli herd derives, were used.

A1/β estimates were obtainable for 22 countries in total. As herd A1/β test results may not have been representative of the national herd, we supplemented herd tests with consumer milk tests. For New Zealand, with separate herds milked for export and domestic supply up to 1992, any estimates were for the latter.

Ischaemic heart disease

In reviewing the results of the WHO MONICA (Monitoring trends and determinants in Cardiovascular disease) Project in 21 countries including New Zealand, the authors concluded that “the results support prevention policies based on the classic risk factors but suggest potential for prevention beyond these.” It may be timely to consider new concepts, including McLachlan’s A1 hypothesis.
The IHD-A1 correlation was only valid for “healthcare-affluent” countries. We assumed that a certain level of health expenditure was needed to achieve a reasonable minimum chance of survival of IHD. Per capita income was not significantly correlated with IHD mortality in the 20 countries selected, but mortality may be correlated with national expenditure on healthcare, for those with IHD surviving long enough to reach hospital. Income and IHD would have correlated significantly had we included Hungary (low GDP/capita, low health expenditure, highest IHD rate).

Similarly, the higher correlations with IHD found for A1/capita compared with other fat variables may be true only of healthcare-affluent countries. For example, inclusion of Hungary, with its atherogenic index and IHD rate each exceeding any such values in Table 1, resulted in IHD being more correlated with the atherogenic index than with A1/capita. On the other hand, low expenditure on healthcare can be expected to decrease survival and raise IHD mortality, outweighing dietary influences. Austria had a higher IHD mortality than A1/capita and dietary predictors would suggest. This was not due to misclassification of IHD (based on CVD minus stroke mortality). We were not, however, able to compare Austria with other countries for adoption of effective coronary care practices.

Food supply statistics have been significantly correlated with survey data across many countries, but food supply statistics are the only feasible way to compare all countries across time. We assumed that per capita milk supply was proportional to its consumption in childhood or at age 35–64 years. FAO assigns an average 3.3 g of fat and 3.3 g of protein per 100 g of milk. This standardised milk will give the same correlations for its protein, fat, saturated fat or any other fixed component. Table 2, however, shows that the total protein in milk was more highly correlated with IHD rates from 1980 to 1995, than was total saturated fat, total dairy fat or butter. If the milk effect was due to its dairy fat content, then the opposite should have been true.

Saturated fat recorded for individuals in the 1960s had a high correlation (r = 0.85) with IHD 10 years later across the 16-cohorts of the Seven Country Study. Between 1970 and 1990, of the 18 countries listed for saturated fat in Table 1, the 11 English-speaking or Nordic countries, with mostly high IHD rates in 1970, all lowered per capita saturated fat in their food supply, while the other countries in Table 1 with mostly low IHD rates, increased it. This reduced the correlation between the per capita saturated fat supply and IHD in 1990, and 1995 (r = 0.37, Table 2).

Based on the estimated A1/capita in milk, cheese contributed an estimated country average of one third of the A1 β-casein in the diet, and one half or more in France, Germany and Italy. Inclusion of cheese weakened the correlation with IHD of A1/capita in milk and cream by 10 percentage points (Table 2). The extent of decrease in A1/β in manufacture or during shelf life may vary by brand or country. In any case, A1/capita in milk, whether including A1/capita in cheese or not, was more strongly correlated with IHD 5 years later than any other food supply variable found.

Plant foods (cereals, rice, nuts, beans, potatoes, olives, peas, but not counting vegetables) as measured by polyunsaturated fat (PUF), were closely associated with low national rates of IHD mortality. Of Table 1 countries, Italy, Japan and Switzerland had the highest consumption of polyunsaturated fat in plant foods.
The Mediterranean diet has been followed most closely among Table 1 countries by Italy and, though consuming less olive oil, by Israel; both countries ranked low in IHD mortality. The Mediterranean diet, as surveyed in Crete in 1948, derived half its calories from cereals, nuts and pulses, one third from olive oil, and the rest from vegetables and fruit.\textsuperscript{47} Milk consumption was low (milk protein 8 g/day).\textsuperscript{48} Cretan men had the lowest IHD mortality in the Seven Country Study, mostly attributed to low saturated fat. An additional explanation is that A1/capita supply on Crete was low, possibly only 0.5 g/day, due to a low milk supply, and particularly due to low cow-milk availability. Forty per cent of milk in Greece was goat or sheep milk,\textsuperscript{49} which contains no A1 \(\beta\)-casein.

The “French paradox” refers to France’s low IHD mortality (second lowest, Table 1) despite a high butter supply (second highest, Table 1). This was not a misclassification error – in 1995, France also had the lowest CVD mortality, and French women had the second highest life expectancy. France’s low IHD mortality has been attributed to wine, garlic, plant PUF or vitamins.\textsuperscript{50} In France alcohol supply/capita was one half higher than in Ireland; and wine supply/capita 16 times higher (Table 1). In Figure 1, the French IHD data point is below the 95\% confidence limits for A1, and high French alcohol consumption may explain this. However, alcohol was not correlated with IHD (Table 2). The Irish/French IHD rate ratio of 3.8:1 was in line with the milk protein ratios (total protein/capita, 3.1:1; A1/capita, 4.1:1) (Table 1).

The A1 hypothesis, if confirmed, could explain the low IHD rates in Mediterranean countries, and the Irish–French IHD differences.

**Diabetes Type 1**

Of over 170 foods and nutritional variables in the food supply in 1990, milk was the only food highly correlated \( (r >0.60, p <0.01) \) with DM-1, apart from the northern European crops of oats and rye, which with latitude, may merely reflect the geographical distribution of A1/capita supply.

In this 19-country study based on 1990–4 surveys, we confirmed Elliott’s pre-1991 findings from 10 countries that A1/capita was highly correlated with DM-1,\textsuperscript{6} but found that with B (or C) \(\beta\)-casein added, the correlation decreased, and B or C separately were not correlated with DM-1 (Table 4).

Elliott noted that the distinctive peptide formed mostly from A1 \(\beta\)-casein and partly from B \(\beta\)-casein was \(\beta\)-casomorphin-7, and this was possibly the active ingredient. Lack of correlation between DM-1 and B \(\beta\)-casein raises the possibility that B \(\beta\)-casein, which differs in solubility, may be processed differently by the intestinal mucosa. Countries with above-average B \(\beta\)-casein were Australia, Austria, Denmark, France, Germany and Venezuela. Milk may be exposed to different temperature patterns at the farm, or during processing, across countries and time periods.

The method used here and by Elliott\textsuperscript{1} assumed that childhood milk consumption was proportional to its per capita supply. Surveys have since confirmed that A1 \(\beta\)-casein consumption of two-year-old children was lower in Iceland (1.7 g/day) than in other Nordic countries (average 2.4 g/day).\textsuperscript{51} No such difference was found in surveys of 11–14 year-olds.\textsuperscript{51} The correlation between DM-1 and A1/\(\beta\) was equally high at 0–4, 5–9 and 10–14 years of age, suggesting that early childhood exposure to cow milk...
A1/ß may permanently change the islet cells, making them prone to other factors or processes that cause islet cells to die at a later age. Anti-A1 antibodies tend to be higher in DM-1 diabetics and their siblings, while anti-A2 antibodies tend to be higher in their parents and controls. This suggests a defective immunotolerance to cow milk antigens in DM-1, possibly due to ß-casomorphin-7.  

The A variant of kappa casein/capita (Table 4) was highly correlated with A1/capita (r = 0.79), and less so with DM-1. Genes for kappa and beta casein are situated very close together on cattle chromosome 6. Besides A2, B and C ß-casein, other cow proteins in the milk supply – albumin, immunoglobulin, and lactoferrin – showed no correlation with DM-1 in Nordic countries.  

A1 ß-casein in cheese per capita (estimated from A1/ß of the milk) did not correlate with DM-1, certainly not as closely as A1 casein in milk and cream. First, child consumption of cheese, more than milk, was likely to vary from adult consumption. Second, due to wastage, cheese supply may not reflect consumption as does milk supply. Third, its A1/ß ratio was likely to vary in ways not predicted by the A1/ß of the milk it was made from. Proteolytic enzymes, salts, temperature during manufacture, and on-shelf ageing, can vary the A1/ß ratio between types of cheese. Information on the market share and on-shelf A1/ß tests for each cheese type might improve the estimate of national A1/capita from cheese as consumed.  

Insulin-dependency makes for a clear definition of DM-1, and diabetic registers and the second round of the DiaMond survey have made for very high ascertainment. The increase in DM-1 rates with age during childhood suggested environmental causes. From 1960 to 1996, A1/capita across 17 countries with historical data declined 21%, or 0.6% a year, whereas the rate of DM-1 increased by an average 3% a year in 37 populations surveyed. Other factors besides A1/capita and milk supply per adult are needed to explain the global increase in DM-1 in children. While the milk supply has decreased, child nutrition surveys are needed to determine whether rising incomes and the marketing of infant formula, coloured and flavoured milks, yoghurts, and ice cream may have led to increased children’s consumption of cow protein, and thereby increased A1/capita or ß-casomorphin-7 in their diet.  

A DM-1 rate was not calculated for Guernsey for Table 3, as only five DM-1 cases were found in 1990–4, and we had no information on genetic predisposition to DM-1 among Guernsey children. Clearly, however, milk very low in A1 does not entirely prevent DM-1 from occurring. Similarly, Jersey residents consumed only Jersey milk (A1/ß = 0.09, A1/capita 0.3 g/day), and again numbers were small. The low Venezuelan DM-1 rate may reflect incomplete ascertainment but, even assuming it was 10 times higher, the correlation over all countries was unaltered at r = 0.92. DM-1 in countries excluding Australia had a correlation with A1/capita of r = 0.94; Australian DM-1 data were based on one survey site in New South Wales.  

In summary, from 1980 to 1995, IHD mortality in 20 healthcare-affluent countries was more highly correlated with total milk proteins (and particularly A1) than with fats in the food supply at population level, providing an alternative and testable hypothesis to explain the higher IHD mortality in northern compared to southern Europe.
Across 51 countries surveyed, DM-1 rates were significantly correlated with per capita fresh milk protein, and in 19 countries for which data were available, A1 β-casein/capita substantially increased this correlation, from 68% to 92%. In contrast, A2, B and C variants of β-casein in milk, and cheese proteins, correlated less strongly with DM-1 than total milk protein.

The correlations of A1/capita with DM-1 and IHD rates raise the possibility that intensive breeding of cows over many years may have emphasised a genetic variant of milk with adverse effects in humans. Clinical trials will be needed to determine whether A1-free milk can reduce the risk of DM-1 and IHD.

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Conflicts of interest: The IHD section of this paper was funded by a grant from A2 Corporation, Auckland, to the first author, who is a minor shareholder in A2 Corporation. Both authors are directors of the NZ Milk Institute Ltd, which owns a patent related to A1-free milk.

Correspondence: Dr Murray Laugesen, Health New Zealand, P O Box 25-920, St Heliers, Auckland. Email: laugesen@healthnz.co.nz

References:


The use of complementary/alternative medicine by cancer patients in a New Zealand regional cancer treatment centre

Kathryn Chrystal, Simon Allan, Garry Forgeson and Richard Isaacs

Abstract

Aim To study the prevalence and patterns of complementary/alternative medicine (CAM) use in cancer patients managed by a New Zealand regional cancer treatment centre.

Methods A self-administered anonymous questionnaire was used to survey patients attending outpatient clinics of the MidCentral Regional Cancer Treatment Service. Questions addressed patient demographics, cancer diagnosis and conventional treatments received. CAM users were asked to identify types of therapies used, reasons for use, perceived effectiveness, safety and financial cost.

Results Questionnaires were distributed to 350 patients, with 200 assessable replies received. Overall, 49% of patients in this group used CAM, with vitamins, antioxidants, alternative diets, and herbal therapies the most commonly used agents and usage was more common in younger patients. CAM was used by 47% to improve quality of life and by 30% in the hope of a cure of their cancer. Of CAM users, 71% believed these therapies had been helpful in the management of their cancer, and 89% felt they were safe. Only 41% of users had discussed CAM with their oncologist and almost one third had started such therapies before being seen at the Cancer Treatment Centre. The median cost of CAM was NZ$55/month.

Conclusions CAM is commonly used by New Zealand cancer patients, who often use multiple therapies, not only during conventional treatment, but also without consultation with their oncologist. This lack of open communication about CAM between patients and medical staff may prevent identification not only of potential harmful effects, but also of positive and negative drug interactions between CAM and conventional therapies.

The use of Complementary/Alternative Medicine (CAM) is increasing worldwide. A national survey in the United States demonstrated an increase in use from 33.8% to 42.1% between 1990 and 1997.¹ The overall use of CAM in Australia was 48.5% in 1993, with a reported AU$981 million per annum spent by patients.²

There has been extensive literature published recently on the use of CAM by cancer patients, with the prevalence of reported use ranging from 22% in Australia, up to 70% in the United States and Canada.³⁻⁵ Studies have also found that cancer patients have a higher usage of CAM than patients with other medical conditions.⁶ In New Zealand, there has been recent public and media attention regarding the use of CAM, particularly in relation to the management of cancer.⁷⁻⁹ There have been only three studies to date addressing the use of CAM in this country, none of which directly addressed the prevalence of use in cancer patients.¹⁰⁻¹²
The aim of this study was to determine the prevalence of use by cancer patients attending outpatient clinics at a regional cancer treatment unit in New Zealand, and to identify types of CAM being used; reasons for use; satisfaction; and financial cost of CAM to the patient.

Methods

Patients attending oncology outpatient clinics at either Palmerston North or Taranaki Base Hospitals, between April and December 2001, were offered a self-administered questionnaire by reception staff. Information sheets explaining the purpose of the study and return post-paid envelopes were attached. Responses were voluntary and anonymous and assumed consent.

The questionnaire obtained demographic, disease and treatment-related data, as well as expectations of conventional treatment for all patients. Patients using CAM were asked to indicate the types of CAM therapies used, and these were divided into multiple categories. CAM users were also asked about timing of CAM use, reasons for CAM use, its perceived effectiveness, and to describe any side effects. They were asked whether they had discussed CAM use with their oncologist, and to estimate the monthly financial cost of CAM therapies and of visits to CAM practitioners.

Data were entered into an Excel spreadsheet and StatView statistical package for analysis. Associations between patient characteristics and CAM use were assessed by bivariate analysis ($\chi^2$ test for categorical variable and t-test for continuous variables). A p value of 0.05 was considered significant.

This study was approved by the Whanganui-Manawatu and Taranaki Ethics Committees, and the Palmerston North Hospital Cancer Treatment Protocol & Research Committee.

Table 1. Characteristics of questionnaire respondents (n=200)

<table>
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</tr>
</tbody>
</table>

NHL=Non-Hodgkin’s lymphoma
Results

350 questionnaires were distributed and 203 (58%) of these returned. 200 were included in the analysis. The remaining three were excluded because patients had not indicated if they had used CAM therapies.

**Patient characteristics and conventional treatment** Characteristics of respondents are shown in Table 1. Ages ranged from 20–88 years, with a median age of 58 years. Females made up 71% of the total respondents; 86% of patients were European and 13% Maori. Breast cancer was the most common diagnosis (40%), with a range of other malignancies reflecting patients treated by Oncologists as outpatients. Cancer diagnosis was not indicated by 6% of patients.

Of all patients, 67% had received chemotherapy, 52% radiotherapy, and 22% hormonal treatments. Fifty two per cent of patients had the expectation that conventional treatment would cure their cancer, 46% that it would control the cancer and prolong life, and 12% expected it to improve symptoms and quality of life.

**Use of CAM** Of the 200 respondents, 97 patients (49%) reported using at least one form of CAM therapy. Of CAM users, 80% used more than one type of therapy, 40% reported using four or more different types of therapies, and 14% used at least seven different therapies.

Table 2 shows the types of CAM therapies used, with vitamins (68%), and antioxidants (54%), being the most frequent. Other commonly-used therapies were (in descending order of frequency of use) spiritual, diets, relaxation, herbal, imagery, naturopathy and massage.

### Table 2. Types of CAM therapies used

<table>
<thead>
<tr>
<th>Type of CAM therapy</th>
<th>Patients (n=97)</th>
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<tbody>
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<tr>
<td>Vitamins</td>
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<td>Antioxidants</td>
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<td>Spiritual</td>
<td>27</td>
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<tr>
<td>Diets</td>
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<tr>
<td>Relaxation</td>
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<tr>
<td>Herbal</td>
<td>23</td>
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<tr>
<td>Imagery</td>
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</tr>
<tr>
<td>Naturopath</td>
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</tr>
<tr>
<td>Massage</td>
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<tr>
<td>Aromatherapy</td>
<td>13</td>
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<tr>
<td>Detoxification</td>
<td>12</td>
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<tr>
<td>Chiro/osteopath</td>
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<tr>
<td>Acupuncture</td>
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</tr>
<tr>
<td>Homeopathy</td>
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</tr>
<tr>
<td>Electr/biomagnetic</td>
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</tr>
<tr>
<td>Shark cartilage</td>
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<tr>
<td>Traditional/cultural</td>
<td>4</td>
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<tr>
<td>Hypnosis</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>19</td>
</tr>
</tbody>
</table>
Over one third (35%) of patients began using CAM therapies before they were diagnosed with cancer, and 39% commenced them at the time of diagnosis. A significant proportion of patients (38%) reported using CAM during conventional treatment, and 20% only began using CAM following conventional treatment.

Most patients reported learning of CAM therapies from family (39%) and friends (41%); however a further 23% of patients gained information from media sources. Other cancer patients provided information about CAM therapies to 21% of patients. Of health professionals, doctors were a source of information for 14% of patients, while pharmacists and nurses were a less common source (8% and 2% respectively). Only 3% of patients reported gaining information from the Internet. Some patients cited more than one source of information.

**Reasons for CAM use** Nearly 50% of patients reported improvement in quality of life as one of the reasons they were using CAM. Reasons for CAM use are shown in Table 3, with many patients giving more than one reason. Over half of patients were using CAM in the hope of anticancer effects, with over one quarter (28%) of CAM users hoping for cure, and a further 30% for control of cancer.

**Table 3. Reasons for CAM use**

<table>
<thead>
<tr>
<th>Reason for use</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>Improve quality of life</td>
<td>46</td>
</tr>
<tr>
<td>Lessen side effects of conventional treatment</td>
<td>42</td>
</tr>
<tr>
<td>Prevent recurrence of cancer</td>
<td>33</td>
</tr>
<tr>
<td>Assist other treatments to work</td>
<td>32</td>
</tr>
<tr>
<td>Hope to control cancer</td>
<td>31</td>
</tr>
<tr>
<td>Hope of cure</td>
<td>29</td>
</tr>
<tr>
<td>To relieve symptoms</td>
<td>25</td>
</tr>
</tbody>
</table>

**Patient characteristics associated with CAM use** Younger patients were significantly more likely to use CAM than older patients (p = 0.01). There was no difference between CAM users and non-users with regards to gender, ethnicity, employment status, diagnosis, or conventional treatment received. Patients whose expectation of conventional treatment was that it would improve symptoms and quality of life, rather than cure cancer or prolong life, were significantly more likely to use CAM (p = 0.03)

**Helpfulness and safety of CAM** Patients were asked to rank on a numerical scale from 1 to 5 how helpful they felt CAM therapies had been in the treatment of their cancer, (1 being not at all helpful, 5 being extremely helpful). Of CAM users, 71% felt these therapies had given them some benefit and, of those, 32% thought they had been extremely helpful. Only 6% thought that the CAM had not been helpful at all.

When asked if they believed CAM therapies were safe, 89% felt they were, 5% did not know, and 5% did not answer. Only one patient in this study thought CAM therapies were unsafe. Most patients using CAM also stated that they had not been aware of any side effects from CAM therapies (91%). Only four patients reported having side effects, and 6% did not answer this question.
Cost  The estimated financial cost of CAM therapies, including visits and travel to complementary/alternative practitioners ranged from NZ$0–650 a month, with the median amount spent being NZ$55 a month and the average NZ$102.

Discussions with oncologist  Only 41% of CAM users had informed their oncologist that they were using CAM, 54% had not informed their oncologist, and 5% did not answer this question. Older patients were significantly less likely to inform oncologists than younger patients (p = 0.0002).

Discussion

Our study is the first to directly assess the prevalence of CAM use in New Zealand cancer patients, and to compare the characteristics of CAM and non-CAM users. The Clinical Oncology Group carried out a survey in 1987 of medical advice concerning alternative treatments given to cancer patients in several New Zealand centres. They found that 32% of patients had been given advice about alternative medicine, 65% of whom intended to follow some of the treatment advice. However, the study did not assess the actual prevalence of CAM use.

We found that 49% of cancer patients reported using at least one form of CAM therapy. As response to the survey was voluntary and anonymous, no information was obtained about non-responders. This may have created a potential selection bias if non-responders over-represented a particular subgroup. Anonymity of the survey, however, was designed to minimise nondisclosure of CAM use due to fear of disapproval. Patients who choose CAM therapies as their sole treatment for cancer are also not represented, as they are unlikely to be attending oncology clinics. The prevalence of CAM use in our centre is consistent with reports from other countries. In a systematic review of published data of 26 surveys from 13 countries, the use of CAM therapies in adult cancer populations ranged from 7–64%, with the average prevalence across all adult studies being 31.4%.

Several studies have looked at the predictors of CAM use and found younger age, female sex, and higher education were associated with greater CAM use. We found that younger age was the only significant demographic variable associated with CAM use in our population.

Vitamins and antioxidants were the most commonly-used CAM therapies in this study.

Eisenberg et al found a 130% increase in the use of high-dose vitamins and a 380% increase in the use of herbal remedies between 1991 and 1997. Published trials of vitamins and antioxidants, however, have not shown any significant benefits in the treatment or prevention of cancer. Acupuncture and hypnotherapy are complementary therapies that have been shown to improve chemotherapy-related nausea and vomiting, and also have benefit in pain control, yet these were not widely used by patients in our study (8% and 2% respectively).

We found, as have others, that a significant proportion of CAM users used multiple different therapies, with 40% of patients using four or more therapies. Patients using multiple therapies commonly combined potential perceived “alternative anti-cancer treatments” (such as antioxidants), with more psychosocial therapies (such as imagery, aromatherapy, spiritual and relaxation techniques), suggesting that they hoped to gain a more holistic management of their disease than conventional medicine.
can offer. Our finding that 47% of patients reported using CAM therapies to improve their quality of life supports this. In our study, 29% of patients were using CAM therapies for the hope of cure, and 64% to either control cancer or prevent recurrence, which is consistent with other studies.\cite{3,4} Controlled studies of cancer patients comparing CAM users and non-users have found no improvement in survival with CAM use,\cite{13,23,24} and quality-of-life scores were significantly better in conventionally treated patients.\cite{23} Patients, however, perceive that they are benefiting from CAM therapies; 70% of patients in our study felt that they had been moderately to extremely helpful in the treatment of their cancer.

Many patients in our study reported using CAM therapies during conventional treatment. CAM therapies are often advertised as safe for use, but drug interactions can occur and are seldom appreciated by patients or health professionals. Indeed, such interactions cannot be discussed when a health professional is not aware that a patient is taking CAM, which is frequently the case as this study shows. Potential antagonistic interactions of CAM with chemotherapy agents have been suggested,\cite{25} and interactions of many herbal remedies with commonly-used medicines such as anticoagulants have now been shown.\cite{26} Some herbal therapies can have hepatotoxic and nephrotoxic effects, which may be interpreted wrongly as disease progression and lead to unnecessary investigations, or at worst precipitate organ failure.\cite{27,28} “Alternative diets” can be poorly balanced and lead to nutritional deficiencies and weight loss.\cite{29} Despite these documented adverse effects, as well as the many unknown potential side effects of some CAM therapies, 89% of patients in this study thought that they were safe. Ideally, patients should be aware of such interactions whilst receiving conventional treatments.

The financial cost to patients of many CAM therapies is not insignificant. Estimates of monthly costs ranged from no cost for patients altering their diet, to NZ$660 for some specific immune-based therapies. Comparable financial costs have been found in Australia, but the majority of patients felt they were getting value for money.\cite{5}

Previous studies have found that under half of patients inform their physicians of their use of CAM therapies,\cite{1,3,4} which is consistent with our results (41% disclosure). It is important that oncologists are able to identify patients taking CAM therapies, as some of these have been shown to have detrimental effects on health and interfere with conventional treatments. Older patients were significantly less likely to report CAM use to their oncologist, however, reasons for non-disclosure were not specifically asked. We suggest that older patients may still perceive the traditional “paternalistic” doctor–patient relationship and fear their oncologist’s disapproval. The addition of direct questioning about CAM use as part of history taking has been shown to significantly increase disclosure of the use of these therapies to the oncologist.\cite{16} Therefore, including nonconfrontational questioning about CAM therapies as part of the standard history and examination of oncology patients will need to become routine if we are to increase our knowledge of CAM use.

While many ‘alternative’ cancer therapies promoted for use instead of mainstream medicine have no proven benefit and indeed may be harmful, there is evidence supporting certain ‘complementary’ therapies (such as acupuncture, hypnosis, imagery and relaxation) as being useful adjuncts to conventional medicine in improving cancer-related symptoms and quality of life. It was this desire to obtain improved quality of life that was the most common reason cancer patients chose to
use CAM therapies in our study. This indicates that we need to help patients identify those CAM therapies that are likely to benefit them, and to provide greater access to these in the New Zealand public health system. We also need to have ready access to reliable patient information regarding such therapies, which should be discussed as a matter of routine with cancer patients.

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**Acknowledgements:** Thanks to reception staff at the oncology clinics in Palmerston North Hospital and Taranaki Base Hospital for their distribution of surveys.

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**References:**


Understanding of pulse oximetry among hospital staff

Gwyneth Davies, Anne-Marie Gibson, Maureen Swanney, Deborah Murray and Lutz Beckert

Abstract

Aim To assess the level of understanding of pulse oximetry in a hospital setting and identify training needs.

Methods Twenty nine nurses and 34 doctors anonymously completed a questionnaire survey previously used by researchers in Exeter, UK. Respondents were required to explain the basic principles of pulse oximetry and demonstrate an understanding of the physiological factors limiting its accuracy. They were asked to apply their knowledge in different clinical scenarios.

Results A higher proportion of nurses than doctors demonstrated an awareness of the physiological limitations of pulse oximetry. The majority of respondents correctly identified normal ranges for adult patients. Twenty nine per cent of respondents did not know how a pulse oximeter worked. Respondents failed to recognise the clinical implications of low oxygen saturations in many of the hypothetical scenarios. Only 16% of respondents had received any formal training in the use of pulse oximetry, with 65% identifying a need for more training.

Conclusions Medical and nursing staff at Christchurch Hospital have a good understanding of pulse oximetry. A higher proportion of participants were aware of checking vital signs when the oximeter reading was unreliable, than in the original UK study cohort. A need was identified for further education in this core technique. Staff training may increase the clinical value of pulse oximetry.

Since its invention in 1972, pulse oximetry has represented a major advance in assisting those monitoring patients in intensive care units and during anaesthesia. It is now widely used on medical and surgical wards, with oxygen saturation measurements included in baseline observations for most patients.

Pulse oximetry is a simple, non-invasive way of measuring the saturation of haemoglobin with oxygen in arterial blood. It operates on the principle that the light absorbance of oxyhaemoglobin is different to that of reduced haemoglobin. A pulse oximeter measures the differential absorption of red and infrared light by oxyhaemoglobin and haemoglobin across a pulsatile fraction of blood in a vascular bed (usually the nail bed).

A Cochrane systematic review found that although pulse oximetry can detect perioperative hypoxaemia and related events, there was little data to suggest an improvement in the outcome of anaesthesia. Nevertheless, pulse oximetry is increasingly relied upon to assess a patient’s oxygenation and has been found to reduce the number of arterial blood gases taken. Its limitations have been widely described in the literature; the main criticism being that it may give a false sense of security in the presence of serious hypercapnia.
Many reports have questioned the accuracy of pulse oximetry in clinical practice.\textsuperscript{14–16} Recent studies have found that the accuracy of contemporary oximeters is within clinically acceptable limits.\textsuperscript{17,18} The accuracy of the technique is reduced at physiological extremes. Threshold oxygen saturations of 92–97% are quoted as being necessary to ensure against hypoxia.\textsuperscript{14,19,20}

The lack of understanding about how and why pulse oximetry works may have led to unjustified criticism and decreased the clinical value of the technique. We believe that when used by a trained operator with understanding of the clinical implications and limitations of oximetry, it remains a valuable tool. Following publication of an article by Stoneham et al about the knowledge of pulse oximetry among medical and nursing staff at the Royal Devon and Exeter Hospital,\textsuperscript{21} we decided to assess the level of understanding of pulse oximetry at Christchurch Hospital using the same methods. We compared the responses using the Exeter study as a benchmark.

Methods

We administered a supervised questionnaire to nurses and doctors working at Christchurch Hospital during a four week-period during October/November 1999. This questionnaire was designed by researchers at the Royal Devon and Exeter Hospital, UK. We invited nurses on a general medicine, a respiratory and an emergency medicine ward to participate in the anonymous survey. The doctors interviewed were from the same wards as the nurses, or were recruited during teaching sessions. Participation was voluntary and the questionnaire was supervised by one of the authors. There were two refusals to complete the survey, mainly due to time constraints and also, by the staff members’ own admission, a lack of knowledge of the subject. Respondents were asked not to reveal details of the questionnaire to colleagues. A total of 29 nurses and 34 doctors (Table 1) consented to participate. Respondents were shown a photograph of a Criticare 504-US pulse oximeter with a visible waveform, a pulse rate of 84 and an oxygen saturation ($\text{SpO}_2$) of 98% (Figure 1). They were asked to identify the equipment, explain what it measured and how it worked, and identify factors that could influence the accuracy of readings. They were then asked to approximate normal ranges of $\text{SpO}_2$ in groups of patients and demonstrate knowledge of the implications of readings in various clinical scenarios. Lastly, respondents were asked about their previous training and training needs, and questioned regarding local issues relating to the use of pulse oximetry.

Figure 1. Photograph of Criticare 504-US pulse oximeter shown to respondents
Table 1: Survey respondents

<table>
<thead>
<tr>
<th>Nurses</th>
<th>Doctors</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 respiratory ward nurses</td>
<td>5 consultants</td>
</tr>
<tr>
<td>17 general medical ward nurses</td>
<td>12 registrars</td>
</tr>
<tr>
<td></td>
<td>7 house officers</td>
</tr>
<tr>
<td></td>
<td>10 trainee interns</td>
</tr>
</tbody>
</table>

Results

Knowledge of equipment The majority of respondents recognised the pulse oximeter and were aware of what it measured and how it worked (Table 2). All doctors and the majority of nurses knew what it measured. Two nurses thought it recorded venous saturation. It was somewhat surprising that three nurses did not recognise the pulse oximeter. Twenty nine per cent of respondents did not know how a pulse oximeter worked.

Table 2. Knowledge of equipment: respondents’ answers*

<table>
<thead>
<tr>
<th>Question</th>
<th>Correct answer</th>
<th>Doctors (n=34)</th>
<th>Nurses (n=29)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>What is this instrument?</td>
<td>Pulse oximeter or saturation monitor</td>
<td>32</td>
<td>94</td>
</tr>
<tr>
<td>What does it measure?</td>
<td>Oxygen saturation of haemoglobin</td>
<td>34</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Pulse rate</td>
<td>34</td>
<td>100</td>
</tr>
<tr>
<td>How does it work?</td>
<td>Light sensor-red, infra red</td>
<td>24</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>Light absorption by haemoglobin</td>
<td>24</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>Pulsatile flow required</td>
<td>24</td>
<td>71</td>
</tr>
<tr>
<td>Factors affecting the accuracy of saturation readings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nail varnish</td>
<td>May cause falsely low readings</td>
<td>28</td>
<td>82</td>
</tr>
<tr>
<td>Dark-skinned races</td>
<td>No effect</td>
<td>28</td>
<td>82</td>
</tr>
<tr>
<td>Anaemia</td>
<td>No effect</td>
<td>23</td>
<td>68</td>
</tr>
<tr>
<td>Jaundice</td>
<td>Negligible effects</td>
<td>27</td>
<td>79</td>
</tr>
<tr>
<td>Peripheral vasoconstriction</td>
<td>May cause failure to pick up signal</td>
<td>33</td>
<td>97</td>
</tr>
<tr>
<td>Cardiac arrhythmias</td>
<td>May cause failure to pick up signal</td>
<td>13</td>
<td>38</td>
</tr>
<tr>
<td>Shivering</td>
<td>May cause failure to pick up signal</td>
<td>22</td>
<td>65</td>
</tr>
<tr>
<td>Carbon monoxide poisoning</td>
<td>Readings tend towards 100%</td>
<td>25</td>
<td>74</td>
</tr>
<tr>
<td>Bright overhead lighting</td>
<td>May cause over-reading</td>
<td>6</td>
<td>18</td>
</tr>
</tbody>
</table>

*Adapted from Table 2, Stoneham et al.†

More nurses knew which factors affected the accuracy of pulse oximeter readings compared with the doctors surveyed. A higher percentage of doctors than nurses were unaware that cardiac arrhythmias, nail varnish, carbon monoxide poisoning and bright overhead lighting could affect the accuracy of readings.

Normal ranges Figure 2 illustrates the percentage of doctors and nurses who correctly and incorrectly identified the normal range of SpO₂ in four clinical settings. The lowest SpO₂ was defined as the point at which respondents would consider intervention. Many respondents had difficulty in applying an SpO₂ range for a one-
year-old infant, either stating values much too high (such as 110%), or too low (such as 85%). When asked to indicate an acceptable range for an 80-year-old patient, many respondents indicated values that were too high, such as SpO$_2$ 95–100%. The majority of doctors and nurses defined the correct range for a fit adult.

Figure 2. Doctors’ and nurses’ predictions for normal SpO$_2$ ranges in four clinical scenarios

Clinical scenarios The clinical scenarios provided an insight into how pulse oximetry is used in clinical settings. This section of the survey looked at how respondents interpreted pulse oximetry readings and what credence was given to the values.

Q1 If a patient’s saturation is unacceptably low, what are your immediate actions?
One quarter of respondents stated that they would check airways, breathing and circulation (ABC). Of those who would check ABC, a higher proportion were nurses (45% nurses, 9% doctors). Most said that they would increase oxygen flow (76% nurses, 79% doctors) and half the doctors said they would take an arterial blood gas. Doctors were less trusting of the oximeter readings, with 85% stating they would check the equipment compared with 45% of nurses.
Q2 An elderly patient is admitted with pneumonia and has a pulse oximetry reading of 75% breathing air. With oxygen 6L per min, saturation improves to 85%. What are the implications of this oximetry reading?

Only 8 nurses (28%) and 13 doctors (38%) recognised that the patient was severely hypoxic. Nurses were more likely to increase oxygen flow (34% nurses, 20% doctors), whereas more doctors would want to check blood gases (44% doctors, 13% nurses).

Q3 A previously fit patient has just returned from theatre following a laparotomy with a morphine infusion running and oxygen at 4L per min via a face mask. A pulse oximeter shows that saturation is 85%. What are the implications of this oximeter reading?

Most respondents recognised that this scenario was due to respiratory depression secondary to morphine (59% nurses, 85% doctors). However, only three nurses and two doctors would check ABC. Only one doctor and one nurse suggested checking the level of consciousness. Reversing opiate effects with naloxone was suggested by three doctors (9%) and none of the nurses. Seven nurses wanted to increase oxygen flow (no doctors); increasing the oxygen alone was considered an unacceptable answer. Five doctors (15%) would check blood gases.

Q4 A patient with chronic obstructive pulmonary disease is breathing 24% oxygen via a face mask and the pulse oximeter displays an $SpO_2$ of 90%. What are the implications of this oximeter reading?

The majority of respondents (59% nurses, 56% doctors) recognised that this $SpO_2$ value may be acceptable in a patient with chronic airways disease. However, two nurses (7%) and two doctors (6%) wanted to increase the oxygen and two nurses wanted to decrease the oxygen. These answers were considered unacceptable without further assessment with blood gases prior to adjusting oxygen flow. Only three nurses and six doctors thought that arterial blood gases should be checked.

Q5 An 18-month-old child is admitted via Casualty with acute stridor. Acute epiglottitis is suspected. Saturation is 80% and pulse is 180. 6L per min oxygen is given via a mask and saturation increases to 90% with a pulse of 180. What are the implications of this oximeter reading?

This is a life-threatening situation; the child may need intubation. The responses to this scenario were the most worrying. Many respondents failed to appreciate the seriousness of the situation and the implications of the low $SpO_2$ and tachycardia. Although no staff members surveyed were working in Paediatrics, some were accident and emergency staff. Only 2 nurses (7%) and 13 doctors (38%) recognised this scenario as a life-threatening situation. The seriousness of the situation was not recognised by 18 nurses (62%) and 15 doctors (44%), ie, inappropriate action was suggested or no further action was deemed necessary by them. The remainder of respondents (24%) identified a need for further action but did not demonstrate an awareness of the life-threatening nature of the situation.
Q6 A patient with a tension pneumothorax and central cyanosis is in the casualty department. The pulse oximeter displays an $SpO_2$ of 100%. What are the implications of this reading?

Only 18 doctors (53%) and 15 nurses (52%) correctly identified the reading as being wrong. Less than one third of doctors and nurses (29% and 28% respectively) stated that they would treat according to the clinical picture.

Q7 What happens to the pulse oximeter reading of a patient immediately after a cardiac arrest?

Q8 What happens to the pulse oximeter reading of a patient during a respiratory arrest?

Most respondents understood what happened to pulse oximetry readings during a respiratory arrest. 20 nurses (69%) and 29 doctors (85%) correctly stated that the saturations decrease until cardiac arrest occurs. There was less understanding of what would happen after a cardiac arrest. 10 nurses (34%) and only 2 doctors (6%) correctly stated that the pulse would be lost, causing the alarm to sound.

Local issues

Q1 If the pulse oximeter does not work, whom do you call for help?

Q2 Have you received any formal training in the application of pulse oximetry?

Q3 What would you say are your training needs?

If the oximeter did not work, 10 doctors (29%) would ask a nurse and only 13 nurses (45%) would then correctly contact the Technical Services Department at the Hospital. Only 10 of the 63 respondents had received any formal training in pulse oximetry. Nineteen nurses (66%) and 22 doctors (65%) said they would benefit from a refresher lesson.

Discussion

There was good general understanding of how and why pulse oximetry works. However, many respondents were unaware of its limitations and doctors were less aware than nurses about some of the physiological limitations of pulse oximetry. This may reflect the difference in daily contact with a pulse oximeter. Most respondents knew what predicted values should be in various patient groups; some struggled with paediatric values.

The clinical scenarios revealed deficits in the understanding of pulse oximetry. Serious errors were made in interpreting $SpO_2$, with some respondents failing to recognise when readings reflected significant hypoxia. Most respondents recognised that lower values may be acceptable in patients with chronic airways obstruction. However, only 14% acknowledged that blood gases should be checked to identify hypercapnia. More nurses than doctors stated that checking airways, breathing and circulation was important if a reading was unacceptably low.
The sample surveyed was probably representative, although two health workers refused to participate, partly because of insufficient knowledge of the subject. This may have led to a slight selection bias towards respondents with better understanding of pulse oximetry. An additional contributory factor may have been that the questionnaire was administered over a four-week period and this may have led to some contamination of the results. However, it is unlikely that this factor seriously influenced the results. Despite these possible small sources of bias in favour of candidates with a better knowledge of pulse oximetry, a potential for further education and training in this fundamental technique was identified.

The demographic data in this survey was slightly different to that of the respondents who participated in the survey in the Royal Devon and Exeter Hospital in 1994. In our study, trainee interns comprised 10 of the 34 (29%) doctors; in Exeter, preregistration house officers comprised 11 of 30 (37%) in this group. The sampled doctors were representative as a whole, since they also comprised 21% house officers, 35% registrars and 15% consultants, thus reflecting a wide range of experience. It is of note that when the questionnaire was originally used in Exeter, 37% of their group were preregistration house officers and the remainder were senior house officers.

The results are similar to the results obtained when this survey was administered in Exeter in 1994. Some points are worthy of note. More respondents in the Christchurch group understood how a pulse oximeter worked (71% compared to 3%) and this may reflect improved education about pulse oximetry. The Christchurch respondents suggested checking airways, breathing and circulation in the clinical scenarios whereas this was not mentioned by the Exeter respondents. However, there were no obvious differences in the groups’ responses to the clinical scenarios. Of concern was that in both the groups surveyed, potential life-threatening situations were not confidently recognised. In Christchurch and Exeter, staff commented that they had little, if any, formal training in the use of pulse oximeters. Only 10 of the 63 Christchurch respondents (16%) had received any formal training, compared with only one of the 60 Exeter respondents. This is an astonishing observation, as pulse oximetry is widely used and applied to monitor critically-ill patients. This is particularly pertinent to staff’s interpretation of oximetry readings. Other studies have also highlighted deficiencies in knowledge about pulse oximetry.23,24

Whilst pulse oximetry has represented a great advance in assisting those monitoring patients’ wellbeing, its increased use on the wards has not been reflected in an increase in staff training. Health workers are required to update their basic life support skills, and a refresher course on the fundamental technique of pulse oximetry could be included in this training. Key learning points should be emphasised: training should cover basic principles and physiological limitations of pulse oximetry; normal ranges in different patient groups; and application of knowledge in clinical scenarios. Increased training would increase the clinical value of pulse oximetry.

In summary, the fundamental lessons to be learned about pulse oximetry are:
Pulse oximetry measures the differential absorption of red and infrared light by oxygenated and reduced haemoglobin across a pulsatile fraction of blood in a vascular bed.

The fact that a pulsatile blood flow is needed has important implications with regard to factors that may affect the accuracy of the pulse oximetry reading. Thus, peripheral vasoconstriction, cardiac arrhythmias and shivering may cause failure to pick up the signal, and nail varnish can cause a falsely low reading. Conversely, bright overhead lighting may cause a falsely high reading. In carbon monoxide poisoning, the pulse oximeter may give a falsely high reading approaching 100%. The carbon monoxide molecule has a high affinity for haemoglobin and the pulse oximeter is unable to distinguish the carbon monoxide molecule from oxygen, thus haemoglobin appears to be fully saturated with oxygen. In such circumstances, it is imperative to take an arterial blood gas to accurately assess oxygen status.

Some misconceptions about physiological factors affecting the accuracy of the pulse oximeter reading include the false belief that accuracy may be affected if the patient is dark-skinned, anaemic or jaundiced. In these situations, the pulse oximeter should still give an accurate measurement of the oxygen saturation of haemoglobin.

Normal ranges for SpO2 vary in different patient groups. Whilst a value of 88% may be acceptable in an 80-year-old patient, values below 90% would not be acceptable in a fit adult or one-year-old child.

SpO2 readings must be interpreted according to the clinical picture and the premorbid condition of the patient. For instance, a patient with COPD may have chronic respiratory failure and so an SpO2 of 90% on air may be normal for them and a higher SpO2 on supplemental oxygen may be associated with the development of worsening hypercapnia. However, an SpO2 of 90% with supplemental oxygen in a child who is also tachycardic is abnormal and requires immediate further intervention.

It is important not to rely solely on the pulse oximeter reading. This may be inaccurate at physiological extremes. Moreover, the SpO2 may be satisfactory in the presence of severe hypercapnia, notably in COPD patients, and so the importance of taking blood gases in this situation must be emphasised.

Most importantly, the pulse oximetry reading must be assessed according to the clinical context. Look at the patient first, not the oximeter!

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References:
Alcohol and injury among attendees at a New Zealand emergency department

Gayl Humphrey, Sally Casswell and Dug Yeo Han

Abstract

Aim This study investigated the role of alcohol in injury cases among patients attending an emergency department in Auckland during December 2000.

Methods A random sample of patients was interviewed and breath tested in the emergency department. Interviewing took place continuously for a three-week period. Using a case-crossover design the causal role of alcohol was assessed.

Results Thirty five per cent of injured patients reported having consumed alcohol prior to sustaining their injury; this is a high proportion compared with overseas research. Males and the under 30 years age group were over-represented in both alcohol-related and non alcohol-related injury cases. The risk of sustaining an injury was 2.8 times greater when alcohol was consumed. The median amount of self-reported absolute alcohol consumed prior to alcohol-involved injury was 103 ml (equivalent to about seven cans of beer), with the lower quartile at 37 ml and upper quartile at 246 ml. For injury cases reporting consumption of alcohol prior to their injury event, there was a cumulative risk of 1.14 for each 30 ml of absolute alcohol (two cans of beer) consumed. There were no differences between the quantity of alcohol consumed by males and females or younger and older participants. Of those with blood alcohol concentration (BAC) readings obtained from breath samples, 51 % had BAC reading equal or greater than 0.300 mcg. Violence was found to be the cause of 17% of the injury cases and alcohol was reported as involved (victim and/or perpetrator) in 79% of these cases. Injury involving violence occurred most often in a public place or on a licensed outlet.

Conclusions This is the first study of alcohol involvement in injury presenting to an emergency department in New Zealand. Findings indicate that a relatively high proportion of injury cases requiring emergency department treatment were alcohol-related and that the risk of an injury occurring was significantly increased by consumption of alcohol.

There is comparatively little research in New Zealand that examines the role of alcohol in injury occurrence, and none that clearly documents the level of alcohol’s involvement. In a study of New Zealand rugby injury, Quarrie et al found 14% of males and 8% of females participating reported that injuries they sustained in the previous 12 months were the result of their drinking. The study also found that heavier drinking was the norm, with 61% of males and 38% females consuming six drinks or more in one session at least weekly. Langley et al used the New Zealand Health Information Service database to examine the incidence of death and hospitalisation from assault occurring in and around licensed premises. In spite of some recording inconsistencies, the study found that when place of assault was recorded, 10% of these assaults took place in or around licensed premises, 17%
involved people under 20 years of age, and males were over-represented in all assault figures.

There have been no investigations of alcohol involvement in patients with an injury presenting to the emergency department in New Zealand, but there have been studies in Australia,3 the USA and Canada,4,5 Mexico and Spain,6,7 Finland,8 and the United Kingdom,9 which have shown that between 10% and 18% of injury cases attending emergency departments were alcohol-related. Studies have also shown that young people and males were over-represented in these figures,10,11 and that alcohol-related injury patients were more likely to report heavy typical consumption patterns, to have experienced prior alcohol-related injury, and were unlikely to use health care services other than the emergency department (ED).12

The aim of this study was to describe the proportion and context of alcohol-related injury cases among injury cases attending the emergency department during the study period. It used a case-crossover design to assess the causal role of alcohol in the injury. This study was undertaken as part of a World Health Organisation (WHO) international collaborative study investigating alcohol involvement in injuries presenting to EDs.

Methods

Injury/poisoning (subsequently referred to as injury) presentations to the Auckland ED were surveyed continuously twenty four hours a day in the first three weeks of December 2000. The ED computer admission record and ED staff were consulted to identify all injury attendees. Details of all injured patients (age, gender, triage code, injury complaint, presentation time) attending the ED during the study period were recorded in a case log book. Interviewers approached all injured patients, informed them of the study, provided them with an information sheet and then asked the screening question to determine eligibility. Eligible participants were determined as those: injured within six hours of arrival time to the ED; presenting for first treatment of their injury; and able to give informed consent. Every second eligible participant was invited to participate. This systematic sample frame was chosen to allow for busy periods within the ED and to minimise missed cases. If the patient agreed to participate but was perceived to be too intoxicated to answer the questionnaire in detail, provision was made to delay its administration until a more appropriate time. Breath samples were collected using an Alcotec AR1005 breathalyser that was calibrated and validated according to the manufacturer’s specifications. Participant data were collected directly from participants through an interviewer-led questionnaire. Information collected included: demographics; a description of the injury event; involvement of violence; injury event location; alcohol consumption prior to injury; location(s) at which alcohol was consumed; quantity of alcohol consumed on a typical drinking occasion; and frequency of alcohol consumption. Specific case-crossover methodology questions included alcohol consumption one week previous; if the injury event interrupted the drinking occasion; and an estimate of how much more alcohol would have been consumed if the injury event had not occurred.

Three measures of alcohol involvement were used: blood alcohol concentration (BAC) measured using the Alcotec AR1005 breathalyser; participant self-report of alcohol consumption; and a clinical observation of intoxication judged by the ED’s senior triage nurses at first contact with the patient. (Agreement analysis between the observational assessment and BAC obtained from the breathalyser will be reported on separately.) An alcohol-related injury was determined by a self-report that alcohol was consumed prior to the injury occurring.

To check for breathalyser reading reliability, a sample of similar reading results were selected, and each participant’s alcohol consumption characteristics examined (eg, amount of alcohol consumed, time between breath sample and last drink etc) for comparability. If discrepancies were found, five readings before and after were also selected and similarly checked for comparability.
Frequency analysis was used to estimate the proportions of alcohol-related injuries compared with nonalcohol-related injuries. The case-crossover design was used to assess the risk of injuries following alcohol consumption. In this design, participants acted as their own controls between periods of exposure and non-exposure to injury, therefore controlling for potential confounding factors due to participant characteristics. Thus, the exposure categories were obtained by dichotomising within the hazard period (injury) and control period (one week earlier). The relative risk and its 95% confidence interval were calculated to establish the risk of experiencing an alcohol-related injury. Logistic regression was used to estimate the effect of different levels of alcohol quantities on the risk of an injury. The use of this model does not violate the proportional odds assumption ($p = 0.33$), and is commonly used when outcomes can be ordered in nature. The ordinal scale for the amount of absolute alcohol quantity prior to injury was graded from 1 to 3; where 1 was less than 100 ml, 2 was between 100 and 300 ml, and 3 was greater than 300 ml. For alcohol-related injury cases, three drinking variables were collected and used for analysis: the quantity of alcohol consumed prior to injury occurrence; the quantity consumed at the same time one week prior to injury occurrence; and the quantity consumed on a typical occasion. For non alcohol-related injury cases, two quantity periods were used: alcohol quantity consumed one week prior to injury; and typical alcohol quantity consumption.

**Results**

A total of 273 participants were eligible to participate in this study. Of these, 170 were invited and consented to participate and 166 (61%) completed the procedures, with four (1.5%) incomplete. These four were excluded from the analysis. Of the remaining 103 eligible, 63 (23%) were invited but refused to participate, and 40 (15%) were unable to be invited because they had left the department before being approached by the interviewers (Figure 1).

There were no significant differences in demographic characteristics (age, gender, and ethnicity) between those who participated and those who refused or were missed. There were also no differences in triage code allocation, or the day or time of visit. This is comparable with other ED studies. Males represented two thirds of all the injury presentations and participants were aged between 16 and 90 (median 32 years). Although two thirds of the injuries were experienced by the under 30 years age group there were no significant differences between the demographic variables (age, gender, ethnicity, education, employment, income) by alcohol and non alcohol-related injury.

Blood alcohol concentrations (breath tests) were obtained from 148 (90%) participants. Fifteen participants refused to give a breath sample but agreed to the interview, two participants were unable to give a sample and one participant’s breath sample data were corrupted.

There were 59 (35%) alcohol-related injury cases and 107 (65%) non alcohol-related. Of the 59 alcohol-related injury cases, 54 (92%) had a corresponding positive BAC reading, while five had a BAC reading of zero, despite their self-report of consuming alcohol prior to their injury. After following the quality check procedures, discrepancies were found as such these five readings were excluded from the BAC analyses.

Of the 107 non alcohol-related injury cases, 94 (88%) supplied a breath sample and 13 (12%) refused to provide a breath sample but agreed to complete the interviewer-led questionnaire. Of those who supplied a BAC, two participants were found to have a positive BAC reading despite reporting consuming no alcohol before their injury.
After reviewing the data according to the quality check procedure, a misread was found to be unlikely and as such these BAC data were included in the analysis.

**Figure 1. Recruitment flow diagram for eligible participants**

![Recruitment flow diagram for eligible participants](image)

**Type of injury** Cuts and bruises were the most common injuries for alcohol-related injuries, while cuts, bruises and sprains were the most common injuries for non alcohol-related injuries (Table 1). There were significant differences in injury severity (defined by triage code allocated at admission) between alcohol-related injury and non alcohol-related injury cases (p = 0.047), with alcohol-related injury being assessed as more serious.

These injuries reflect those commonly reported for claims by the Accident Compensation Corporation.16

**Place of injury occurrence and place of last drink** Home (own or others) (34%) and public place (21%) were the two most common locations for sustaining an injury. Injuries in which alcohol was a factor were more likely to occur in the home (29%) and in a licensed outlet (23%), with public place and private vehicles the two next most common locations (21% and 16% respectively) (Table 2).

Table 2 also shows that participants reporting injury location as either a public place (21%) or vehicle (16%) were moderately more likely to have had their last drink.
somewhere else. With respect to the other data, there were no significant patterns between injury location and last drinking place.

Similarly, for non alcohol-related injury cases, home (own or other) was the most common location for the injury to occur (33%). Public place (29%) and work place (23%) were the next most common injury locations reported by this group.

Table 1. Alcohol-related and non alcohol-related injury description

<table>
<thead>
<tr>
<th>Injury*</th>
<th>Alcohol-related n (%)†</th>
<th>Non-alcohol-related n (%)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture</td>
<td>8 (10)</td>
<td>17 (12)</td>
</tr>
<tr>
<td>Sprain</td>
<td>9 (11)</td>
<td>28 (19)</td>
</tr>
<tr>
<td>Cut</td>
<td>24 (30)</td>
<td>40 (27)</td>
</tr>
<tr>
<td>Bruise</td>
<td>22 (28)</td>
<td>35 (24)</td>
</tr>
<tr>
<td>Burn</td>
<td>0</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Concussion</td>
<td>2 (3)</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Organ</td>
<td>1 (1)</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>11 (14)</td>
<td>16 (11)</td>
</tr>
<tr>
<td>Unknown</td>
<td>2 (3)</td>
<td>6 (4)</td>
</tr>
</tbody>
</table>

*some participants sustained more than one type of injury; † percentages do not total 100 due to rounding

Table 2. Place of injury occurrence and place of last drink

<table>
<thead>
<tr>
<th>Place of last drink</th>
<th>Place of injury occurrence n (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Licensed outlet</td>
</tr>
<tr>
<td>Licensed outlet</td>
<td>12 (63)</td>
</tr>
<tr>
<td>Home</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Others’ home</td>
<td>0</td>
</tr>
<tr>
<td>Public place</td>
<td>0</td>
</tr>
<tr>
<td>Vehicle</td>
<td>0</td>
</tr>
<tr>
<td>Work place</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>13 (23)</td>
</tr>
</tbody>
</table>

Kappa = 0.52, 95% CI [0.37, 0.67]  
*percentages do not total 100 due to rounding; † pub, tavern, nightclub, restaurant etc

Blood alcohol concentration (BAC) determined by breathalyser The BAC reading range was 0.008 to 1.147 mcg, median 0.3255 mcg. Of the 54 alcohol-related injury cases with positive breath readings, 39 (72%) were over the New Zealand legal BAC limit for driving (>0.04 mcg).

Self-reported quantity of alcohol consumed prior to injury The median of self-reported absolute alcohol consumed by alcohol-related injury participants prior to the injury occurrence, was 103 ml (equivalent to almost seven cans of beer), with a lower quartile of 37 ml (just over two cans of beer), and an upper quartile of 246 ml (16 cans of beer). There were two extreme values reported – 2520 ml and 14 653 ml – the contextual remarks accompanying which reported “a session” (lasting three days) and
“a bash” (of similar duration). Both of these cases reported bottles of spirits as the beverage consumed.

**Self-reported typical occasion alcohol consumption** Alcohol-related injury cases were more likely to report a frequency of typical occasion alcohol consumption of at least once a week or more (56%) than the non alcohol-related injured participants (38%). This pattern is repeated in frequency of drinking larger quantities (eg, 5–11 drinks (26% vs 17%), and 12 plus drinks (12% vs 7%)) on any one occasion.

**Alcohol consumed prior to injury, one week before injury, and typical alcohol consumption** Almost half of the alcohol-related injury cases reported that they would typically consume more than the amount consumed on this occasion. The reason given for this was that this drinking occasion was interrupted by the injury event. The median amount that would have been consumed if the injury had not occurred was a further 35 ml, or just over two cans of beer.

To compare whether the amount of alcohol consumed on the injury occasion was different from one week before or that reported as consumed on a typical occasion, the amount that would have been consumed was calculated in order to give an amount reflective of an occasion without an injury. This adjusted amount was then compared with the amount given for one week before and a typical drinking occasion. No significant differences (p = >0.5) were found between injury day alcohol amount, reported last week amount and typical occasion amount.

**Alcohol and risk of injury** Data on alcohol consumption on day of injury and one week before were analysed for risk of injury using the relative risk calculation recommended in the case-crossover method. Controlling for personal characteristics, there was a 2.8 (95% CI: 1.99–3.96) times greater risk of having an injury if alcohol had been consumed.

Further analyses using an ordinal logistic regression model were conducted to examine if there were differences in the risk of injury associated with different quantities of alcohol consumed. The results found that there was a cumulative risk of having an injury of 1.14 for every 30 ml or two cans of beer (OR = 1.14, 95% CI: 1.003–1.300). Applying this cumulative risk result to the median amount of alcohol reported as consumed by alcohol-related injury participants (ie, 103 ml absolute alcohol), suggests that half of the alcohol-related participants were 3.91 times or more at risk of having an injury than their non alcohol-related injury counterparts. This risk is greater for those participants in the upper quartile percent, with 246 ml of absolute alcohol resulting in a 9.34 times greater risk of injury.

**Violence involved in injury occurrence** Twenty-eight injury cases (17%; males 23, females 5) responded that violence was involved in their injury. The age range of these participants was 16 to 59, median 25.5 years. Of those, 23 (82%) reported that “in their opinion” the other person involved was intoxicated/drunken. In addition, 22 (78%) reported that they had themselves been drinking. With respect to the alleged perpetrator, nearly half (43%) reported that the person involved was unknown to them, while 25% reported that the person was known. The remaining 25% reported a mix of security, police or other authority figures.

Public place was the most commonly reported location for an injury involving violence (39%), followed by licensed outlet (25%), and the home (21%). This is
different to non violence-related injury cases, for which home was reported as the location by 33% and public place by 24%.

Discussion

This was the first New Zealand study undertaken to examine the relationship between alcohol and injury among ED attendees. Thirty five per cent of injury cases were found to be alcohol-related. This is higher than that reported in international studies where between 10% and 18% of injury cases have been found to be alcohol-related.\textsuperscript{10,17}

Although seasonality has been found to affect consumption levels\textsuperscript{18} and these data were collected in December 2000, no significant differences were found between the three data sources of self-reported alcohol consumption (injury occasion, one week before and typical occasion). This result suggests that the injury event was not affected by an assumed increase in alcohol consumption associated with the Christmas season and the millennium celebrations.

It is, however, also likely that these figures could underestimate alcohol involvement; the study used a six-hour exclusion criterion, and so did not include people who had been injured more than six hours previously and who reported, in the screening process, that alcohol was involved at the time of the injury. Few studies have sampled cases for injuries occurring more than six hours previously and as such alcohol-related injuries may be greater than currently identified. An Australian study that did investigate this issue reported that 44% of participants with an injury that occurred between 6 and 24 hours prior to attending the ED, reported consuming alcohol prior to their injury occurring; this is twice the amount who attended the ED within the six-hour period (22%).\textsuperscript{14} A pilot study undertaken in Canada reported similar results (alcohol-related injury: 24 hours 28.4%, 6 hours 18.2%).\textsuperscript{19} These studies highlight the potential for under-estimation of alcohol-related injury cases when using a six-hour exclusion period.

This study found that two thirds of all the injuries presented were in males and the under 30 years age group. This result is consistent with international studies.\textsuperscript{20} The high representation of males is supported by other New Zealand alcohol consumption statistics, which highlight males under 30 as heavy drinkers.\textsuperscript{21} In addition, their attendance is also in keeping with reports of gender differences in health service usage, in particular ED utilisation.\textsuperscript{22}

One third of all injury cases (alcohol-related or not) reported alcohol consumption patterns reflective of typical heavy drinking patterns. The frequency and quantity of typical occasion drinking patterns appears to be predictive for sustaining an injury. Caution is recommended in interpreting this result further, as the sample size was small, but the connection between heavy and frequent typical drinking and alcohol harms has been found in other studies. For example, Roche et al found that irrespective of alcohol involvement in current injury event, a substantial proportion of all injury cases surveyed were heavy typical drinkers.\textsuperscript{23}

The location where the injury was sustained was found to be moderately predictive of alcohol-related injury. Where drinking location and injury location were the same, home (own or others) and licensed outlet were the most commonly reported locations. When drinking and injury location were not the same, public place and vehicle were
the likely injury locations, possibly indicating a risk of travelling from one drinking location to another (drinking or not) location.

Public place was the most frequently reported location for injury involving violence to occur with – not surprisingly – licensed outlet the second most frequently reported. Although the sample for reported injury involving violence is small, other research has shown that young males in particular do most of their drinking in licensed outlets, and that these places are associated with alcohol involved injury, assault and homicide. Studies with larger samples would allow more detailed investigation of violence and other contextual factors in order to gain a better understanding of how they contribute to the risk of an injury, and who is most at risk. From this broader contextual understanding, policy and prevention strategies would be better informed.

The risk of injury associated with alcohol consumption is well documented. The present results highlight that, when all contextual factors are held constant, there was a 2.8 times greater risk of experiencing an injury when alcohol was involved. This is in line with other non case-crossover studies. For example, a review of accidental falls and alcohol literature by Higson and Howland reported odds ratios (OR) of between 2.5 and 10 for having an alcohol-related injury compared with a non alcohol-related injury. Cherpitel et al reported an OR of 3.53 if the injury case reported feeling drunk at time of injury, and an OR 1.34 when cases reported consuming alcohol but not feeling drunk. However, there is a paucity of research that quantifies the influence of the quantity of alcohol consumed on the risk of an injury event. A study similar to this by Vinson et al reports a similar cumulative risk of injury with increasing amounts of alcohol consumed, as does one by McLeod et al. The findings from this study are consistent with those results and show that cases in the top 25%, who consumed 246 ml absolute alcohol (sixteen cans of beer), were at a nine times greater risk of injury.

This study had all the advantages of the case-crossover design in that assessment of the causal role of alcohol was without socio-demographic confounding. However, information recall is problematic, in particular among participants who were alcohol-related injury cases and whose recall may have been in part impaired due to the alcohol consumed. Study protocol provisions to reduce this were present, that is, delaying the interviewer-led questionnaire to a more appropriate time. Also, provision was made within the questionnaire to capture a range of information on, for example, alcohol consumption, and this contributed to the quality of the data on the use of alcohol immediately before the injury, a similar exposure period (one week before) and typical consumption. Furthermore, the results from this study are consistent with other cited studies and suggest that the findings are not influenced by information recall.

In summary, this is the first study carried out in New Zealand to assess and quantify alcohol involvement in injured patients presenting to an ED. It showed a significantly increased risk of injury when alcohol had been consumed. Furthermore, this risk was increased as the quantity of alcohol consumed increased. The proportion of 35% of the injury presentation as alcohol-related is high by international standards. The fact that males and the under 30 years age group were the most represented in the alcohol-related injury data and that they are the least likely to utilise health care services other than the ED, suggests that the ED can play an important role in
identifying and investigating contextual factors that influence alcohol-related injuries. It also raises the question of the ED as a potential intervention location. These findings support a growing body of international research highlighting the ED as an environment in which to explore harm minimisation and brief intervention strategies.30–32

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**References:**

An adult asthma assessment and management protocol for use in the emergency department

Matthew Masoli, Shaun Holt, Geoffrey Hughes and Richard Beasley

Protocols for the assessment and management of severe asthma in the emergency department (ED) have been widely used in New Zealand hospitals for over a decade. Their development and implementation arose from the recognition that the medical staff responsible for the management of adult asthmatic patients in the ED were often inexperienced junior doctors and that the use of protocols can improve the standard of care delivered.1–3 This was the experience in the Wellington Hospital ED, where the implementation of an asthma protocol in 1988 resulted in an improved standard of care and provided a useful form of ongoing training for junior medical and nursing staff in the management of adults with severe asthma.4 The protocol has recently been updated and revised in accordance with new scientific evidence and consensus asthma guidelines.5–7 In this article, we present the revised protocol for the Wellington ED as an ‘up-to-date’ example and to provide the basis for discussion of the assessment and management of severe asthma in adults in the ED. It is reproduced at the end of this article in the form of Figures 1, 2a and 2b. The protocol is not designed for use in children, for whom modifications would be required in terms of specific features of both assessment and treatment.

Assessment of severity: history and examination

The basic assessment of severity from the history and clinical examination has remained unchanged from the previous protocol. Features of the history that provide a quick assessment of severity and risk of a bad outcome are the number of recent hospital admissions, a previous ICU admission, speed of onset of the attack, and amount of β-agonist used during the attack.8–10 The general appearance of the patient, the respiratory rate, and the heart rate form the basis of the clinical examination. These key features of history and examination can be easily documented in box form in the assessment protocol.

Assessment: lung function measurements

Spirometry remains the basis of the objective assessment of asthma severity in response to treatment, with repeated measurement of FEV₁ (forced expiratory volume in one second) expressed as a percentage of predicted normal values. If the peak flow is chosen as an alternative to the FEV₁, consideration needs to be given to the observation that the FEV₁ is on average 10 percentage points lower than the peak flow across the spectrum of asthma severity (eg, an FEV₁ of 40% predicted is equivalent to a peak flow of about 50% predicted).11,12 Routine monitoring of oxygen saturations by pulse oximetry is encouraged, with arterial blood gas measurements only recommended if an FEV₁ <30%, or oxygen saturations <92%, are recorded. These objective measurements, together with the basic clinical examination features, form the basis of the recognition of the patient with severe asthma and/or a life-threatening attack of asthma requiring admission to intensive care (Table 1).
Table 1. Assessment of asthma severity

1) Features of severe asthma:
- too wheezy or breathless to complete sentences in one breath
- respiratory rate ≥25 breaths/min
- heart rate ≥110 beats/min
- FEV₁ ≤50% of predicted normal or best

Caution: Patients with severe attacks may not be distressed and may not present all these abnormalities.

2) Features of a life-threatening attack requiring ICU admission:
- minimal improvement or deterioration in FEV₁ following nebulised bronchodilator
- PaO₂ <60 mmHg (< 8.0 kPa) despite oxygen therapy
- PaCO₂ >45 mmHg (< 6.0 kPa)
- exhaustion
- confusion or drowsiness
- unconsciousness
- respiratory arrest

Management

The key points of asthma management contained within the protocol are summarised in Table 2.

Table 2. Key points in the management of asthma

- The management of asthma in the ED can be improved through the use of simple assessment and treatment protocols
- Assessment of asthma severity should be based primarily on the measurement of FEV₁, expressed as a percentage of normal predicted values
- For most patients, initial treatment with high-flow oxygen, nebulised β-agonist and systemic corticosteroids is sufficient
- Currently available evidence does not support the use of IV bronchodilator therapy (theophylline or β-agonist) in acute asthma
- Patients with features of potentially life-threatening asthma should be admitted to an intensive care or high dependency unit
- Long-term management of patients should be reviewed before discharge, and medical follow-up arranged

The mainstay of treatment remains high-flow oxygen, repeated inhaled bronchodilator and systemic corticosteroids.

**Bronchodilator therapy**

The recommendations regarding bronchodilator therapy are based on the following key points:
- repeat nebulised β-agonist is superior to intravenous (IV) β-agonist therapy;¹³,¹⁴
- there is no advantage to the administration of doses of nebulised salbutamol higher than 2.5 mg every 20 minutes;¹⁵
the addition of IV theophylline to repeat administration of nebulised β-agonist does not increase the efficacy but does increase the risk of side effects;¹⁶
the addition of ipratropium bromide to inhaled β-agonist therapy provides a modest increase in bronchodilation.¹⁷,¹⁸

The revised protocol recommends the administration of nebulised salbutamol (2.5 to 5 mg) as the initial bronchodilator treatment for severe asthma. If there is a poor response to this initial nebulised treatment, it is recommended that salbutamol can be administered in a regimen of up to 2.5 mg every 20 minutes, with the addition of ipratropium bromide up to 0.5 mg hourly.

**Systemic corticosteroids**

The recommendations for systemic corticosteroid therapy have been changed to recognise that there is no benefit in very high intravenous doses.¹⁹ It has been shown that hydrocortisone 50 mg intravenously every 6 hours is as effective as 500 mg administered every 6 hours for 48 hours in severe asthma; also that similar efficacy, including time to onset of effect, may be achieved with oral steroids, suggesting that prolonged IV treatment is often unnecessary.²⁰ This has led to the recommendation that IV hydrocortisone 100 mg and/or 30 to 60 mg of prednisone be prescribed as initial systemic steroid treatment.

**Intravenous magnesium**

The use of IV magnesium has recently been shown to cause significant bronchodilation in patients with life-threatening asthma, but not in those with less severe asthma responding to initial treatment.²¹ This has led to the recommendation that a single administration of 2 g of IV magnesium can be given to patients with life-threatening asthma, recognised by an FEV₁ <30% after initial bronchodilator treatment.

**Discharge arrangements**

The provision for documentation of discharge arrangements within the framework of the protocol remains in an attempt to ensure that the attending doctor addresses these issues prior to discharge.

**Conclusion**

This revised protocol for the assessment and management of adults with severe asthma in the ED is presented as an ‘up-to-date’ system for use in the hospital emergency and/or general practice after hours departments. We recommend consideration of the issues that have led to the revision of the protocol that was previously in place, in particular the use of bronchodilator therapy.
**Figure 1. Adult asthma assessment sheet**

**Adult Asthma Assessment Sheet**
To be placed in the emergency department notes and a copy in the patient’s hospital records.
If discharged, copies to be given to patient and sent to GP

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Number</td>
<td>Time of arrival</td>
</tr>
<tr>
<td>Name of GP</td>
<td></td>
</tr>
</tbody>
</table>

**Asthma History:**

<table>
<thead>
<tr>
<th>Duration of current attack</th>
<th>Beta agonist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta agonist use, last 24 hrs</td>
<td>Inhaled steroid</td>
</tr>
<tr>
<td>Previous ICU admission</td>
<td>Other</td>
</tr>
<tr>
<td>Number of hospital admissions in last 12 mths</td>
<td></td>
</tr>
</tbody>
</table>

**Usual Medications:**

<table>
<thead>
<tr>
<th>Beta agonist use, last 24 hrs</th>
<th>Inhaled steroid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous ICU admission</td>
<td>Other</td>
</tr>
<tr>
<td>Number of hospital admissions in last 12 mths</td>
<td></td>
</tr>
</tbody>
</table>

**Lung function:**

| Predicted FEV<sub>1</sub>: % saturation: | pH: |
| Predicted VC: | O<sub>2</sub> therapy (L/min): |

**Initial oximetry:**

| Predicted FEV<sub>1</sub>: % saturation: | pH: |
| Predicted VC: | O<sub>2</sub> therapy (L/min): |

**Blood gases: (if indicated)**

| Predicted FEV<sub>1</sub>: % saturation: | pH: |
| Predicted VC: | O<sub>2</sub> therapy (L/min): |

**Progress Report:**

<table>
<thead>
<tr>
<th>Data</th>
<th>Initial Assessment</th>
<th>Post-nebuliser (1)</th>
<th>Post-nebuliser (2)</th>
<th>Final Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Respiratory rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse rate</td>
<td>FEV&lt;sub&gt;1&lt;/sub&gt; litres</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>% pred</td>
<td>O&lt;sub&gt;2&lt;/sub&gt; Sats</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>O&lt;sub&gt;2&lt;/sub&gt; Therapy</td>
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<td>L/min</td>
<td>L/min</td>
<td>L/min</td>
</tr>
<tr>
<td>Treatment given</td>
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<td></td>
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</tr>
</tbody>
</table>

**Outcome:**

<table>
<thead>
<tr>
<th>Admitted</th>
<th>Ward</th>
<th>Bronchodilator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharged</td>
<td></td>
<td>Inhaled steroid</td>
</tr>
<tr>
<td>Date to see GP</td>
<td></td>
<td>Oral prednisone</td>
</tr>
<tr>
<td>Predicted PEF</td>
<td></td>
<td>Inhaler technique</td>
</tr>
<tr>
<td>Pre-discharge PEF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urgent medical help to be sought if PEF&lt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-management plan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Discharge Medications:**

<table>
<thead>
<tr>
<th>Name of Doctor:</th>
<th>Signature:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 2a: The adult asthma management protocol currently in use in the Wellington Hospital Emergency Department

**Adult Asthma Management Protocol**

- **Give oxygen 6-8 litres/min by Hudson mask**
- **FEV₁ = forced expiratory volume in 1 second**
- **ICU = Intensive Care Unit**
- **IV = intravenous**

**Assessment**

- Can’t speak or unconscious. Unable to perform spirometry.

**Perform spirometry**

**Give nebulised bronchodilator**

**Reassess in 15 minutes**

- **Repeat spirometry**
  - FEV₁ 30-70% predicted or clinically unstable

**FEV₁ >70% predicted**

- Reassess in 30-60 minutes

**Clinically stable or improving and FEV₁ >70% predicted**

**Discharge** with appropriate advice (see notes).

- **Unstable or FEV₁ <50-60% predicted.**

**FEV₁ <30% predicted**

**Life-threatening attack**

- Protect airway. Call medical and anaesthetic registrars for help. Give repeat nebulised bronchodilators, hydrocortisone IV and magnesium IV.

- **Admit to ICU as quickly as possible**

- **Admit**

- **Give hydrocortisone IV, magnesium IV and repeat nebulised bronchodilator. Bedside chest xray. Arterial blood gas analysis. Discuss with medical registrar and consider ICU admission.**

- **Clinically stable or improving and FEV₁ >70% predicted**

- **FEV₁ 50-70% predicted**

- **FEV₁ <50% predicted**

- **Stable, FEV₁ >50-60% predicted. Rₜ prednisone 30-60 mg daily until early medical review.**
Figure 2b: Guidelines for the initial management of asthma in adults
(notes to accompany management protocol)

<table>
<thead>
<tr>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Nebulised bronchodilators</td>
</tr>
<tr>
<td>Salbutamol (Ventolin) 2.5–5.0 mg nebulised, using oxygen at 6–8 litres/min, until finished.</td>
</tr>
<tr>
<td>If there is a poor response to initial nebulised treatment, salbutamol 2.5 mg can be administered every 20 min with the addition of ipratropium bromide up to 0.5 mg hourly.</td>
</tr>
<tr>
<td>2) Corticosteroid therapy</td>
</tr>
<tr>
<td>a. Hydrocortisone 100 mg intravenous stat, and/or</td>
</tr>
<tr>
<td>b. Prednisone 30–60 mg orally stat.</td>
</tr>
<tr>
<td>3) Parenteral magnesium therapy</td>
</tr>
<tr>
<td>Magnesium sulphate (IV infusion 1.2–2 g MgSO$_4$ in 100 mls N/saline over 20 mins)</td>
</tr>
</tbody>
</table>

Pre-discharge considerations
1) Before discharge, consider whether the patient needs:
   • a course of oral prednisone, 30–60 mg daily, until early medical review;
   • to start, or increase the dose of, inhaled corticosteroid;
   • specialist referral, if high-risk asthmatic.
2) Before discharge, ensure that the patient:
   • can use their inhaler correctly and has a supply of their medications;
   • has been advised to make an early follow-up appointment with their GP;
   • has a peak flow meter and knows at what level to contact emergency medical help;
   • has a copy of the assessment sheet;
   • has an asthma self-management plan in place.

NOTE:
These are guidelines only and may not suit all patients. If there is any doubt about a particular patient, discuss with the ED consultant or medical registrar. Admit any patient who is unstable regardless of the FEV$_1$.

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References:


Diaphragmatic herniation of laparoscopic Nissen fundoplication wrap due to forceful post-operative retching: three case reports

Christopher Wakeman, Philip Bagshaw, Grant Coulter and Kiki Maoate

The open Nissen fundoplication was the standard anti-reflux procedure until 1991, when the first laparoscopic Nissen fundoplication (LNF) was performed in Belgium. Since then, LNF has taken over as the operation of choice for gastro-oesophageal reflux disease (GORD). It has been shown to be as efficacious and as safe as the open procedure.1-3 The three cases described here illustrate one of the serious complications of Nissen fundoplication. That is, herniation of the fundal wrap of the stomach into the thorax, after disruption of the cruroplasty (suturing to narrow the diaphragmatic oesophageal hiatus), due to forceful retching and vomiting in the immediate post-operative period. This complication is rare, but is more frequent with LNF than with the traditional open operation.4

Case reports

The following cases of early diaphragmatic herniation after LNF occurred in Christchurch hospitals between December 1999 and June 2001.

Case 1

A 53-year-old man with a six-year history of severe GORD had an elective LNF. The crura were approximated using two Ethibond sutures and a 360° wrap was fashioned. The wrap was lax so the short gastric vessels were not divided. The surgery was routine. The nasogastric tube was removed at the end of the case.

Severe nausea with retching started in the post-operative recovery room and continued on the surgical ward. Two days post-operatively, because of ongoing pain, a Gastrograffin swallow was performed. This showed that the fundal wrap had herniated through the diaphragm. At laparotomy, the cruroplasty was found to have torn apart, allowing the wrap to herniate into the chest. The wrap was reduced into the abdomen by light traction on the stomach and the cruroplasty redone.

Case 2

An LNF was performed on a 12-year-old boy for GORD and recurrent vomiting. A 360° Nissen fundoplication wrap was completed with divisions of the gastric vessels for a loose procedure. A cruroplasty was performed using a single Tycron suture. The surgery was uneventful. The patient had severe retching and dysphagia post-operatively, with dislodgment of the nasogastric tube. This was not replaced. After a gastroscopy and a barium meal, which confirmed a hiatus hernia (Figure 1), a laparoscopy was performed on the tenth post-operative day. Here, the cruroplasty was found to have torn apart and the fundal wrap had migrated into the thorax. The wrap was taken down and redone laparoscopically, and a further cruroplasty done with a Tycron suture.
Case 3

A 39-year-old man had severe retching and pain immediately after an LNF. Post-operatively he did not have a nasogastric tube. A barium meal showed complete gastric outlet obstruction. On the third post-operative day, a laparoscopy revealed a tear in the diaphragm extending from the crura laterally for about 10 cm. Through this, the entire stomach, omentum and transverse colon had herniated into the thorax. The procedure was converted to a laparotomy to repair the defect.

In all three cases, the subsequent post-operative recovery was uneventful, and the patients were symptom free at follow up three months later.

Discussion

Although herniation of Nissen fundal wraps has been previously described, it is timely to raise awareness of this potentially serious and avoidable complication. Frequencies of between 0.8% and 7% have been reported.\textsuperscript{4-10} Although it is more common with LNF, performing a cruroplasty reduces the frequency.\textsuperscript{8-10} Several causes have been proposed for this complication. The reduced post-operative pain associated with laparoscopic surgery may mean earlier mobilisation and return to normal activities. This could be associated with increases in abdominal pressure before sufficient scar tissue and adhesions have formed. Gastric distension and vomiting have also been associated with the complication. Again, these cause
increased intra-abdominal pressures and reduced intra-thoracic pressure.\textsuperscript{4,7,9,10} The use of nasogastric tubes post-operatively has not been found to alter the rates of herniation, and they are generally removed at the end of the case.\textsuperscript{1,3,5}

In the three cases here, there was severe retching and vomiting that caused the cruraplasties, and the diaphragm in one case, to be torn apart. Subsequent vomiting caused the fundal wraps to herniate into the thorax. It is clear that post-operative retching and vomiting should be avoided or minimised after LNF. Medical and nursing staff should be informed of the potential complication and its management. Intravenous narcotic should be proscribed whenever possible, and alternative analgesic medications including non-steroids and panadol used. Early and regular prophylactic use of antiemetics such as Ondansetron should be encouraged. Alternative antiemetics and Dexamethasone should be trialled early on if vomiting and retching does not cease with Ondansetron. If patients have ongoing problems with pain, retching and vomiting or dysphagia, this complication should be considered early and investigated quickly.

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**References:**

Provide the citizens of New Zealand the miracle of folic acid fortification

Godfrey Oakley, Nicholas Wald and Gilbert Omenn

Each year in New Zealand, 50 children are born with the serious birth defects, spina bifida and anencephaly. These defects are caused by folate deficiency – a B vitamin deficiency. Since 1991, we have had definitive proof from a randomized controlled trial that these birth defects can be largely prevented if women consume enough of the synthetic vitamin folic acid before and during the early weeks of pregnancy. Since 1998, the United States and Canada have required that all enriched grain products, such as flour and corn meal, contain folic acid. As a result of these actions, in these countries and in 20 other countries in which folic acid fortification is mandatory, babies are being born every day without birth defects they might otherwise have had. Unfortunately for the children of New Zealand, there is no universal fortification of flour and preventable birth defects continue to occur.

Lack of folic acid fortification is also bad for adults. Fortification in the United States has virtually eliminated folate-deficiency anaemia among adults to their benefit. Fortification has also lowered serum homocysteine concentrations. Elevated homocysteine, like serum cholesterol, increases the risk of heart attacks and strokes. The risk from homocysteine is independent of the effect of cholesterol. Lowering homocysteine with folic acid could reduce the risk of heart attack by about 15% and stroke by about 20%. There is also an indication that folic acid may reduce the risk of colon cancer.

Recently, Professors Mann and Green of the Department of Human Nutrition, University of Otago, have argued in the NZMJ against the folic acid fortification that will prevent birth defects, prevent folate-deficiency anaemia and reduce homocysteine concentration in the blood of almost all adults living in New Zealand. They argue that fortification should not be introduced until they and others around the world conduct more research. We think that it would be wrong to wait for more research before introducing universal fortification with folic acid in New Zealand. Folic acid fortification has been shown to be safe and effective in the United States and Canada. The citizens of New Zealand – young and old – should receive the benefits of folic acid fortification of flour immediately. In the 1960s, public health officials concluded that smoking causes lung cancer; they did this on the basis of less evidence than we have in support of the benefits of folic acid in preventing several human diseases. The health and food authorities should not be hesitant to act because of arguments that more research is needed. The wait will cause avoidable disease.

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Conflicts of interest: Professor Oakley is co-inventor of a patent that covers adding folic acid to contraceptive pills and is a paid consultant to Ortho McNeil on this issue.

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References:


Mandatory fortification of flour? Science, not miracles, should inform the decision

Murray Skeaff, Tim Green and Jim Mann

In this issue of the NZMJ, Oakley et al suggest that universal folic acid fortification of flour will achieve miracles in New Zealand. Historically, miracles occur by divine intervention or happen for reasons that are difficult to substantiate. The ability of periconceptional use of folic acid supplements to prevent neural tube defects may be considered to be a miracle but is also proven science. That which remains unproven is the “miraculous” improvement in public health that Oakley et al contend will occur if folic acid fortification of flour becomes mandatory in New Zealand. Universal fortification of flour will affect every New Zealander, and it is vital that the public health risks and benefits are dispassionately evaluated and quantified before the government directs a change in the food supply. We offer the following viewpoint as a contribution to the debate about mandatory folic acid fortification in New Zealand.

The unique aspect of universal folic acid fortification of flour that demands a prudent approach to its introduction is that a substantial proportion of the population will ingest amounts of folate never before attainable naturally in the diet. The effects of lifelong exposure to large amounts of the synthetic form of folate – folic acid – are unknown. Is high exposure to folic acid throughout childhood and adolescence safe? The lack of evidence of toxicity for folic acid should not be offered as proof that folic acid is not toxic. Proving the safety or toxicity of folic acid will be difficult because there will be no unexposed population in New Zealand. In a sense, mandatory folic acid fortification would represent an uncontrolled clinical trial with all New Zealanders as participants.

To what extent will folic acid fortification of flour reduce the incidence of neural tube defects in New Zealand? New Zealand already has a very low birth prevalence of neural tube defects (5/10 000 births). The randomized controlled trials in which the benefits of folic acid supplementation were proven, were carried out in populations with high background incidence of neural tube defects. The underlying recurrence rate in women not taking folic acid in the MRC trial and Hungarian trials was 350/10 000 and 25/10 000 births, respectively. The results of a recent study in two regions of China, involving over 250 000 women with confirmed pregnancies, suggest that the effectiveness of folic acid in preventing neural tube defects may be diminished in populations with a low incidence. In the northern region of China, with a neural tube defect birth rate of 48/10 000, there was a 79% (95% CI: 68 to 87) reduction in risk with the use of folic acid supplements. However, in the southern region, with a defect rate of 10/10 000, use of folic acid supplements did not significantly reduce the risk of neural tube defects (16%, -14 to 39). Even when compliance with supplement use was taken into account, the efficacy of periconceptional folic acid at reducing neural tube defect risk was barely evident in the southern region (40%, -2 to 64; not significant) and was half that of the northern region (85%, 62 to 94). The results of the Chinese study raise questions about the tacit assumption that in New Zealand, where the birth
prevalence of neural tube defects is low, folic acid fortification will prevent the great majority of neural tube defects.

Furthermore, the magnitude of the reduction in neural tube defects achievable with folic acid fortification, will depend, in part, on the initial folate status of women – only those with low folate status expected to benefit. The results from a survey of Dunedin women of childbearing age indicate that over one third have red blood cell folate concentrations exceeding the level that confers a very low risk of neural tube defects. Therefore, it is likely that a considerable proportion of women in New Zealand will derive no additional benefit from folic acid fortification of flour.

Mandatory folic acid fortification in the United States has been associated with only a 19% decline in neural tube defects, despite estimates that women are consuming twice as much folic acid as predicted. The decline falls well short of the maximum achievable risk reduction (72%) – based on the MRC trial – if all women took folic acid supplements at the critical time of pregnancy. Furthermore, neural tube defect rates in the United States were in decline long before the implementation of mandatory folic acid fortification, making it difficult to attribute all of recent change to fortification. Even if we accept that the 19% reduction reported in the United States is possible in New Zealand, it represents a reduction of four cases of spina bifida annually. Preventing even one case of spina bifida is a priceless relief for the afflicted child or family, but is the prevention of four cases of spina bifida each year sufficient justification for accepting the risks of exposing four million people?

Advocates of universal folic acid fortification of flour argue that the risks to public health are illusory. This is not true. Folic acid taken at doses of as little of 400 µg a day can mask the haematological signs of vitamin B12 deficiency, allowing irreversible neurologic damage to occur because of delayed diagnosis. This concern is most pronounced in older people, who are at the greatest risk of vitamin B12 deficiency. Prevalence estimates on the number of New Zealand elderly at risk for vitamin B12 deficiency range from 7–23%. We recognise that masking affects only a small proportion of those with vitamin B12 deficiency, but the cost of irreversible neurological damage must be considered. Introduction of mandatory folic acid fortification will necessitate a significant increase in resources allocated to monitoring the vitamin B12 status of older people. Due primarily to concerns of a negative impact on older people, the UK Board of the Food Standards Agency recently decided against universal folic acid fortification of flour.

Oakley et al contend that folic acid fortification of flour will improve the cardiovascular health of New Zealanders. This effect, they assure us, will result from the documented ability of folic acid to lower serum homocysteine concentrations. We recognise that there is a body of observational epidemiological evidence linking elevated serum homocysteine concentrations with cardiovascular risk, but are reminded of similar claims, based on the same levels of evidence, that vitamin E supplements would prevent heart disease and beta-carotene would prevent lung cancer. Comprehensive results from the clinical trials of vitamin E and beta-carotene supplements have not confirmed these claims; in fact, of particular concern, was the surprising demonstration that beta-carotene increased the risk of lung cancer in smokers. A recent meta-analysis of the observational evidence linking homocysteine and cardiovascular disease concluded that an elevated homocysteine concentration is, at most, a modest predictor of disease risk; a 25% lower homocysteine was associated
with 11% lower ischaemic heart disease risk and 19% lower stroke risk.\textsuperscript{14} A single, relatively short-term clinical trial in people with established cardiovascular disease suggests benefit resulting from supplementation with vitamins B\textsubscript{6} and B\textsubscript{12} and folic acid.\textsuperscript{22} However, it seems appropriate to await the results of the several large-scale intervention studies currently underway before making strong claims about the cardioprotective effects of folic acid. Indeed, in the light of present evidence, it seems entirely inappropriate to claim that the evidence linking folic acid to the prevention of cardiovascular disease is stronger than that available to public health officials in the 1960s who concluded that smoking causes lung cancer.

Is there an alternative to universal folic acid fortification? Yes, voluntary fortification and the folic acid health claim should continue, but the government must initiate a deliberate public health campaign to dramatically increase the use of folic acid supplements by women during the periconceptional period. Supplementation has the advantage that it provides folic acid at the correct dose directly to and only to the target population. The disadvantage is that almost half of pregnancies are unplanned.\textsuperscript{23} Mandatory fortification of flour, on the other hand, will reach almost all women, but only a small proportion of them will receive the effective dose. We estimate that if half of all women planning a pregnancy (25% of all pregnancies) took folic acid supplements at the correct time, the reduction in the incidence of neural tube defects would be equivalent to that achievable by mandatory fortification.

Greater use of supplements has the potential to exceed the effectiveness of any mandatory fortification programme. At the end of a comprehensive three-year Folic Acid Campaign in the UK, 38% of women who were pregnant claimed to have taken folic acid when trying for a baby.\textsuperscript{24} Unfortunately, similar efforts to educate New Zealand women about folic acid and change their behaviour have been little short of nonexistent. Why can women in New Zealand not buy a 400 µg folic acid supplement? Why is it not permissible for multivitamins for women – of course, referring to quality controlled preparations – to contain 400 µg of folic acid? Perhaps these issues should be addressed prior to a consideration of mandatory fortification.

Other benefits of folic acid have been suggested. These include possible improvement of cognitive function in the elderly via a homocysteine-lowering effect. Should such benefits and a cardioprotective effect be confirmed by clinical trials it would be appropriate to reconsider the scientific case for mandatory fortification. In the absence of such evidence and in the light of the observations above, it would appear to us that expectation of a miracle rather than science would need to be invoked as the justification for the introduction of mandatory fortification at present.

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**References:**


Angioplasty for intermittent claudication: has the balloon finally burst?

Tim Buckenham

Intermittent claudication (IC) is the most common symptom of lower limb arterial disease and is typified by a cramping pain caused by inadequate supply of blood to the affected muscles. The calf is the most common area affected and the pain is typically brought on by exercise and relieved rapidly by rest. IC has a prevalence of 4.5%, which increases with age and is predominant in males. Most patients with IC will have risk factors for arterial disease, such as smoking, hypertension, diabetes, or a dyslipidaemia. On examination, diminished or absent pulses may be found in the symptomatic limb, however, some patients will have intact lower limb peripheral pulses but a reduced ankle brachial pressure index (ABPI). This reduction in ABPI may manifest only after exercise, but ABPI measurement is a reliable method for distinguishing true intermittent claudication of an arterial aetiology from other conditions with similar symptoms. Furthermore, an exercise ABPI of 1 excludes the diagnosis.

The management of intermittent claudication has been profoundly altered by the introduction of percutaneous transluminal angioplasty (PTA). Angioplasty is now regarded as an appropriate minimally invasive therapy for patients with short segment occlusive or stenotic disease, particularly of the suprainguinal arteries. The expansion of PTA as a treatment option for IC has not been paralleled by the accrual of level one data (randomized controlled trials) to support its use and the enthusiasm shown by many practitioners for percutaneous recanalisation of arteries has obscured the important considerations that surround IC. These being the benign natural history of IC with respect to limb loss, and the importance of managing the systemic atheromatous burden that occurs in claudication in order to prevent death from coronary or cerebrovascular disease.

The natural history of intermittent claudication

For the patient with intermittent claudication, two questions are particularly important: are the symptoms likely to worsen, and what is the risk of requiring an amputation? There are many studies documenting the natural history of peripheral arterial occlusive disease manifesting as IC; on average in only one quarter of patients will their walking distance diminish over time. In the Edinburgh artery study, 50% of claudicants became symptom free, and 25% stabilised during the five-year follow-up period. Of the one quarter that deteriorate, only a small number will ever require reconstructive surgery. This figure may be as low as 3–6% over a five-year period. The annual risk of amputation is also low at approximately 1%. This is in keeping with the increased understanding of critical limb ischaemia (CLI) (in which revascularisation is required for limb preservation), where few patients who present with CLI have ever been a claudicant. IC is a risk factor for cardiac and cerebrovascular disease, and death from cardiovascular events. Atherosclerosis is a systemic disease, and the manifestation of lower limb atheroma as IC is a strong marker of cardiac and cerebrovascular disease, which places the patient at risk.
significantly increased risk of sudden death from stroke or myocardial infarction. The “all cause mortality” for patients with IC is approximately 30% at 5 years, 50% at 10 years, and 70% at 15 years. This gives a prognosis similar to that following resection of Duke’s B carcinoma of the colon. Non-fatal events are also common, with approximately one quarter of patients suffering a cardiac or a cerebrovascular event over an 11-year period. This high mortality and morbidity furthers our impression that IC is a life-threatening, but not a limb-threatening condition.

Management of intermittent claudication

A great variety of medications have been prescribed for IC over the years purporting to increase walking distance, but none has been universally accepted as an effective treatment. Surgical revascularisation or PTA has been commonly offered to patients with more severe symptoms. PTA is a technique that involves accessing the common femoral artery with a percutaneous puncture and dilating a stenosed or occluded artery with a balloon catheter. This may be augmented with the placement of a stent, which is a tubular metallic structure with intrinsic radial force that holds the dilated segment open. Optimal lesions for PTA are short segment stenoses or occlusions with relatively disease-free inflow and outflow. Complications may occur; the most common relate to the access site, where haematoma or pseudoaneurysm formation may occur. Other complications are acute occlusion of a non-diseased segment, distal embolisation (including cholesterol embolisation), and arterial rupture. The angioplasty is performed under radiological guidance and the segments are imaged with iodinated contrast media, which can result in an exacerbation of renal dysfunction in patients who are at risk, eg, diabetics and those with pre-existing azotaemia. Overall, the risks of PTA are low, with complication rates generally being less than 5%. Procedures are carried out under local anaesthesia and many patients are treated as a day case. Supervised exercise is a non-invasive alternative, but requires vigorous invigilation and may lack durability.

Does PTA work?

It has been 35 years since Charles Dotter first described the technique of percutaneous angioplasty, and in that time only two randomized controlled trials have been performed to assess its value in the treatment of intermittent claudication. These are the Edinburgh and Oxford trials. In both these trials, patients were randomized between PTA and supervised exercise therapy. At six months’ follow-up in the Oxford trial, mean walking distances were lower in the angioplasty than the exercise group, but in the Edinburgh trial, the mean claudication distance was considerably higher in the angioplasty group. Quality of life was similar between the angioplasty and control groups, except that fewer angioplasty patients reported pain compared to control. At two years’ follow-up in the Edinburgh trial, the angioplasty group did not have a significantly greater claudication distance on treadmill exercise than the control group; however, the mean ABPI was slightly higher in the angioplasty group. Quality of life did not differ between the two groups. At six years’ follow-up in the Oxford trial, one third of patients were not re-evaluated due to death, illness or inability to be contacted. The losses were similar in both groups. Of the remaining subjects, no significant differences were found between the angioplasty and exercise groups in either median walking distance or median ABPI. This small data set suggests that there is a short-term advantage to angioplasty, but this comes at a cost. In the Oxford Group, of the 20 patients in the angioplasty arm, three had a groin
haematoma complicating the dilatation, and one had a rupture of the external iliac artery.

**Management of risk factors**

As 50% of claudicants will have a cardiovascular event within five years of diagnosis (half of these being fatal), the management of patients’ systemic atheromatous burden assumes greater importance than the management of the presenting symptom. Management of risk factors such as hypertension and smoking combined with antiplatelet medication such as Aspirin, will reduce the risk of coronary events and stroke an effect that may be enhanced by statins. The above management strategy may also have a benefit in altering the natural history of the lower limb atheromatous disease. Cessation of smoking is associated with a reduction in risk of amputation in those patients with intermittent claudication. Those patients with diabetes are 30% more likely to have deterioration in the involved limb compared with non-diabetics, but as yet there is no evidence that improved diabetic control per se influences the amputation risk. Hypertension is a risk factor for peripheral arterial disease; however, hypertension appears not to influence the local progression of peripheral arterial occlusive disease.

**Conclusion**

Prior to the advent of PTA, many patients with intermittent claudication were advised to stop smoking, buy a dog, and keep walking. After 35 years of PTA, it may be prudent to revisit this advice with the understanding that IC is a marker of cardiac and cerebrovascular disease, and is therefore a life-threatening but not a limb-threatening condition. Supervised exercise therapy and identification and management of risk factors may well be a better combination than percutaneous balloon dilatation, along with reassurance of the patient that their symptoms are unlikely to progress and that their risk of amputation is low. The enthusiasm practitioners have to embrace new technology must be tempered by the need to obtain level one evidence to support the change in practice. Sadly, this has not happened with PTA for intermittent claudication and 35 years after Charles Dotter described this technique, it still must be regarded as an experimental procedure. It may be that significant resources are being spent on an unproven technique and that these resources might be better spent on the medical management of risk factors, cessation of smoking, and supervised exercise therapy.

Ultimately, the results of ongoing randomized controlled trials will determine the usefulness and place of PTA. In the meantime, the paucity of level one data and our increased understanding of natural history should make practitioners give thought to their management of patients with IC.

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References:


The hazards of liquid nitrogen

David McBride

Liquid nitrogen is an inert, colourless, odourless, noncorrosive, nonflammable, cryogenic liquid used in a number of cryotherapy applications, including wart treatment in general practice. Despite the inert nature of this substance, there are hazards associated with its use.

Case report

One such hazard is illustrated by the following case history, in which a practice nurse describes the sequence of events following the accidental fall of a thermos flask filled with liquid nitrogen:

“I just had time to back out of the room before there was a huge explosion, with a flash of white light across the ceiling, and the room filled up with vapour. When the vapour had cleared, small pieces of glass and plastic were all over the room, with some even sticking to the ceiling. All that was left of the flask was the twisted outer metal, with part of the plastic handle still attached. There was also a large hole in the ceiling. We never found the lid, so presume it must still be up in the ceiling.”

Discussion

Cryogenic liquids such as liquid nitrogen are liquefied gases that have a normal boiling point below -238°F (-150°C), and liquid nitrogen has a boiling point of -320.5°F (-195.8°C). The most likely mechanism for this event was not an explosion but an implosion, the lining of the thermos flask having cracked due to either repeated thermal stress or the mechanical action of being knocked over.

The alternative scenario is that liquid oxygen, with a boiling point of -183°C, may have formed in the flask by condensation from the air. Liberation of the oxygen and the presence of either oxidizing materials or organic vapours may then have set the scene for an explosive finale.

These problems can be avoided by remembering that liquid nitrogen is a hazardous material and requires special precautions during storage and use. It should be stored in a suitable container, that is to say a Dewar Flask. This is made to withstand extremes of temperature, has an outlet that prevents atmospheric moisture from plugging the neck, and allows gas produced from vaporized liquid to escape while keeping moisture out. The cold hazard associated with handling the liquid nitrogen itself may be managed by the use of suitable protective equipment.

This report emphasises the importance of performing adequate risk assessments on all the hazards that may be found in the practice environment and providing adequate staff training on those identified.

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References:


Cytomegalovirus and inflammatory bowel disease

Peter Carne and Frank Frizelle

The association between inflammatory bowel disease (IBD) and cytomegalovirus (CMV) infection has been well described, however is often overlooked. It occurs most commonly in immunosuppressed patients with ulcerative colitis (UC) refractory to corticosteroid treatment. CMV is very rarely found in patients with their first episode of colitis. Prompt diagnosis and treatment may prevent further complications of colitis. We present a case of CMV infection associated with a first presentation of acute Crohn’s Colitis (CC).

Case report

A 75-year-old female presented with a six-month history of diarrhoea and abdominal pain. Other than hypertension, her health was good. Her HIV status was unknown. Colonoscopy and biopsies suggested CC. CMV was looked for and not detected. Stool cultures were negative for bacteria and parasites. Repeat flexible sigmoidoscopy showed ongoing CC, without evidence of CMV. Corticosteroids were commenced. An abdominal computed tomogram performed 17 days later for clinical deterioration, showed thick-walled colon from the hepatic flexure to the sigmoid colon. The patient’s clinical condition continued to deteriorate despite maximum medical therapy, so she came forward for colectomy.

A subtotal colectomy with end ileostomy and mucous fistula was performed. A marked thrombocytopenia (39x10^9/L), with associated diffuse non-surgical bleeding, necessitated packing of the abdomen. The following day, the packs were removed and the abdomen closed. The patient’s condition continued to deteriorate, and multisystem organ failure developed. On the second post-operative day, treatment was withdrawn and the patient died. Histopathology of the colon showed severe CMV colitis and features of Crohn’s disease.

Discussion

Adults are commonly infected with CMV, usually with few if any symptoms. CMV can be associated with severe infection in immunocompromised patients, though rarely in the immunocompetent. The prevalence of CMV in patients with IBD refractory to corticosteroids has been reported at between 0.53% and 36%. CMV infection associated with IBD may result in a more severe clinical course, with a high mortality rate, even after colectomy. Improvements in mortality, and the need for surgery have occurred since the introduction of ganciclovir.

In patients with CC or UC refractory to medical treatment, a high degree of suspicion for CMV needs to be maintained. In one study, 7 of 19 patients with severe refractory ulcerative colitis and Crohn’s disease had cytomegalovirus diagnosed on rectal biopsy and on buffy coat preparation. Five of the seven patients went into remission after antiviral treatment.
The possibility of the very uncommon combination of a patient newly diagnosed with colitis, and steroid-naive having CMV, as in our patient, is exceptionally rare; only six previous cases are reported.\(^4\)

The diagnosis of CMV may be difficult to make. If endoscopic biopsies are negative for CMV, then testing for the presence of CMV DNA in peripheral blood by polymerase chain reaction (PCR), and for CMV antibodies, may be useful in confirming the diagnosis. In our patient, there was no pre-operative evidence of CMV, although her blood had not been tested for CMV.

CMV should be considered in patients with IBD refractory to corticosteroid therapy. While more frequent in UC, it may occur in CC, even in a patient’s first episode of colitis. The diagnosis of CMV may be difficult. Cessation of corticosteroids and commencement of antiviral therapy is appropriate and can reduce the need for surgery when CMV is a confirmed pathogen.

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In every treatise on the diseases of children, if the habit of thumb-sucking is referred to, it is always strongly condemned. It is a habit so objectionable that many authors advise mechanical restraint, should milder measures fail to correct it. Keene and White ("American Text-book of Surgery") write: "Sucking the thumb has a marked influence on the position of the teeth, and if persisted in may cause considerable deformity of the jaw."

Owen ("Surgical Diseases of Children") states: "Thumb-sucking is a habit of which a child should be broken as quickly as possible, or else it may be persisted in for years. In early childhood the jaws are soft and pliable, and if the thumb be constantly pressed at the back of the intermaxillary bone, and, what is more, forcibly thrust against it in long continued energetic sucking, the alveolar process and the incisor teeth will be driven forwards, the palatine arch rendered high and narrow, and the inferior maxilla repressed."

Holt ("The Diseases of Infancy and Childhood") is even more emphatic. He says: "The results of sucking may be serious. Deformities of the thumb or finger, of the lips and teeth, and even of the jaws are sometimes produced. . . . In the management of these cases the most important thing is to arrest the habit early before it becomes fixed. Too often the habit of thumb-sucking, or of sucking a rubber nipple, is encouraged by mothers and nurses, because of the temporary quiet which is thereby produced. Even physicians are sometimes accessory to this procedure. Under no circumstances should it be resorted to as a means of putting children to sleep, or otherwise quieting the nervous system."
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Specialist services to Pacific Island nations must be delivered within a service, educational and cultural framework. This framework must encompass the short- and long-term health needs of each country. The initial aim is to identify and provide services for the priority areas within each specialty. This will define the credibility of the service provided and foster the relationships to enable long-term educational goals to be established. Educational programmes are the key to the development of local ownership and services. Keep it simple and be effective with common conditions. Demystify the supposed complexity of the specialty. Let them know of our level of ignorance. Identify and train health workers (in or out of the country) to be competent at their respective levels. Provide ongoing support from the respective visiting teams.

It is easy to impose, but one must always remember to respect their way of life, their culture, skills, trust and warmth. The best human trait to have in the Pacific is “humbleness”. Next in line is a “good sense of humour” and the ability to “laugh”. “Patience” is certainly not the least. We are talking years.


Introduction There are few reports describing the surgical management and outcome of children suffering purpura fulminans secondary to meningococcal sepsis. New Zealand is in the grip of a meningococcal epidemic and, with the attendant sequelae of the disease process, the authors sought to formally review the children who have required surgical involvement.

Methods A retrospective case review of children with the sequelae of meningococcal disease presenting to the Plastic Surgical Unit in a university teaching hospital was undertaken.

Results There were 117 procedures in 21 children performed over a 12-year period. Surgical management was separated into two phases – early and late. The mean delay from admission with acute sepsis to the first surgical procedure (ie, early intervention) was 15.9 days. Debridement and autologous skin grafting was the mainstay of managing the necrotic defects, however allograft skin proved a useful adjunct as a physiological dressing. Local flaps were used with deep defects down to bone, but in the extremities amputation to viable tissue was required once gangrene had demarcated. Amputations were carried out in 9 of 21 children. Late interventions were related to relief of contractures or fibula overgrowth causing stump ulceration. Clinical follow up revealed that all children interviewed over five years of age, (9
children) attend ordinary regular school classes and were physically active within the context of their physical disabilities.

Conclusions Our data would suggest that children requiring surgery for purpura fulminans achieve age appropriate milestones and are primarily limited by their physical disability related to amputations, scarring and abnormal bone growth.

Thromboprophylaxis in plastic surgery patients. S Hulme, G M Duncan.

Introduction A large proportion of patients admitted to plastic surgery units have multiple risk factors for thromboembolism, but this has not received due attention in the medical literature. There is no consensus on prophylaxis of thromboembolism in this diverse population. Other surgical specialties have reported a high degree of complacency with thromboprophylaxis.

Aim and Method A review of literature was carried out with the aim to arrive at a consensus for thromboembolism prophylaxis in plastic surgery patients.


Neurothekeomas are benign tumours of presumed nerve sheath origin most commonly involving dermal and subcutaneous nerves in the head and neck region of young women. They rarely involve sub-fascial peripheral nerves or the central nervous system. We present a case of neurothekeoma involving the sciatic nerve. To the best of our knowledge, neurothekeoma involving a deep peripheral nerve of the lower limb has not been previously reported. The size of the lesion described here is also significantly larger than the usual dimension of 3 to 31 mm.


We present an 11-year review of adult facial fractures, looking at the incidence of severe visual impairment or blindness. Of 2516 patients treated over the period, we found 19 who suffered severe visual impairment or blindness, to give an incidence of 0.8%.

The aetiology, fracture patterns and other aspects were analysed to see if there was any correlation between fracture and visual impairment. Findings are discussed and recommendations made.

Correction of sagittal synostoses in Auckland, a review. W J Flapper, T de Chalain.

Sagittal synostosis is the most commonly occurring form of craniosynostosis. Surgical treatment of this condition is the norm, although the operation of choice continues to be debated. Studies performed overseas have compared a number of techniques with respect to operative variables as well as looking at long-term outcomes, but to date no such comparison has been carried out in New Zealand. The aim of this study was to review the New Zealand data, evaluating the techniques used and comparing these
with already published data from overseas. We looked at the operations performed for sagittal synostoses at the Starship Children’s Hospital over a five-year period between November 1995 and December 2001. Operative and post-operative variables were analysed and the results of this analysis will be discussed.

A South Island experience with ear replantation. R A Smith, S J Langley.

The first known case of a successful ear replantation in the South Island is presented. A young man has almost the entire pinna bitten off by an assailant and this was revascularised using microsurgical techniques. Pre- and post-operative photographs are shown and post-operative management is discussed including the use of leech therapy.

A review of similar international cases is presented.

Necrotising fasciitis – small microbe, lethal punch! Y Rajapakse, R Wong She, M Klaassen.

Necrotising fasciitis (NF) is a rapidly spreading infection of the deep fascia, resulting in secondary necrosis, systemic toxicity and death if untreated. 40–60% of cases are fatal. Recent popular press publicity about sporadic cases has led to hysteria and the fear of a “flesh-eating disease”. Common areas affected are the limbs and the trunk, including the perineum and the abdominal wall. In the last decade, the Group A streptococcus bacteria has been implicated as the main pathogen, although the causative bacteria may be mixed flora. The streptococcus produces superantigens, which are microbial proteins capable of activating immune cells and causing the excessive release of inflammatory cytokines. This explains the dramatic shock and organ failure seen in severe streptococcal infections.

Management of NF revolves around early diagnosis, antibiotics, resuscitation in an intensive care setting, aggressive surgical debridement and reconstruction of soft tissue defects. We present a review of the Waikato Hospital experience of NF from 1996 to 2002, illustrated by case examples and suggested management guidelines.


Hydroxyapatite cement paste provides a pliable alternative to other forms of implants used for the treatment of bony defects. We discuss its use, applications and indications and present four patients that have undergone treatment in Christchurch. Two patients had congenital abnormalities and two patients had frontal bone defects following previous surgery, all of whom had pleasing results. Maximum follow-up time post-operatively was 19 months and minimum follow-up time two months, but results to date have been very encouraging.
Perineal wound healing after anterior-perineal (AP) resection with flap reconstruction – a case-control study. D Thomas.

Perineal wound healing following AP resection is a common problem because of wound location and radiotherapy effects on tissue. These factors and others such as poor nutritional state are not peculiar to perineal wounds, however in this setting after AP resection it is a frequent problem. To our knowledge there is nothing in the literature on the effectiveness or role of local flaps to aid in wound closure, healing and in preventing wound breakdown following AP resection. The two flaps commonly used are rectus and gracilis local pedicled flaps. We retrospectively examined healing in patients who had undergone flap reconstruction comparing healing outcome with matched controls.

Four sarcomata, five free flaps...and a p53 oncogene? S Hall, C Adams, S Tan, C McKinnon, H Brasch.

We report the case of a 29-year-old man who has had four sarcomata involving the head and neck region since age 16. Each tumour has required surgical excision and free flap reconstruction.

The initial tumour comprised a liposarcoma of the left cheek, treated by excision, free flap reconstruction and adjuvant radiotherapy. The patient subsequently developed chondroblastic osteosarcoma of his right mandible, metastatic chondroblastic osteosarcoma of his left mandible, followed by a new primary liposarcoma of the right cheek. All of these subsequent tumours were treated by surgical excision and free flap reconstruction.

We discuss the incidence of maxillofaial sarcoma, the challenge of multiple free flap reconstruction to the head and neck region, radiation induced sarcoma and the possibility of p53 oncogene involvement in this particular patient.

Cystic pancreatic lesions: how imaging can help. H Roberts.

Pancreatic cystic abnormalities can cause diagnostic difficulty, and errors of diagnosis can lead to unnecessary surgery or delayed treatment of potentially curable neoplasms. The main differential diagnoses of cystic pancreatic lesions include pseudocyst, serous cystadenoma, mucinous cystic neoplasm, cystadenomacarcinoma and intraductal papillary mucinous tumour (IPMT). While the history and physical examination, combined with laboratory analyses, can clinch the diagnosis, it is not uncommon for the optimum management path to remain unclear at this stage of the diagnostic algorithm. There are strong proponents of analysis of aspirated cyst fluid, but debate continues about the place of this investigation in the work-up of patients with a cystic pancreatic lesion. Many people feel that radiological assessment is the key to diagnosis. This talk will focus on the contribution that imaging can make to achieving a firm diagnosis in patients with a cystic pancreatic mass.

Introduction Many patients with liver tumours are unsuitable for hepatic resection due to tumour location or inadequate hepatic reserve. Radiofrequency ablation (RFA) is a novel technique of local tumour destruction by heat.

Aim To report the initial experience with RFA in the management of primary and metastatic liver tumours in New Zealand.

Methods Patients who underwent RFA between 2/2000 and 6/2002 were included. The clinical, pathological and follow-up information of individual patients was entered prospectively on a computerised database.

Results Thirty four procedures were performed in 33 patients (20 male, median age 58 yrs), 21 procedures were performed percutaneously under ultrasound guidance, while 13 were carried out during a surgical procedure. Ten patients had primary liver tumours, 24 patients had metastatic tumours (colorectal 10, neuroendocrine 7, non-colorectal non-neuroendocrine 7). The median diameter of treated lesions was 25 mm (range 5–60 mm). The median number of treated lesions per patient was 2 (range 1–6). Twenty eight of the 34 procedures were classified as curative (all disease treated). Six patients with neuroendocrine tumours underwent cytoreduction only and were classified as palliative. Eight patients (4 percutaneous, 4 surgical) developed complications. There was no treatment-related mortality. At a median follow up of 13 months, 6 patients (all treated with percutaneous RFA) have developed recurrence in treated lesions, 5 patients have developed new liver lesions, 19 are alive and disease free, and 3 have developed extra hepatic disease.

Conclusions RFA is safe but significant complications can occur. RFA performed percutaneously is associated with a higher rate of recurrence than RFA performed at operation.

Ethnic disparity of acute pancreatitis in South Auckland. A Phillips, C Lawes, A Ng, G Cooper, J Collins, J Windsor.

Introduction The epidemiology of acute pancreatitis has not been well documented in New Zealand.

Aim To document the epidemiology of acute pancreatitis in South Auckland with particular reference to ethnic differences.

Methods Retrospective review of all first-time admissions with acute pancreatitis to Middlemore Hospital between 1995 and 1997 inclusive. Diagnosis was confirmed by the presence of an appropriate clinical syndrome, raised serum amylase and/or surgical or post mortem findings. Denominator population data were obtained from the 1996 New Zealand census. Age standardised incidence rates were calculated using the Segi world population.

Results There were 257 first-time attacks (60% female) that comprised Maori (n = 52), Pacific (n = 40) and European (n = 165, including 7 persons of other minority ethnic groups). The overall crude incidence rate was 29.3 per 100 000 per year. Age specific rates increased with advancing age in all ethnic groups, but were almost
uniformly higher in Maori (1.5–3.5 times) and Pacific subgroups (2.0–3.5 times) compared with the European group. The age-standardised incidence rates in the Maori (46.0/100 000 person years) and Pacific (35.7/100 000) subgroups were also significantly higher than the European group (19.1/100 000) with the rate for Maori females (59.7/100 000), the highest of any subgroup in this study. There were no marked differences in the aetiology of pancreatitis between the ethnic groups. Severe pancreatitis occurred in 20% of cases in each ethnic group and the overall mortality rate was 5%.

**Conclusion** The crude rate for acute pancreatitis was very high by world standards. Maori and Pacific people have 2–3 times the relative risk of developing acute pancreatitis compared to Europeans and this is most marked in Maori females.

**Management of a clinical breast lump in the year 2002. B M D Scott.**

This paper will outline the latest information on imaging, biopsy and management of the classical breast lump.

It is important to be aware of what is available outside of the office to help diagnose breast problems, and hopefully avoid surgery in unnecessary cases.

However, it is also necessary not to miss a cancer diagnosis, particularly in younger patients, who are the group overseas most likely to sue if this is the case.

The well accepted Triple Test will be outlined in detail and its pitfalls presented.

**Experience in the Waikato with thoracic endoluminal grafting. P Puckridge, T M Vasudevan, R D Blair, D W Ferrar, C M Holdaway, M Muthukumaraswamy.**

**Aim** To report the experience of Waikato Hospital with thoracic endoluminal procedures from 1998 to 2002 (in treatment of thoracic aortic aneurysms and dissections).

**Methods** Examination of prospective data related to thoracic endoluminal procedures. The endoluminal programme in Waikato hospital was started in 1997 with stenting of abdominal aortic aneurysms. With accumulating experience with endoluminal procedures, this programme has been extended to the use of thoracic endoluminal devices in selected thoracic aneurysms and in trauma.

**Results** A total of eight patients have been successfully treated by endoluminal grafts since 1998. Diagnoses include traumatic thoracic aortic transection, thoracic aneurysms, a spontaneous dissection and an aorto-oesophageal fistula. There was no procedure-related mortality. All procedures were completed successfully. Zenith endoluminal grafts (Cook, Australia) were used in all cases. The mean operating time was 65 minutes. Three patients were treated for acute pathology within 8 hours of diagnosis. The mean hospital stay was 3 days. No added procedures were required in any patient.

**Conclusion** Endoluminal grafting for thoracic aortic pathology is feasible in selected patients, both acute and elective. It is associated with minimal mortality and morbidity as shown, and is likely to expand with better access to grafts, which is the main limiting factor particularly in thoracic aortic trauma.

Aim Retrospective analysis of 8 years of data for elective AAA repair was undertaken to compare local results with results in other centres both national and international. We looked at changing trends of practice and our results, especially in the current environment of emergence of endoluminal AAA repair.

Methods Systematic review of all case notes of patients with elective AAA repair between 1994–2001. The list of patients was generated using the hospital computer database.

Results 114 patients were identified (mean age 72.6 yrs, 82.5% male). Medical history revealed prevalence 77% ex or current smoker; 45.6% IHD; 42.9% hypertension; 19.3% CVA/TIA; 18.4 PVD; 15.8 arrhythmias, 9.6% diabetes; 7.9% renal impairment; 6.1% hyperlipidemia. 81% had ASA classification of =3. The average AAA size was 5.6 and 6.2 on USS and CT respectively. Intraoperative endpoints included average operation times of 147 minutes. Dacron tube graft was used in 66%; 34% were bifurcated. Estimated blood loss was on average 2013 ml. 66% were extubated in the operating theatre, 32% within 24 hours. Post-operative endpoints included 30-day mortality of 3.5%. Post-operative morbidity included CHF 17.5%; arrhythmia 14%; MI 12.3%; and pneumonia of 9.6%. Length of stay in ICU was 24 hours or less in 85%. Length of hospital stay was on average 7.8 days.

Conclusions Comparison of our data with the literature shows mortality and morbidity rates similar to those in major vascular units around the world.


On 20 May 2002, East Timor became the newest nation of this millennium; the contribution made by Australia and New Zealand will be listed. Our College, through AUSAID had a surgeon and an anaesthetist in the Dili National Hospital. Some aspects of local medicine will be discussed with an overview of the present status of this nation.

Colonel Maguire has recently returned as the surgeon to the UN MILHOSP, Dili, East Timor.


Introduction Head and neck cancer patients frequently require gastrostomy feeding. Different insertion techniques have been described.

Aim To compare clinical results of percutaneous endoscopic and radiological gastrostomies in patients treated in a regional head and neck cancer unit.

Materials and Methods The records of patients who received either percutaneous endoscopic gastrostomy (PEG) or percutaneous radiological gastrostomy (PRG)
between August 1997 and February 2001 were reviewed retrospectively. Documented complications (leak, infection, nausea and vomiting, ileus, bleeding, peritonitis) were recorded, compared and evaluated.

**Results** There were 74 patients (56 PEGs, 18 PRGs), most with stage III and IV head and neck malignancy. There was a significantly lower incidence of complications in PEGs than PRGs (11% vs 44%, p = 0.004). There was a delay of feeding due to tube placement in 4% of PEGs and 22% of PRGs (p < 0.025). Major complications occurred in 3.6% and 5.6% of PEGs and PRGs respectively. Generally, our complication rate for either form of gastrostomy was comparable with other studies. No procedure-related deaths occurred.

**Conclusions** Selection bias, technique and tube type appeared to influence the complication rate in this review. PEGs will remain our preferred method with PRGs reserved for those cases in which endoscopic placement is deemed to be impractical.

**Recurrent pleomorphic adenoma: prevention and treatment. R P Morton, N P McIvor.**

**Introduction** Recurrent salivary gland adenomas represent a major surgical challenge. Difficulties accessing, identifying and preserving the facial nerve are compounded by the need to adequately resect the tumour-bearing tissue. The risk of malignant change in recurrent, persistent pleomorphic adenoma has been widely reported and the technical difficulties associated with revision parotid surgery are well recognised.

**Aim** This paper reviews our experience with recurrent benign parotid salivary tumours, and seeks to identify factors that may prevent their occurrence and aid in their management.

**Methods** A retrospective review of patients who were treated for recurrent pleomorphic adenoma by the authors was conducted. A literature review of other clinical series was also performed.

**Results** Three types of recurrence are identified, relating to the nature of the original or previous surgical approach (open biopsy vs parotidectomy) and tumour handling (disruption vs capsular dissection). Each form of recurrence requires a specific surgical approach. No subsequent tumour recurrence has been recorded in any patient that we operated on for recurrent parotid tumour. No recurrences have yet emerged from over 200 parotidectomies for pleomorphic adenoma by the senior author over the past 18 years.

**Conclusions** Certain precautions are appropriate when performing parotid surgery for pleomorphic adenoma. Awareness of the nature of previous surgery will assist treatment planning of recurrent tumours. There are specific strategies that may be useful in surgery for recurrent parotid tumours.

Introduction Extrathyroid spread of thyroid carcinoma has a significant negative impact on morbidity and mortality, especially from local recurrence.

Aim To determine that complete resection of extrathyroid spread can be achieved with acceptable morbidity and will improve quality of survival.

Materials and Methods Analysis of disease, treatment and outcome of 40 consecutive patients treated for extrathyroid spread of thyroid carcinoma at the Green Lane Hospital Head and Neck Unit between 1988 and 2001.

Results Twelve patients (30%) had previous surgery and/or radioiodine therapy at other units. Common structures involved were strap muscles (58%); recurrent laryngeal nerve (40%); trachea (55%); larynx (30%); and pharynx/oesophagus (43%). In 35 patients, an aggressive surgical approach including resection of involved structures was combined with appropriate reconstruction techniques. Five patients were managed palliatively. Selective and/or central neck dissections were performed in 17 patients (49%). Unplanned recurrent laryngeal nerve palsy occurred in one patient (1.7% of nerves dissected) and permanent hypoparathyroidism occurred in 14%. Good functional results in terms of voice and swallow were achieved employing speech/swallow therapy and phonosurgical techniques. There have been no deaths from local recurrence in patients with differentiated thyroidal cancer.

Conclusions Resection of structures involved by local extension of thyroid carcinoma is feasible with acceptable morbidity and very good local control in a unit with appropriate expertise.


Background Upper gastrointestinal cancer is the third most common cause of cancer mortality in New Zealand. Prognosis of these and other cancers is possibly affected by the accessibility of hospitals. Several studies have revealed a reduction in survival that correlates with increasing distance from a major cancer centre. The aim of this study was to analyse any correlation between survival from upper gastrointestinal cancer and distance from a major centre, socioeconomic status, gender, age and ethnicity.

Methods Details of all 3351 patients diagnosed with cancers of the oesophagus, stomach, pancreas, liver and biliary tract between 1 January 1995 and 31 December 1997 were retrieved from the New Zealand cancer registry. The effect of age, gender, ethnicity, socioeconomic status and distance from a major centre was analysed using univariate and multivariate regression analysis to identify any associations with survival.

Results and Conclusions Increasing age and being of Maori descent were the only consistent indicators of poorer survival in this study. The relationship between distance and survival was complex, and in this study deprivation had no effect on the prognosis of upper gastrointestinal cancer.
Why fetal surgery remains embryonic. S Beasley. Christchurch Hospital, Christchurch.

In the early 1980s, the two great advances in paediatric surgery appeared likely to be minimally invasive surgery (laparoscopy) and fetal surgery. Improvements in antenatal ultrasonography led to a rapid increase in the accuracy of diagnosis of major structural abnormalities, and it seemed that the outcome of many of these lesions could be significantly improved if they could be treated by in-utero intervention. Congenital diaphragmatic hernia (CDH) attracted most interest because it is associated with a 50% or greater mortality, despite advances in neonatal care. However, it has proved difficult to identify prognostic indicators of outcome to allow appropriate selection of patients for interuterine surgery. Many barriers have been overcome (eg, how to open the uterus during late gestation without causing it to contract), but other problems appear to be insurmountable (eg, how to reduce the liver and not cut off placental blood flow back to the fetus). Despite accurate prenatal diagnosis and sophisticated ventilatory support (including ECMO) the prognosis of prenatally diagnosed CDH remains dismal, because of pulmonary hypoplasia and pulmonary hypertension.

This presentation reviews some of the difficulties encountered in the development of fetal surgical techniques, as applied to a range of conditions including congenital cystadenomatoid malformation, cystic hygroma, posterior urethral valves with bilateral hydronephrosis, and congenital diaphragmatic hernia. The future place of fetal surgical interventional techniques is uncertain: perhaps increasing knowledge may progress it from the embryonic to the fetal stage.

One stage complete closure of unilateral cleft lip and palate. G B Blake.

The problems of closure of the anterior palate and alveolus are addressed and a logical closure technique described. The method is ideal for use in Third World countries but long-term results are awaited in Christchurch.


We propose a classification for congenital auricular anomalies based on embryology and apply this to assist treatment strategies. Congenital auricular anomalies are classified as either malformational or deformational. Malformational auricular anomalies are caused by an aberration of morphogenesis leading to deficient or excess surface topographic components. Deformational auricular anomalies are due to the application of external forces to the auricular cartilage in utero. Both types of anomaly may co-exist. Deformational ear anomalies are ideally treated non-surgically by splinting during the neonatal period. Malformational anomalies require surgical correction. In the presence of both deformation and malformation, both splinting and surgery may be required. This classification guides the management of congenital auricular anomalies.
Primary open rhinoplasty in cleft lip repair. G Bartlett.
The author presents his philosophy towards the management of the cleft lip nasal deformity and outlines his experience with the open rhinoplasty approach to the nose at the time of lip repair. Open rhinoplasty allows more accurate mobilisation and repositioning of the lower lateral cartilages. Early repositioning of the nasal cartilaginous skeleton should allow more normal nasal development to occur.

Case report: total hip arthroplasty following acetabular and ischial reconstruction with a deep circumflex iliac artery free flap. N Hartnett, S T Tan, P Devane, G Horne.
Deficiency or loss of acetabular bone stock presents a challenge for primary or revision hip procedures. Numerous operative procedures have been described, detailing the advantages and disadvantages of allogeneic and autogeneous bone grafts used in conjunction with prosthetic components and internal fixation for replacing the lost acetabular element of the pelvis.
We present a case of a 29-year-old woman who underwent a two-stage operative procedure for a failed arthrodesis of her left hip for developmental dysplasia of the hip and juvenile rheumatoid arthritis. The first stage involved the use of a free vascularised deep circumflex iliac artery bone flap from the opposite iliac crest, followed by a left total hip joint arthroplasty nine months later.

The balloon expander in breast augmentation. G M Duncan.
The author presents his experience using the balloon dissector in breast augmentation over the past year. An anecdotal study, which concludes that the device adds little in terms of final results but is technically easy, may reduce blood loss, and is fun to use.

The effect of quilting donor site closure on the incidence and the volume of seroma in latissimus dorsi myocutaneous flaps and transverse rectus abdominis myocutaneous flap for breast reconstruction. S Hulme, D W Glasson.
Introduction The incidence of seroma in the donor site following latissimus dorsi myocutaneous (LDMC) flaps has been reported to be up to 60% and much lower for the transverse rectus abdominus myocutaneous (TRAM) flap. The aetiology is multifactorial and includes the shearing action between the cutaneous and muscular layers. Some studies have reported a reduction of the incidence of seroma with a quilting closure of the donor sites.
Aim To assess the incidence of seroma formation at the donor sites of LDMC and TRAM flap used for immediate and delayed flap breast reconstruction following a quilted closure.
Materials and Methods Review of the medical records of 72 LDMC and 79 TRAM flap breast reconstructions performed by one surgeon (DWG) were reviewed over a seven-year period up to May 2002. A seroma <25 mL was defined as small, and large defined as >25mL.
Results and Conclusions We will present the results of our study and compare them to published results in the literature. A quilted closure of the donor site significantly reduces the incidence and volume of seroma formation. The incidence of seroma is also lower in delayed breast reconstruction and with the TRAM flap.

Mast cells and haemangioma. S T Tan, R Wallis, M He, P F Davis.

Aim Mast cells (MCs), which are highly heterogenous in their morphology, function and metabolic products, have been implicated in the expression of a wide variety of biological responses. Although their association with a haemangioma is well known, their role in the evolution of this tumour is unclear. We examined the role of MCs in haemangioma.

Methods Using histochemical and immunohistochemical (IHC) methods, we characterised MCs and their products during the spontaneous and steroid-induced regression of haemangioma. RT-PCR and IHC methods were used to study the expression and localisation of the apoptotic gene clusterin/apoLipoproteinJ (clust/apoJ) during the spontaneous regression of haemangioma.

Results Throughout the development of haemangioma, MCs were predominantly of histamine biogenic amine phenotype, which did not alter following successful steroid therapy although their number increased fourfold. MCs, all of which stained positive for tryptase, and those that stained positive for chymase as well (ie, MCTC) were identified in haemangioma biopsies throughout the three phases. The total number of MCs was highest during the involuting phase, less in the involuted, and least in the proliferative phase. However, the proportion of proliferating MCs was highest in the proliferative phase, and lowest in the involuted phase. The proportion of MCTC decreased from the proliferative through involuting to the involuted phase, with progressive deposition of the extracellular matrix. The short-chain type VIII collagen, considered important for angiogenesis, was predominantly localised within MCs in the early proliferative phase, with increasing extracellular localisation in later phases. Clust/apoJ was expressed maximally in the involuting and involuted phases but was negligible in the proliferative phase.

Conclusions The roles of MCs in the life cycle of haemangioma are complex and may involve stimulators of angiogenesis in the proliferative phase but inhibitors in later phases. The presence of clust/apoJ positive MC granules both in the adjacent endothelial cells and in capillary lumens suggests that MCs may be secreting this apoptotic modulator to promote the regression of haemangioma.

Mast cells and common skin cancers – a review. A Wan, S T Tan, P F Davis.

Skin cancers are common in Australia and New Zealand, however, current treatments (surgery and/or radiotherapy) remain empirical. Although treatment has become more standardised for the primary tumour, control of metastatic disease, particularly in malignant melanoma, and to a lesser extent squamous cell carcinoma, remains largely unchanged. This is despite an enormous amount of international research effort over the last few decades. Progress in the management of these cancers is likely to result from improvement in the understanding of cancer biology. Knowledge in cellular and molecular interaction within these individual cancers is likely to be the key to developing biologic and targeted treatment in the future.
Mast cells are highly heterogeneous in terms of their morphology, function and metabolic product. These cells have been implicated in the expression of a variety of biological responses, including immediate hypersensitivity reactions, host responses to parasites and neoplasms, immunologically non-specific inflammatory and fibrotic conditions, angiogenesis, tissue remodelling and wound healing. Further, recognition is emerging of their participation in the genesis of immune suppression within skin following exposure to UV-B radiation, which has been implicated in the development of skin cancers. Increased numbers of perilesional mast cells have been observed for sometime and this has been implicated in the aggressiveness of cutaneous malignancies. However, the phenotypic characteristics of mast cells and their precise cellular interactions with various cutaneous cellular elements, in particular neoplastic cells, are unknown. This review focuses on the current knowledge of the role of mast cells in common skin malignancies.

First aid treatment for burns was improved by a public education/awareness campaign. A M Skinner, M J Muller, B G Peat.

Introduction In response to a high apparent incidence of inappropriate burns first aid treatment (BFAT), we were prompted to undertake a concerted campaign to improve the situation.

Aims To assess the type of burns first aid received. To examine the effect of burns first aid on outcome. To determine the effectiveness of a public education/awareness campaign on adequacy of burns first aid.

Methods All persons presenting with burns to Middlemore Hospital over two four-month periods were assessed for adequacy of BFAT before (pre-test) and after (post-test) an extensive public burns education/awareness campaign that was conducted November 2000 – February 2001.

Results Pre-test totalled 164 burn patients, of these 121 were enrolled (43 outpatients and 78 inpatients). An over-representation of Pacific Islanders (27%) and Maori (20%) was noted. Children under 10 years were the largest group (34%) and scalds the most common burn (40%). Post-test figures were similar: 123 patients were enrolled of a possible 153, of whom 45 were inpatients. Adequate BFAT was received by 40% pre-test patients compared with 59% post-test. Pre-test adequate BFAT was associated with fewer inpatient procedures and less surgery. Skin grafting for adequate BFAT scalds reduced from 20% to 4%. Patients with burns were from lower socioeconomic suburbs and racial concordance is evident.

Conclusions Inadequate BFAT results in more surgery and longer inpatient stays. A significant improvement in adequacy of BFAT was demonstrated following a public education/awareness campaign. A strategy is required to ensure ongoing community awareness aimed at improving burns first aid treatment, targeted at high risk populations in the community.

Introduction Inflammatory cell infiltrates are abundant in abdominal aortic aneurysms (AAA), particularly in inflammatory aneurysms, and may represent an autoimmune component in the pathogenesis of this disease. Inflammation has been associated with the size and growth of AAA. It is also accepted that about 20% of patients with AAA have a family history of AAA, however, the genetics remain elusive. The HLA DR system is inherited and plays a part in the stimulation of inflammation and autoimmunity. HLA DR 2 has also been associated with inflammatory aneurysms (Rasmussen, 1997). Considering this influence, characterisation of the HLA DR genotypes in a large AAA population may help further our understanding of the genetics of AAA.

Methods 240 patients with AAA, 47 of whom had a family history of AAA, and 264 control patients were genotyped for the HLA DR type. An allele-specific PCR method was used, which has the same sensitivity as serology testing.

Results HLA DR 1 was associated with AAA 15.3% compared to 9.5% in the controls (p = 0.007). There were no HLA types associated with familial AAA compared to non-familial AAA. HLA DR antigens did not associate with inflammatory AAA, however, there was a trend to HLA DR 2 associating with (p = 0.17), and HLA DR 6 (p = 0.17) being selected against in inflammatory aneurysms.

Conclusions HLA DR B1 is associated with AAA in this population suggesting that this is a genetically determined factor influencing the development of AAA. However, HLA DR genotype does not associate with familial AAA.

Digital Fridge for composite grafts. W McEwan.

Introduction Post-operative cooling has been shown to enhance composite graft survival. Cooling the entire recipient site retards cellular degeneration in the graft until neovascularisation occurs. Methods of cooling used have been direct graft contact with icepacks, or iced water and aluminum foil. Successful cooling requires a motivated, compliant patient and regular changes of coolant.

Aim To make a simple cooling system for composite grafts for use on mobile patients that allows early discharge.

Methods Using readily available materials, a cooling circulating unit was constructed.

Results Graft bed temperature maintained at 4 degrees Celsius with minimal requirement for coolant changes.

Conclusions The Digital Fridge cooling unit may be an adjuvant for successful composite grafting. It is now ready for clinical trials.

Criteria utilisation in the assessment of the priority of patients awaiting elective general surgery. A D MacCormick, B R Parry.

Introduction Previous work had identified seven criteria that general surgeons felt they utilised in prioritising patients for elective surgery.
Aim We wished to verify that these criteria were indeed utilised when surgeons were faced with a patient.

Methods Thirty two vignettes were constructed, consisting of eight vignettes covering each of four diagnoses. The subjects were sixty general surgeons randomly selected from those available on the New Zealand Medical Council Vocational Register. Subjects rated the influence on priority, over seven criteria, using visual analogue scales for each vignette. The surgeons also made a global assessment of priority for the vignette in light of patients they habitually see in their own clinics. Statistical analysis was performed using SAS 8.2 (SAS institute, Cary, NC). Multiple regression was undertaken using the seven criteria and subject as independent variables, and global assessment of priority as the dependent variable.

Results Using the above model, the R squared was 0.74. Five criteria and subject were significant.

Conclusions Surgeons utilise five criteria in determining their global assessment of priority for elective surgery. The significance of the subject variable implies that inter-surgeon reliability may be an important issue. There is still a need to cross validate these results in a clinical setting.

Colorectal cancer training – is it safe? A Connolly.

Introduction In a training hospital there must be a balance between the clinical needs of the public and training requirements of the surgical registrars. Can the public be reassured that the need to train does not adversely affect outcome in colorectal cancer?

Aim To test the hypothesis that supervised training will not adversely affect outcome in colorectal cancer.

Materials and Methods Review of prospective data of all patients undergoing resection for colorectal cancer under the care of one consultant colorectal surgeon over the period October 1997 to March 2002. Data were analysed according to the status of the operating surgeon (Consultant or Trainee). Variables analysed were local recurrence (LR), involvement of the circumferential resection margin (CRM), and survival.

Results There were 207 consecutive resections for colorectal cancer. Consultant n = 124 (75 rectum, 49 colon), Trainee n = 83 (33 rectum, 50 colon). Median follow up: 24 months Consultant, 28 months Trainee. Two cases lost to follow up. There was no difference in LR (1, Consultant) or CRM positivity (1, Consultant). There was no difference between Consultant and Trainee in overall survival or stage-specific survival.

Conclusion Training does not adversely affect colorectal cancer outcome.


Aim To evaluate the spectrum of cutaneous melanoma in Caucasian New Zealanders
**Methods** Data were obtained from the New Zealand Cancer Registry by way of a computerised search of the melanoma ICD-9 codes from 1995 to 1999. The number of registrations for Polynesians was less than 1%, in keeping with the worldwide trend that this is a disease of Caucasians. The final database used is for people identifying themselves as European. The denominator population are people stating their ethnicity as European in the 1996 NZ Census; all others were excluded. The Cancer Registry Act 1993 made reporting of cancer mandatory. Cancer data before July 1994 is of dubious accuracy.

**Results** There were 4966 cases of cutaneous melanoma reported in NZ between 1995 and 1999 by people identifying themselves as European. The trends and statistically relevant findings will be discussed.

**Conclusions** New Zealand continues to have one of the highest rates of melanoma in the world, with an increasing depth of melanoma lesions (p <0.001) over the five-year period. This corresponds to a poorer prognostic Breslow grouping but not AJCC staging group. The incidence of melanoma has appeared to reach a plateau over the review period. The far north of New Zealand (Whangarei and further north) has the highest rate of melanoma in New Zealand (59.1/100 000, age standardised) and the lowest rate is in Southland (23.5/100 000). Other results will be also be discussed.

**Component separation technique for ventral hernia repair. B J Nye, S Langley, S Sinclair, G Blake.**

Closure of ventral herniae have presented reconstructive challenges for many years. In prospective studies, ventral hernia has been found to complicate up to 11% of abdominal operations and primary repair is reported to have recurrence rate as high as 45%.

Many techniques have been advocated for closure of herniae. The utilisation of synthetic mesh to provide tension-free repair may be complicated by infection, extrusion or enteric fistula formation, especially when covered by skin graft. These complications have been somewhat alleviated by the use of tissue expansion of abdominal skin and autogenous fascial grafts. Flap repair is also reported to have a 42% recurrent hernia formation rate and 20% necrosis rate.

Component separation has been performed on seven patients at Christchurch, two male and five female with an average age of 60 years. The defects were between 9 and 14 cm wide and up to 22.5 cm vertically. Two patients had previous ileostomies, two patients had multiple herniae, and two were treated following removal of infected synthetic mesh repairs.

Mean hospital stay in this series was 11 days and in a mean of 16 months’ follow up there have been no recurrences of hernia. Pre-operative functional testing was not performed, but on review all patients reported loss of pre-operative abdominal pain, with some reports of “tightness” post-operatively. Of the three patients who suffered obstructive symptoms pre-operatively, none had post-operative symptoms. All patients reported improved function when questioned about sitting from lying, walking, lifting and carrying.

The technique of components separation is becoming the gold standard for closure of abdominal wall defects. (Ramirez, Annals, December 1998). It provides a dynamic
repair for ventral hernia with a low recurrence rate and excellent functional outcomes for this difficult group of patients.

**Predictions for the future role of the molecular laboratory in the management of common adult cancers. I Morison.**

An overwhelming array of new molecular disease classification techniques is being developed at present. These include DNA chip gene expression arrays and proteomic spectra, which are being analysed using a vast range of complex techniques including self-organised hierarchical clustering techniques and neural networks. Their potential to subclassify human cancer into diagnostic and prognostic groups has been demonstrated, but the role of these techniques in the clinical laboratory has not yet been established. The potential for these new-age techniques to contribute to the management of human cancer will be discussed. It is my view that the current discovery phase will be followed by the development of simple comprehensive tests based on a small number of critical genes, proteins or DNA regions. Examples demonstrating the future direction of molecular pathology will be provided.

**Improving the performance of sentinel node biopsy for breast cancer, and determining the effect of surgery on the presence of nodal micrometastases. A K Ng, B Youngson, N Miller, D R McCready.**

**Aims** To assess a policy of extensive sentinel node (SN) examination upon performance of sentinel lymph node biopsy (SLNB) in clinically node-negative breast cancer, and to determine whether the presence of SN micrometastases is influenced by surgery.

**Methods** A cohort of 205 patients who had undergone either synchronous or metachronous tumour excision in conjunction with SLNB and axillary dissection was reviewed. Each SN was bisected and 5 serial sections were taken from each half; sections 1, 3, and 5 were stained with H&E, and sections 2 and 4 were stained with an immunohistochemical marker for cytokeratin (IHC).

**Results** Group 1 comprised 162 patients (75%) who underwent simultaneous SNB and tumour excision. Group 2 comprised 54 patients (25%) who underwent excision biopsy a mean of 43.4 days prior to SLNB. Ninety six patients (46.8%) were node-positive. There were two false negatives and no false positives. Accuracy, sensitivity, specificity, negative predictive value, and false negative rates were 99%, 97.9%, 100%, 98.2%, and 2.1% respectively. Of 94 SN-positive patients, 39 (41.5%) had micrometastases only: in 29 they were visible on H&E, and in 10 on IHC only. There was no difference in the proportion of micrometastases between Groups 1 and 2. Had IHC not been used, the accuracy would have fallen to 98% and importantly the false negative rate would have more than doubled to 4.5%.

**Conclusions** Serial sectioning and IHC as part of SN examination improves the accuracy and false negative rate of SLNB. Simultaneous tumour excision and SLNB does not appear to increase the rate of nodal micrometastases.
Sentinel lymph node biopsy 2002. B M D Scott

Sentinel lymph node biopsy (SLNB) is becoming one of the most exciting advances in surgical management of breast cancer since the advent of partial mastectomy. It is described as a minimally invasive but accurate way of staging the axilla such that as many as 50% of women with primary breast cancer could avoid axillary clearance and the morbidity this carries with it. There remains much controversy around who benefits from this technique and who should be undertaking it in surgical practice. This paper will outline some of the more recent papers on SLNB, and discuss these issues.

In the era of multidisciplinary practice, it is important that a team is developed that is able to understand the problems associated with SLNB. An outline will be given of which patients are suitable for SLNB, which techniques give the best results, and how as a surgeon you can best offer them to your patients. Axillary lymph node status remains the most important prognostic indicator despite newer markers for this disease. Thus, it is vitally important that we as surgeons offer our patients accurate and fair advice regarding this practice.

Laparoscopic distal pancreatectomy. K Maoate, G Azzie, S Beasley.

Aim Indications for partial pancreatectomy during infancy are rare, but when required, surgery has been performed as an open procedure. This report describes the technique of laparoscopic distal pancreatectomy with splenic preservation, as carried out for an enlarging cystic lesion of the pancreas in a three-month-old 6 kg infant girl.

Methods The procedure can be performed through 3 mm and 5 mm ports. The gastrocolic ligament is divided. The tail of the pancreas is mobilised off the splenic vessels using Harmonic scalpel dissection. The cyst is decompressed by aspirating its contents. Once mobilised, the pancreas to the right of the cyst is transected with the Harmonic scalpel and oversewn with a continuous 3/0 Vicryl suture.

Results There were no intra-operative complications and minimal blood loss. The operative time was two hours. Full feeds were tolerated by the second post-operative day and discharge was on day three.

Conclusions Laparoscopic distal pancreatectomy can be performed in children, but it should always include splenic preservation because of its important immunological function.

Upper GI problems in adults with repaired oesophageal atresia. S Beasley.

The oldest survivors of repaired oesophageal atresia are now entering their early 50s, which makes it important that upper GI surgeons are aware of the long-term implications of this condition. The oesophagus in oesophageal atresia is never completely normal: there are inherent abnormalities of its nerve supply that affect its motility, and extensive mobilisation of both ends of the oesophagus such as is required to repair long gap oesophageal atresia, can further compromise its function. Long-standing gastro-oesophageal reflux is common, and is occurring into an oesophagus that empties poorly (delayed oesophageal clearance), which increases the duration of contact of the oesophageal mucosa with gastric acid. There are now
sporadic reports of oesophageal adenocarcinoma occurring between 20 and 40 years after repair of oesophageal atresia. Malignancy can also occur in the oesophageal remnant after oesophageal replacement, and has been reported in skin tube conduits (although none have been performed in New Zealand). Current evidence would suggest that there is increased risk of malignancy in survivors of repaired oesophageal atresia, and this high-risk group may justify regular surveillance of the oesophagus.


Introduction Post-operative hiatus hernia (PHH) or paraoesophageal hernia is a major long-term complication of open anti-reflux surgery. Over the past few years, the laparoscopic Nissen fundoplication has largely replaced the open procedure to treat GORD. However, the incidence of post-laparoscopic fundoplication hiatus hernia has yet to be determined. This study is designed to analyse the relative incidence of post-operative hiatus hernia after laparoscopic versus open Nissen fundoplication.

Methods A retrospective review of the incidence of post-laparoscopic hiatus hernia was conducted by evaluating the medical records of children who underwent redo laparoscopic Nissen fundoplication in Christchurch Hospital from September 1996 to June 2002. In addition, a meta-analysis of the incidence of post-operative hiatus hernia after open and laparoscopic Nissen fundoplication was carried out by performing a Medline Database search.

Results There were eight children who had a redo laparoscopic Nissen fundoplication for recurrent reflux symptoms, mainly vomiting and spilling (5) during a period in which 116 laparoscopic fundoplications were performed (incidence = 2.59%). PHH (3), loose wrap (3), and wrap disruption (4), were found to be the causes of recurrent symptoms at the time of the second operation. In the Medline search, nine articles documented PHH after open Nissen fundoplication, but only two articles after a laparoscopic Nissen procedure. The overall incidence of PHH after open Nissen (5.52%) and laparoscopic Nissen (1.72%) fundoplication were calculated by combining the results of 11 articles and the local review (p <0.01). Routine crural repair in open Nissen fundoplication appears to cause less PHH (5.59% vs 16.85%).

Conclusions Laparoscopic Nissen fundoplication may have a lower post-operative hiatus hernia rate than open Nissen fundoplication.


Aim To compare the causes, patterns and outcomes of hepatic trauma in children with those in adults.

Methods An audit was conducted for a five-year period from 1 January 1996 to 31 December 2000 of patients admitted to Christchurch Hospital with liver injuries. Details of age, mechanisms of injury, injury severity score (ISS), grade of liver injury, and operations and mortality, were recorded and analysed.
Results Twenty two children and 71 adults were reviewed. The average age of each group was 8 and 35 respectively. The most common causes of injury in children were bicycle (32%) and MVA (32%), compared to adults in whom the majority of injuries were caused by MVA (58%). The grade of injury was worse in the children, mean grade of 2.95 versus 2.4. The length of stay was significantly shorter in the paediatric group: 5 versus 12 days.

Conclusion Liver trauma in children had a different spectrum of causes that tended to produce a worse grade of liver injury, but its often isolated nature results in a shorter length of hospital stay.

Relationship of notochordal abnormalities to malformations of the foregut and hindgut. B Q Qi, S W Beasley, A K Williams, D Arsic

Aim The notochord is known to organise normal development of the axial structures including the GI tract, but its role in abnormal development of the GI tract remains speculative. This study used rat models of oesophageal atresia and anorectal malformations to investigate abnormalities of the notochord and their relationship to malformations of the foregut and hindgut.

Methods Timed-pregnant rats were intra-peritoneally injected with adriamycin (1.75 mg/kg) through gestational days 6–9 to induce oesophageal atresia. Control rats received only saline injections. Embryos were harvested by Caesarean section on gestational days 11–14. Another group of pregnant rats were fed 1% Ethylenethiourea (125 mg/kg) by gavage on gestational day 10 to induce anorectal malformations. Their embryos were harvested on gestational days 13–16. Embryos were sectioned on either transverse or sagittal plane, and stained for histological observation. A 3-D reconstruction technique was used to clarify the spatial relationship between the foregut and notochord.

Results In adriamycin-exposed embryos, the foregut did not normally develop into trachea and oesophagus; instead it remained a single tube or was disrupted. The notochord at the same level was remarkably thick, arched and invaded the mesenchyme of the foregut.

In Ethylenethiourea-exposed embryos, urorectal fistula was common. The notochord abnormalities in the lumbo-sacral area included: abnormal antero-posterior branching, and ectopic notochord masses located close to or in contact with the hindgut/cloaca.

Conclusion Given the known role of the notochord in normal GI development, this study would suggest that abnormal notochord development may be pivotal in producing foregut and hindgut malformations, probably by influencing the normal functions of the shh-Gli signalling pathway.

Adriamycin interferes with Shh pathway during foregut development. D Arsic, BQ Qi, SW Beasley.

Introduction The mechanisms that regulate the development and growth of the digestive system remain unclear. Sonic hedgehog (Shh) protein is a signalling molecule that is important for defining patterning in the development of vertebrates. Shh has been shown to be involved in the morphogenesis of many organ systems,
such as notochord, floor plate, limbs. Here we show that Shh protein plays an important role in the development of trachea and oesophagus from the primitive foregut, and that lack of Shh protein may cause abnormal development of foregut leading to oesophageal atresia and/or tracheo oesophageal fistula.

**Methods** Expression of Shh protein in control and adriamycin-treated fetal rats, between gestational day 10 and day 15, was investigated using Western blot and ELISA.

**Results** Shh was expressed in the foregut in control fetuses from day 10 to day 15. We observed decreasing levels of Shh protein as the fetus approached birth. Expression of Shh protein in the foregut of adriamycin-treated embryos was lower than in the control embryos, and time-dependent changes in the level of expression were not present.

**Conclusions** These studies show that Shh protein is expressed in rat foregut during embryogenesis, and its level declines as the embryo approaches birth. In adriamycin-treated rats the level of Shh protein expression is very low without any time-dependent changes. These results support the hypothesis that adriamycin influences the Shh signalling pathway, which in turn is thought to disrupt normal development of the foregut.

Is cholecystectomy necessary after endoscopic sphincterotomy and clearance of common duct stones? S Bardsley, J Windsor, M Rodgers.

**Introduction** It is not known whether a routine cholecystectomy is necessary after endoscopic sphincterotomy and clearance of CBD stones, especially in the elderly.

**Aims** To document current management of CBD stones and determine the outcome of patients in whom the gall bladder is left in situ.

**Methods** Retrospective review of the management of patients with CBD stones presenting to Auckland Hospital in 2000. Patients were identified from the clinical coding database and Endoscribe.

**Results** 800 medical records were reviewed to identify 117 patients (median age 62 years, range 16–102, male:female – 1:1) with CBD stones. An ultrasound scan was performed in 114 (97%) patients, of whom 44% had a dilated CBD and 23% demonstrated a CBD stone. Pre-operative ERCP was performed in 93 (79%) patients, 50 patients (54%) had a CBD stone, and 37 (74%) of these had successful CBD stone removal. Laparoscopic cholecystectomy was performed during the index admission in 42 (38%) patients and a further 22 (14%) at a subsequent admission. IOC was performed at the time of cholecystectomy in only 28% of patients. CBD exploration was performed in three patients. The gall bladder was left in situ at the index discharge in 68 (62%) patients, and more often in the elderly. Only eight (12%) patients had a subsequent admission for gall bladder-related problems.

**Conclusions** CBD stones are managed by pre-operative ERCP in the majority of patients. After endoscopic sphincterotomy and clearance, an expectant approach in the elderly appears reasonable with respect to cholecystectomy.

Introduction and Aim Anecdotally, surgeons and pathologists at Middlemore Hospital noticed a high proportion of early onset diffuse type gastric adenocarcinoma in Maori and Polynesians. In contrast, Caucasian data, both international and local, show a predominance of intestinal type. The hypothesis that in New Zealand, diffuse cancer is predominantly a Maori and Polynesian disease was assessed.

Methods Pathology and hospital activity databases were searched to identify all cases of gastric adenocarcinoma in 2000 and 2001 (excluding familial cases). Ethnicity, age at diagnosis, gender, histological type and management were recorded. Management was defined as surgical (staging laparoscopy/laparotomy, curative or palliative resection) or palliative.

Results Fifty nine patients were identified. Of these, 29 (49%) were Caucasian, 12 (20%) Maori, 14 (24%) Polynesian, and 4 (7%) Chinese. Maori patients presented at a significantly younger age than Caucasians (56 vs 73 years, p = 0.004). Strikingly, 13 (22%) patients presented younger than 50 years, 11 of whom were diffuse type (only one was Caucasian). Of the twelve Maori patients, 10 (84%) had diffuse type cancer, compared to 7(24%) of the 29 Caucasian patients (p = 0.002). There were no differences in management between groups, and overall 19 (32%) of patients had potentially curative resection.

Conclusions Maori appear to have a significantly higher incidence of diffuse gastric cancer presenting at a younger age than Caucasians. Given the higher incidence of gastric cancer in Maori, the factors behind this striking difference need further study.

Management of the plunging ranula. R Eisenberg, N McIvor, J Chaplin, R Morton.

Introduction The plunging ranula occurs when mucus-extravasation from the sublingual gland extends into the neck, where it is manifest as a soft fluctuant submandibular or submental swelling. It is often confused for a cystic hygroma or as submandibular gland pathology leading to inappropriate neck surgery. Auckland has the highest incidence of plunging ranula in the world owing to its large Polynesian population.

Aims To determine the outcomes of patients treated for this condition and identify the appropriate surgical approach.

Materials and Methods A retrospective review of 62 consecutive patients who were treated for plunging ranula by surgeons in the Head and Neck Unit at Greenlane Hospital and Manukau Superclinic over the last 16 years. CT scans were reviewed. Follow-up status was determined either from the hospital record or by telephoning the patient.

Results Fifty seven patients were either Maori or Pacific Islander, three European, one African, one Indian. CT scans revealed characteristic features, but also a surprising variation of appearance. The aspiration of mucus from the cyst was diagnostic. Initially, patients were managed by a combined submandibular/sublingual gland excision via a cervical approach. Excision of the pseudocyst wall was associated with a high incidence of complications. Over the last seven years, an
intraoral removal of the sublingual gland alone was employed with no plunging recurrence. Thirteen patients had recurred after previous surgery and all had residual sublingual gland tissue, excision of which proved curative.

**Conclusions** Plunging ranula is commonly misdiagnosed leading to inappropriate surgery. There are characteristic CT findings and the aspiration of mucus is diagnostic. The appropriate management is intraoral excision of the involved sublingual gland.


**Introduction** The management of severe acute pancreatitis (SAP) in the intensive care environment is complex and challenging, but the New Zealand experience has not been reported.

**Aim** To evaluate the interventions and outcome of patients with SAP admitted to a tertiary-level intensive care unit.

**Methods** Patients admitted to the Department of Critical Care Medicine (DCCM) with SAP from 1988 to 2001 (inclusive) were identified from the DCCM prospective database, and data extracted from several sources.

**Results** 112 patients (male 69, female 43, median age 60 years, range 24–79) were admitted with SAP to DCCM in the 13-year period. The proportion of tertiary referrals increased from 30% to 60% over the study period. The median duration of symptoms prior to DCCM admission was 7 days (range 1–100). Pancreatitis was considered due to gallstones (42%), alcohol (30%), or idiopathic (33%). At admission to hospital, 62% had three or more Modified Glasgow Criteria. At admission to DCCM, the median APACHE II score was 19 (range 6–44), and the median OFS was 5 (range 0–16). Ninety nine (88%) patients had respiratory failure, 79 (71%) had circulatory failure, 55 (49%) had cardiac failure, and 53 (48%) had renal failure. Seventy patients (63%) had laparotomies that included necrosectomies on 36/70 (51%) patients, open intra-abdominal abscess drainage (57%), and drainage of a pseudocyst (6%). Interventions included CT (average three per patient), ERCP (34% of patients), and tracheostomy (34% of patients). Abdominal decompression, enteral nutrition, and percutaneous tracheostomy were introduced. The length of stay in DCCM did not alter (median 4 days, range 1–65) but there was a reduction in the length of hospital stay (median 27 days, range 3–124 to 15 days, 0–64). The overall mortality was 31% (35/112) and did not change.

**Conclusions** SAP remains a formidable disease with a high mortality despite a number of changes in intensive care and surgical management.


**Introduction** In the absence of previous biliary surgery, a focal stricture of the common hepatic duct or hepatic hilus is generally taken to indicate a diagnosis of cholangiocarcinoma. However, histological confirmation can be difficult to obtain without operation.
Aim To contrast the pre-operative diagnosis of proximal bile duct cancer with final histologic diagnosis in 45 patients.

Methods Patients presenting with obstructive jaundice, who did not have a previous history of cholecystectomy, with a clinical and radiological diagnosis of proximal bile duct cancer were followed prospectively. Data on patient demographics, clinical presentation, operative interventions, pathology and follow up were entered on a computerised database. Tissue diagnosis was obtained in all patients.

Results Forty six patients (23 male; median age 64 years; range 33–77 years) presented with obstructive jaundice. All patients were staged with CT chest, abdomen and MR cholangiography. Eleven patients underwent diagnostic ERCP. All patients underwent surgical exploration with an initial laparoscopy followed by open exploration and resection of the stricture (23 patients). The final tissue diagnosis was other than cholangiocarcinoma in 44% (benign strictures 9, choledocholithiasis 2, metastatic colorectal cancer 2, gall bladder cancer 7), while hilar cholangiocarcinomas were confirmed in 25 patients. Resection was possible in 12 patients with cholangiocarcinoma, of whom 6 patients remain alive and free of disease at a median of 13 months’ follow up. All patients with benign strictures and calculous disease are alive and well. No patient presenting with jaundice due to gall bladder cancer could be resected.

Conclusions Of patients presenting with hilar strictures, one fifth will be due to non-malignant causes, but pre-operative diagnosis is difficult and will often be made only after resection. Malignant hilar strictures can be managed surgically, although gall bladder cancer presenting with jaundice carries a poor prognosis.


Introduction Important advances in the management of gallstone pancreatitis (GP) include early laparoscopic cholecystectomy and pre-operative ERCP.

Aims To review the management of GP at Auckland Hospital, determine extent of progress since a similar study was published in 1990, and evaluate compliance with evidence-based guidelines (Glazer et al. Gut 1998;42(Suppl 2):S1–13).

Methods A retrospective review of consecutive patients admitted with acute pancreatitis during a 39-month study period. Recorded data included demographics, diagnosis, severity of GP, the role of ERCP and CT scanning, the type and timing of cholecystectomy, hospital stay, complications, and mortality.

Results 216 patients were admitted with acute pancreatitis, 106 had proven gallstones. Sixty two (59%) patients had ERCP, but not more often in severe pancreatitis. Choledocholithiasis was identified in 26%. Seventy (66%) patients had a cholecystectomy, and 56 (80%) had it within three weeks of admission. There has been an increase in patients having a cholecystectomy during the index admission (c2 = 3.83, p = 0.05), and there has been a reduction in recurrent pancreatitis (p <0.001). The overall mortality from GP did not decrease, but it did for predicted severe GP (p = 0.02).
Conclusions There is reasonable compliance with published guidelines and progress in the management of GP, particularly in relation to performing timely laparoscopic cholecystectomy. Concerns remain regarding the overuse of diagnostic ERCP in patients with mild pancreatitis.


Introduction Organ dysfunction (OD) is the clinical hallmark of severe acute pancreatitis (SAP) and can be modulated by intensive care management.

Aims To document the course of OD in severe acute pancreatitis and to determine whether the changes in the validated markers of OD to intensive care predict outcome.

Methods Organ Failure Scores (OFS) and APACHE II scores were calculated daily for patients with SAP admitted to the Department of Critical Care Medicine (DCCM) from 1988 to 2001.

Results 112 patients with SAP were admitted to DCCM, 35 (31%) of whom died. The time period between onset of symptoms and admission to DCCM was a median of 3 days (range 1–53). APACHE II scores were available on 96 patients for a median of 6 days (range 1–39), and OFS scores on 92 patients for a median of 5 days (range 1-38). The level of organ dysfunction at admission was significantly higher in non-survivors compared to survivors (APACHE II median 26 (range 10–44) vs 16 (6–37); and OFS median 7 (range 1–16) vs 4 (0–11); p <0.0001). Deterioration in organ dysfunction within the first 48 hours increased the probability of death (a rise in APACHE II score of 1 point increased the probability of dying by 24% (p <0.0001). Conversely, an improvement in organ dysfunction after 48 hours of treatment reduced the probability of dying.

Conclusions Organ dysfunction in SAP can be modulated by intensive care, and this might be useful in outcome prediction and triage. Prospective validation is required.


Introduction Live donor laparoscopic nephrectomy (LDLN) has recently been adopted at Auckland Hospital as an alternative technique to the open procedure for procuring kidney grafts. Auckland is the first centre in New Zealand to undertake this procedure.

Aim To report the initial experience of LDLN in New Zealand.

Methods Patients who underwent LDLN between June 2000 and June 2002 were included. The charts of the donors and their matched recipients were reviewed retrospectively.

Results Thirty five procedures have been performed. There has been zero donor mortality and 100% graft survival. There was one ureteric stricture (required operative revision) and no vascular thromboses in recipients of LDLN kidneys. Two donors required conversion to an open procedure (persistent air leak, bleeding). The median
inpatient stay was 3 days. Mean operating time has decreased as the series progressed (5 hours 30 minutes for first five cases vs 4 hours for cases 26–30). The very recent introduction of an entirely hand-assisted technique has reduced the operating time further.

**Conclusion** LDLN in the New Zealand setting provides excellent grafts for renal transplant recipients and is safe for the donor patient.

**What role laparoscopic appendicectomy? An audit of 1022 consecutive cases. C P Tan, G Poole, IG Martin.**

**Introduction and Aim** Whilst laparoscopic appendicectomy (LA) potentially offers advantages over open appendicectomy (OA), a number of questions remain. A recent systematic review suggesting that serious complications, especially intra-abdominal abscess, may be more common after LA than OA prompted us to review our audited experience.

**Methods** Details of all patients undergoing OA or LA between January 1998 and December 2001 were retrieved from our PLATO audit system. Operating time, histology of the appendix, length of hospital stay, readmissions to hospital and intra-abdominal collections were recorded. Intention to treat analysis was performed.

**Results** 1022 patients underwent appendicectomy (618 OA, 404 LA of which 103 were converted to OA). There were 539 male patients. Mean age was 31 years. Operating time was longer for LA (73 vs 57 mins, p <0.001). Hospital stay was almost identical (4.2 vs 4.3 days). Conversion from OA to LA was strongly related to the degree of inflammation of the appendix (p <0.01). There were more readmissions (7.3% vs 4.6%) and intra-abdominal collections (1.7% vs 1.1%) after LA than OA, but these differences were not significant; multivariate analysis linked degree of inflammation and LA with these significant complications (p <0.02).

**Conclusions** LA did not reduce hospital stay and may be associated with a higher incidence of serious complications and readmissions to hospital. Its role in patients with a clear diagnosis of appendicitis is not yet fully defined.

**Criteria elicitation for prioritisation of patients for elective general surgery. A D MacCormick, A K Macmillan, B R Parry.**

**Introduction** A single VAS has been used in Auckland to prioritise patients for elective general surgery. This has been criticised as lacking transparency.

**Aim** We wished to elicit generic criteria used by surgeons for prioritisation of patients for elective general surgery.

**Methods** Semi-structured interviews were undertaken with fifteen general surgeons from main and provincial centres. Using the repertory grid method, participant surgeons were asked to explain their rationale for distinguishing between patients they considered a high priority for treatment, and those they considered medium or low priority. Interviews were audiotaped, transcribed and analysed for themes. The first ten interviews were analysed by a second researcher to cross validate the theme elucidation. The accuracy of the thematic analysis was further checked using a five-
point Likert scale as part of a modified Delphi consensus, to assess participants’ agreement with the utilisation of themes in prioritisation.

**Results** Eight major themes were deduced. These were diagnosis, treatment, patient characteristics, symptomatology and sequelae to date, future complications, quality of life, psychological/emotional impact, and socio-political/logistic factors. The utilisation of these themes was confirmed by the Likert responses.

**Conclusions** Clinical judgement of priority for surgery has been described with eight criteria. The further testing of reliability and validity is axiomatic in the development of a new prioritisation tool that includes these.

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**The effect of immunocompromise in patients with parotid and neck nodal metastases from cutaneous squamous cell carcinoma of the head and neck. K Southwell, R Eisenberg, J Chaplin, R Morton, N McIvor.**

**Introduction** New Zealand has a high incidence of squamous cell carcinoma (SCC) involving the skin of the head and neck. A small proportion (5%) of these patients will present with parotid and/or cervical nodal metastases either initially or at some time following treatment of the primary skin malignancy. A significant number of these patients are immunocompromised.

**Aim** To assess the effect of a compromised immune state in patients treated for parotid and/or cervical nodal metastasis from cutaneous SCC of the head and neck.

**Methods** A retrospective review of patients who underwent surgery in this unit for parotid and/or cervical nodal metastasis from cutaneous SCC of the head and neck between 1997 and 2002.

**Results** Forty three patients were identified. Nine patients (21%) were immunocompromised: chronic lymphatic leukaemia (4), lymphoma (2), medical immunosuppression following renal transplantation (3). All patients were treated by superficial or radical parotidectomy and/or neck dissection. Some patients also underwent lateral temporal bone resection. Six patients had received previous radiotherapy and 33 patients received radiotherapy post-operatively. When compared to the others, the immunocompromised group experienced a significantly longer duration of admission largely due to wound healing problems (29 days vs 13 days); recurrence occurred in 66% vs 23%, and was mainly regional; actuarial survival at one year was 17% vs 90%, and at two years was 0% vs 83%.

**Conclusions** Immunosuppression not only significantly increases the risk of cutaneous SCC metastasising to regional nodes, but is associated with an increase in treatment morbidity and reduced disease-free and overall survival.

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**Surgical gauze: a cause of intra-peritoneal adhesions. D H K Yong, J K Wickremekesera, K Pringle.**

**Introduction** Intra-peritoneal adhesions are an important cause of bowel obstruction, resulting in significant morbidity and mortality. The most common cause of adhesions is previous surgery. Many intra-operative factors are well known to be associated with
adhesion formation. Although there is a definite association between surgical gauze and adhesion formation, this association is less well recognised.

**Aims** To highlight the importance of gauze-related intra-peritoneal adhesions, its potential complications, and way(s) of prevention.

**Materials and Methods** A case is discussed, Medline search was conducted and the literature reviewed.

**Results and Conclusions** This case demonstrates the possible significant morbidity attributable to multiple adhesions that were clearly exacerbated by lint from surgical gauze introduced at operation. Surgical gauze, among other causes, contributes to intra-peritoneal adhesion formation. The precise mechanism(s) for this was more controversial. Gauze wetting may be a way to reduce this risk.

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**Falciform hitch is an excellent liver retractor in paediatric laparoscopic surgery.**

**H L Tan, R Woods, K R Shankar**

**Introduction** Laparoscopic surgery requires optimal exposure of the operating field. While many mechanical devices have been used to retract the liver during laparoscopic surgery, many of these are not suitable for use in small children due to lack of space, and their use is often complicated by inadvertent contusion or lacerations to the liver.

**Aim** To evaluate a new technique for liver retraction in paediatric laparoscopic surgery.

**Methods** Under direct vision, the inferior margin of the falciform ligament is firmly hitched to the anterior abdominal wall. This is done with a percutaneous stitch through the falciform ligament at the point where it meets the liver. The stitch is stabilized externally with an artery clip during the duration of the operation, and is simply removed at the end of the operation.

**Results** Three patients underwent laparoscopic surgery using the falciform hitch to retract the liver. Two underwent laparoscopic removal of choledochal cyst with primary hepatico-duodenostomy, while the third had a laparoscopic fundoplication. Excellent exposure of the operating field was achieved in all three patients. An accessory fan blade retractor was used in the first patient.

**Conclusions** The liver is very floppy in children due to considerable laxity of the falciform ligament. Hitching the ligament to anterior abdominal wall is a simple, inexpensive technique and provides excellent exposure of the gall bladder fossa, porta hepatis and gastro-oesophageal junction in children.

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**Laparoscopic appendicectomy in children under six. A Salloum, S Beasley, K Maoate.**

**Introduction** Laparoscopic appendicectomy is being performed more commonly in paediatric surgical centres. This paper reports our experience in the Department of Paediatric Surgery at Christchurch Hospital using the three trocar technique for children under six years of age.
Methods A retrospective review was undertaken of all children under six who underwent a laparoscopic appendicectomy since April 2000. Data recorded included standard demographic information, symptom duration, operative details, antibiotics, pathology, full establishment of oral feed, length of hospital stay, and complications.

Results There were 16 laparoscopic appendicectomies performed in children aged between 18 months and 69 months (mean 52 months). All children presented with acute abdominal pain. The mean duration of symptoms was 3 days (range 1–7 days), eight (50%) had suppurative appendicitis, six (38%) had gangrenous appendix, one (6%) foreign body in the appendix, and one (6%) was a normal appendix on histology. Ten (62%) had perforation on histology.

All appendices, including perforated and gangrenous appendices, were removed using the three trocar technique. There was no conversion to open appendicectomy. The mean operative time was 60 minutes (range 23–101 min), and the median of antibiotics given was five days (range of one dose to nine days). Full oral feeds were established on average after 72 hours (range 6–408 hours) and the average length of hospital stay was 101 hours (range 23–456 hours). Three (19%) developed peritoneal abscesses, all had had perforated appendices; one (6%) had bowel adhesions and one (6%) developed ileus.

Conclusions A three trocar laparoscopic appendicectomy appears to be safe, had no conversions to open appendicectomy in our hands, and has a superior cosmetic result. Hospital stay is affected directly by the severity of the pathology.

A neural network as a diagnostic tool for paediatric appendicitis. M G Nightingale, S W Beasley

A neural network is a computing system composed of many simple processing elements operating in parallel, whose function is determined by network structure, connection strengths, and the processing performed at each node. The weights of connections are adjusted on the basis of data, and hence the network can learn from examples and ultimately generalise beyond the training data. Neural networks have been utilised in a wide variety of fields including engineering, statistics, neurophysiology and philosophy. They are especially useful for problems that are tolerant of some input imprecision, have lots of training data available, and to which hard and fast rules cannot easily be applied.

The majority of networks in the medical field have been aimed at prediction of tumour behaviour. This is most advanced in the field of Urology. Several groups have developed neural networks looking at predicting and managing prostate cancer. These studies have utilised laboratory values as their data and have had impressive initial results.

Appendicitis has long been recognised as a difficult condition to diagnose. A variety of clinical scoring systems have been used in the past but have not proved successful. Computer-aided diagnosis has been attempted, but presents little improvement on previous scoring systems.

This paper describes a novel use of a neural network as a diagnostic tool in appendicitis. It describes how a neural network can model the diagnosis of
appendicitis and how such a network would be designed, trained and used. A proposal is made to include other centres in this study.


Introduction Contralateral inguinal exploration in children with unilateral inguinal hernia is still controversial. Only 20% of patients with patent processes vaginalis would develop clinically apparent hernia. In 1999, our unit changed the practice of performing contralateral exploration of male children under two years and female children under five years to herniotomy of the symptomatic side based on a metaanalysis published by Miltenburg et al. We only selectively explored the contralateral inguinal area in babies with a history of prematurity.

Materials and Methods A prospective study of patients subjected to unilateral herniotomy from 1999 to 2001 was performed. The age, sex, side of the hernia and incarceration at presentation were recorded. The incidence of metachronous hernia and the risk factors for it were analysed. The follow up was 6 to 36 months.

Results Of the 409 patients presented with inguinal hernia, 264 underwent unilateral herniotomy. 180 (68%) patients had right-sided hernia and 84 (32%) had left-sided hernia. 11(4%) patients presented with metachronous hernia. 5/11 (45%) were less than two years of age at first presentation. 8/11 originally presented with left inguinal hernia. No female child presented with metachronous hernia.

Conclusions The treatment of only the symptomatic inguinal hernia has not significantly increased the incidence of metachronous hernia. This evidence-based change of practice has avoided 152 operations in 264 patients. The side of the hernia, irreducibility, sex, and presentation during infancy has no significant impact on the incidence of metachronous hernia.

Inguinal herniotomy in Southland Hospital. A Moot.

Introduction and Aim Our objective was to audit the results of paediatric herniotomy in Southland Hospital to identify how management if this condition might be improved.

Materials and Methods A search from the medical record database of herniotomies performed on children under the age of 10 years from January 1997 to April 2001 was undertaken. The medical records were searched and a phone survey performed to identify any complications.

Results The average follow-up in the 90% who were followed up by phone or outpatient appointment was 21.3 months.

Only one recurrence has been identified in the 132 herniotomies (0.75%). One testicle (0.9%) is in an unsatisfactory position in the scrotum (from 109 herniotomies involving a male testes). There were seven minor complications (5%).

Almost all emergency admissions (n = 17) for incarcerated hernias were treated by the general surgeons, except one by a urologist. Six of these hernias (35%) were not reduced pre-operatively, 8 were manually reduced, and 3 reduced spontaneously.
Conclusions  The study suggests the morbidity of hernia repair in Southland Hospital is very low. Improvements can be made in the management of incarcerated hernia, in particular to improve the pre-operative rate of reduction.

Idiopathic neonatal gastrointestinal perforations. P L Mandhan.

Introduction  Spontaneous localised perforations of gastrointestinal tract unrelated to the mechanical intestinal obstruction is not common in neonates. This paper reviews their distribution and clinical course.

Methods  A retrospective review of neonates with spontaneous neonatal gastrointestinal perforations treated at Liaquat University Hospital, Hyderabad, Pakistan between January 1999 and December 2001 was conducted.

Results  Twenty nine neonates with spontaneous localised perforations of gastrointestinal tract operated upon during the three-year period were reviewed. The sites of perforation were: stomach (9), jejunum (7), ileum (9), and colon (4). There were 18 males and 11 females, with an average birth weight of 2.35 kg.

Postnatal distress, prematurity, and maternal obstetric complications were common in these neonates. Primary closure was carried out for the stomach and small intestinal (<1 cm) perforations, and resection anastomosis for larger (>1 cm) intestinal perforations. Specimens from 17 patients submitted for histopathological evaluation revealed diffuse acute suppurrative inflammation around the perforation site. The overall mortality rate was 33%. The highest mortality was in babies with birth weight of less than 2.0 kg.

Conclusions  Idiopathic gastrointestinal perforations in neonates are uncommon with uncertain aetiology. Morbidity was primarily related to concomitant disease procedure.

Fatal late onset necrotising enteritis. A R Munro, S W Beasley, P K Pattemore, R Fraser.

A three-month-old infant died following a three-week illness that commenced with diarrhoea and vomiting and produced progressive infarction of his small bowel. The operative appearance was that of necrotising enterocolitis. Post mortem identified multi-organ arteritis of uncertain aetiology, giving rise to coronary artery occlusion and myocardial infarction as well as necrosis of the entire small bowel and other organs. Kawasaki disease and polyarteritis nodosa of infancy are proposed as possible aetiologies in this case, and may provide an explanation for late onset NEC in term infants.


Introduction:  Epidemiological studies have shown an increase in the incidence of adenocarcinoma of the lower oesophagus, particularly in the USA and Sweden. The incidence of oesophageal adenocarcinoma in New Zealand men (2.3/100 000; 1988–1992) is similar to the rate for men in the USA (2.5/100 000; 1988–1990).
Aim To determine the epidemiological pattern and possible trends of primary oesophageal carcinoma in Canterbury over a five-year period.

Methods The database from Canterbury Health Laboratories was surveyed for primary oesophageal and gastric neoplasms from 1996 to 2000. The medical records of identified patients were reviewed and the following data collected: age, sex, ethnicity, and place of birth; location of tumour; histology and presence of Barrett’s oesophagus.

Results 330 cases were identified. There were 215 men (median age 71 years; range 25–94 years), and 115 women (median age 77 years; range 31–96 years).

Carcinoma involving the lower oesophagus formed 38% and junctional tumours formed 11% of all upper GI cancers.

Adenocarcinoma accounted for 73% of lower oesophageal cancers. Barrett’s oesophagus occurred more frequently in males than females (p = 0.002).

The incidence rate of lower oesophageal and junctional tumours has not changed significantly over the five-year study period.

Conclusions Adenocarcinoma is the predominant lower oesophageal tumour in Canterbury, with an incidence rate of 3.6/100 000.


The surgical treatment for GOR in children continues to be challenged. Often, the surgical technique chosen is dependent on the surgeon’s training institution. Minimally invasive surgery has generally changed the access but not the intra-abdominal operative techniques for the anti-reflux surgery. This is a video presentation of our technique for laparoscopic Nissen fundoplication in infants and children. Other controversies regarding the management of GOR in children will be highlighted.

Thyroid surgery at Middlemore over the past five years. J Wheeler.

Introduction There was a suspicion that the incidence of thyroid follicular cancer was higher in the Maori and Pacific Island groups.

Aim To review the last five year’s experience with thyroid surgery at Middlemore Hospital.

Methods A retrospective case review of all thyroid operations was conducted from June 1996 until February 2002.

Results There were 244 operations performed on 236 patients, of which 23% of operations found malignancies. Papillary carcinoma accounted for 61% of malignancies, whilst 14 % were follicular carcinomas with two medullary carcinomas and one anaplastic carcinoma. Eleven of the 57 malignancies were classified as micofoci of papillary carcinoma within other pathologies. For benign disease, 135 operations were for multi-nodular goitres and 35 for follicular adenomas. Of the 236 patients, 70 were Maori, 89 NZ European, and 57 Pacific Islanders, with malignancy accounting for a similar proportion of each group. There were four patients with post-
operative recurrent laryngeal nerve palsies diagnosed on direct laryngoscopy by an ORL surgeon observing an immobile vocal cord. There were four post-operative bleeds that required formal urgent evacuation of haematoma because of stridor. There was one death from a large multi-nodular goitre that had resulted in a pre-operative respiratory arrest.

**Conclusions** Our data are similar to international data with regard to the incidence of thyroid disease and the incidence of complications arising from thyroid surgery. Maori and Pacific Island patients account for the majority of patients requiring surgery for both benign and malignant conditions. This is most likely a reflection of the population demographics within the Middlemore catchment area.

**Use of intraoperative transoesophageal echocardiography during resection of phaeochromocytoma. P S H Soon, S Beehan, P Campbell.**

Since the 1950s, the peri-operative mortality rates for phaeochromocytoma resection have decreased from 20% to 0–4%. This has been attributed to the use of pre-operative alpha blockade. Despite pre-operative alpha blockade, these patients tend to experience intra-operative haemodynamic lability. Indeed, after ligation of the adrenal vein, some patients become hypotensive, requiring large amounts of intravenous fluids to maintain their blood pressure. This results from the loss of balance between excessive catecholamine release and alpha blockade.

Intra-operative transoesophageal echocardiography (TOE) is used in cardiac surgery for assessment of global and regional ventricular function and detection of hypovolaemia and hypervolaemia. Measurement of cardiac filling, and myocardial contractility (which can be impaired by direct toxic effect of excessive catecholamine release), with TOE by an experienced cardiac anaesthetist is simple and less invasive than other means of central pressure assessment, such as Schwann-Ganz catheters.

The use of this technique has not been previously described in the setting of surgery for phaeochromocytoma. We present details of two patients who survived hypertensive crises due to phaeochromocytoma, and subsequently underwent elective resection. Intra-operative TOE was used to assess cardiac filling in an attempt to anticipate and minimise intra-operative haemodynamic lability. The use of this technique and its limitations are described.

**Adjuvant chemotherapy uptake for colon cancer in a major teaching hospital from 1993–2001: can we do better? D H K Yong, S Lolohea, J P Keating.**

**Introduction** The use of adjuvant chemotherapy for stage III colon cancer has been proven in multi-institutional studies to improve survival.

**Aim** We review the use of adjuvant chemotherapy in our institution to investigate whether this survival advantage translates to significant benefit in a single institution and its implications.

**Materials and Methods** Medical notes and histology reports of all patients with resectable colon (not rectal) cancer at Wellington Hospital from 1993–2001 were reviewed and the data analysed using Epi Info 6 program.
Results A total of 482 colon cancers were resected. The median age was 74, and female to male ratio 1.2:1. TNM stages were I = 8.7%, II = 43.2%, III = 29.2%, and IV = 18.9%. 141 had stage III and were eligible for adjuvant chemotherapy. Only 66 were referred. Non referrals were mainly due to physician assessment of unlikely benefit or patients’ refusal. Forty five were accepted, and 35 completed the course. Six did not complete the course because of major side effects.

Conclusions There is a low incidence of adjuvant chemotherapy uptake in our study due to a variety of reasons. Only four patients could possibly be cured over this eight-year period based on the 12% increase in cure rate from randomised trials. More patients having chemotherapy and the availability of agents with less side effects are needed.


Aim To investigate the relationship between colorectal and prostate cancer in Victorian men.

Materials and Methods Victorian men who developed prostate and colorectal cancer were identified retrospectively from the Victorian Cancer Registry, and followed up to the end of 1995. The cause of death in those men who had second primary prostate cancer following colorectal cancer was determined. The stage of colorectal cancer was compared between men with and without second primary prostate cancer and the grade of prostate cancer was compared with men who did not have a prior colorectal cancer.

Results Men who develop colorectal cancer are at increased risk of prostate cancer, with the greatest risk in men under the age of 65 (relative risk ~2). Men with first primary colorectal cancer are more likely to develop prostate cancer than colorectal second primaries, and men who develop second primary prostate cancer are more likely to die of prostate cancer than colorectal cancer.

Conclusions Younger men diagnosed with colorectal cancer are at increased risk of prostate cancer. However, there is no direct evidence that screening for prostate cancer leads to a reduction in mortality. This should be considered when discussing long-term follow up.

Pouchitis experience in Auckland. A Merrie.

Introduction Restorative proctocolectomy with ileoanal pouch is the surgical procedure of choice for FAP and chronic ulcerative colitis. Pouchitis, a non-specific inflammatory condition, is one of the most common complications associated with the procedure. However, the prevalence is unclear.

Aim To assess the prevalence of pouchitis in Auckland, and determine the method and accuracy of diagnosis.

Methods Retrospective review of all ileoanal pouches performed in Auckland from 1987–2002 with ongoing prospective questionnaire evaluation of clinical symptoms
of pouchitis and treatment. Data assessed for ability to calculate the Heidelberg Pouchitis Activity Score.

**Results** 234 patients underwent restorative proctocolectomy, of whom 197 (84%) had UC, 22 (9%) FAP, 7 (3 %) Crohn’s and 7 (3%) indeterminate colitis on final histology. Eighty four patients were diagnosed with pouchitis (36%), the majority having had a restorative proctocolectomy for UC (86%). Twenty nine patients (34%) had sufficient data for a three-modality diagnosis. However, the Heidelberg Pouchitis Activity Score was calculable retrospectively on only seven patients. Questionnaire data are currently being accrued and will be presented.

**Conclusions** Pouchitis remains a challenging complication. The prevalence rate in this study of 36% is in keeping with reported literature. However, it is likely that pouchitis data are under-represented. This is likely to be due to a lack of understanding of pouchitis and absence of standardised diagnostic algorithms. To enable a better understanding of pouchitis and provide appropriate therapy, the diagnosis should be made on clinical, endoscopic and histology findings.

**Reasons for failure to diagnose colorectal carcinoma at colonoscopy. M J Johnston, M Leaper, M Barclay, B R Dobbs, F A Frizelle.**

**Aim** Colonoscopy can produce false negative results and the reasons for this remain obscure. This study aims to examine the frequency of this problem and why it occurs.

**Methods** All colonoscopies performed at Christchurch Hospital (New Zealand) over a 43 month period (1 October 1997 to 30April 2001) were retrospectively analysed. All cases of colorectal carcinoma during the period 1 October 1997 to 30 July 2001 (3 months longer to capture delayed diagnosis) were also identified. The two databases were then compared and all cases in which a colonoscopy was performed greater than six weeks prior to a colorectal carcinoma specimen being received by the pathology department were identified. A two-year interval was accepted for missed cancer; after this it was assumed that they were more likely interval cancers.

**Results** 5055 colonoscopies were undertaken on 4598 patients. 630 colorectal carcinomas were identified. 286 patients were on the colonoscopy and pathology database. Sixty six patients had colonoscopy performed greater than six weeks prior to the diagnosis of colorectal carcinoma. Of the 66 cases, 48 had had a carcinoma identified and the management was being undertaken. Seventeen (5.9%) cancers were missed at colonoscopy Of these, 9 (3.1% of all cancers) were due to incomplete colonoscopy. In 4 cases (1.4 % of all cancers), the cancer was not diagnosed despite adequate bowel preparation and what was thought by the colonoscopist to be an adequate colonoscopy. In a further 4 cases (1.4% of all cancers), cancer was not seen due to poor bowel preparation.

**Conclusions** When an incomplete or inadequate colonoscopy has been undertaken, every effort should be made to image the complete colon, with repeat colonoscopy, barium enema, or CT colonoscopy. The study identified system failures related to follow-up investigations in patients who had an incomplete colonoscopy.

The recognition that colonoscopy may miss cancer should encourage doctors to reinvestigate patients when there is a lack of clinical and investigative correlation.
MRI and complex anal fistula. H Roberts.

This talk on MRI of perianal fistula disease will address the indications for imaging; the strengths and weaknesses of the MRI techniques available; and potential contributions to management planning and outcome prediction that MRI can make. Cases and relevant references will be used to illustrate the topics discussed.

Indications for acute imaging include suspected complex disease, or entrapped pus. Elective imaging may be undertaken to follow up complex disease, or because of delayed healing.

The ‘best’ imaging protocol is the one that works for the institution. Most will include a high resolution axial T2 weighted series as an overview. Fat suppressed, Gadolinium enhanced coronal and axial T1 weighted images are then commonly added to assess detail and disease activity. STIR imaging has some proponents, but has traps leading to false negatives and positives. Sagittal imaging is useful in assessment of fistulation to the vagina.

By demonstrating the relation of the fistulous track to the sphincters, and identifying any secondary tracts and abscesses, MRI can help plan management. Through its ability to accurately categorise perianal fistula disease, MRI can help predict outcome more accurately than clinical examination alone.


Introduction Retroperitoneal laparoscopic nephrectomy (RLN) has become the preferred approach with recent advances in endoscopy. This paper reports our experience in the Department of Paediatric Surgery at Christchurch Hospital, with RLN using a three trocar technique.

Methods A retrospective review was undertaken of all children who underwent RLN or hemi-nephrectomy between September 1998 and May 2002, at Christchurch Hospital.

Results There were 27 nephrectomies and two upper pole hemi-nephrectomies performed in children aged between 8 months and 157 months (mean 54 months). All patients were referred because of a non-functioning renal moiety, or a complication thereof. Sixteen patients had a multicystic dysplastic kidney (MCD), 3 a pelvi-ureteric junction obstruction (PUJ), 2 vesico-ureteric reflux (VUR), 2 duplex system, 2 recurrent pyelonephritis, 2 a hypoplastic kidney, 1 posterior urethral valves (PUV), and 1 with no specific features on histology.

All kidneys were removed using this technique. The average length of operation for MCD and hypoplasia in the absence of inflammation was 70 minutes (range 38–120 minutes). In hemi-nephrectomies, or where inflammation was present (eg, recent pyelonephritis), the average operative time was 146 minutes (range 68–225 minutes), reflecting the increased difficulty of the procedure. Post-operatively, the use of narcotics was minimal and the average stay in hospital was 31 hours (range 8–140 hours).
Conclusion A RLN is safe and our preferred alternative to open nephrectomy. It requires a very short post-operative hospital stay, and causes minimal discomfort. Children return to full activity rapidly. Recent pyelonephritis increases the technical difficulty of the procedure.

To what information about circumcision should parents have access? S Beasley, B Darlow.

Circumcision remains a controversial surgical procedure. There are many parents who wish to have their young boys circumcised, but access to objective information about the procedure has been limited. In recognition of this, the Division of Paediatrics and Child Health of the Royal Australasian College of Physicians; the Australasian Association of Paediatric Surgeons; the New Zealand Society of Paediatric Surgeons; and the Urological Society of Australasia, have developed a document to assist parents who are considering having circumcision undertaken on their male children, and for doctors who are asked to advise on or undertake it.

This document has resulted from a critical analysis of the current evidence available about the benefits and limitations of circumcision in both the neonatal period and in older children. It provides details of the current evidence as it pertains to hygiene, UTIs, sexually transmitted diseases and penile carcinoma. The appropriateness of circumcision performed in the neonatal period and evidence regarding the relative value of the analgesic options is presented.

Fiji paediatric urology outreach. K Maoate.

Maintaining the momentum for paediatric surgical services in a volatile environment has been challenging. Regular changes of staff, reduction in the number of specialty visits and the previously unrecognised need for a paediatric anaesthetist on the visits are some of the issues that needed to be overcome. There is a need to be more collegial in this environment to ensure the support that is required to provide an excellent service; other services such as pathology, radiology, paediatricians, nursing must be involved as well.

This also provides the opportunity to be with and have the surgeons and trainee surgeons on the Masters postgraduate programme. The trainees are representative of nearly all the South Pacific Island nations.

I will present the work in progress in Fiji, particularly as it applies to urology and what the future may hold.


Introduction Cystic hygroma is a benign congenital lymphatic malformation. It is rare lesion occurring in 1 in 12 000 live births. Cystic hygroma most commonly presents as asymptomatic lump in the neck. However, it can occur in many other sites. Surgical excision has been the traditional method of treatment for cystic hygroma. More recently, sclerosant therapies have been used with good results.
Aims To review the treatment of cystic hygroma in our institution over a period of 10 years. To compare our results with results in the literature for both surgical excision and sclerosant therapy with bleomycin.

Materials and Methods The case notes of all patients with cystic hygroma from 1991 to 2001 at the Wellington Hospital were reviewed. Literature review was conducted using Medline search.

Results Nine patients had intral sensual bleomycin: three patients had complete response, four had partial response, and two failed response. Of the two failed, one had haemorrhage into cyst resulting in airways obstruction and required surgery. Eight patients had surgical excision. Five of these had complete excision. Three had incomplete excision. Of these, two had recurrence that required further excision.

Conclusions Intral sensual bleomycin is effective treatment for cystic hygroma, especially when surgical excision is not possible due to site or tissue infiltration.


Aim About one third of renal units have established renal scarring at the time of diagnosis of primary vesicoureteric reflux (VUR). It is not yet clear, however, whether the progression of renal scarring is arrested by anti-reflux surgery. Our aim was to evaluate whether new renal scars appear after ureteric re-implantation.

Materials and Methods A total of 36 children (50 renal units) underwent ureteric re-implantation for primary VUR by Cohen method between the years 1998–2001. Out of these, only those who had pre- and post-operative functional renal scintiscans (DMSA/MAG3) were included in this pilot study. Six patients (four girls, two boys; age range: 2.5–8 years, mean 4.2 years) form the core of this study. None of these six patients had any new renal scars. The average interval between the re-implantation and renal scan was 13 months.

Conclusion Ureteric re-implantation for primary VUR does prevent new renal scar formation. Further studies are needed on a larger scale to vindicate the role of surgery in primary VUR.
Time for gastroscopy

A 48-year-old male psychiatric inpatient presented with dysphagia and a history of swallowing two rings and a wristwatch. Chest X-rays confirmed a wristwatch and two rings in the distal oesophagus. An otolaryngologist performed rigid oesophagoscopy, but the watch migrated into the stomach. A flexible gastroscopy was performed and a Casio digital wristwatch, displaying the correct time, and two signet rings were identified in the stomach and removed using a snare. The patient recovered and has not represented.

We are grateful to Drs Richard B Gearry, H Bramwell Cook and Michael J Burt, of the Department of Gastroenterology, Christchurch Hospital, for this issue’s Medical Image.
European parliament rejects US-style direct advertising of drugs

Members of the European parliament have categorically rejected tentative plans to allow pharmaceutical companies to provide information on drugs directly to the public in the European Union.

As part of its proposals to update existing EU legislation on the approval and marketing of drugs, the European Commission had suggested a five year pilot scheme during which firms could supply data directly to patients on three common illnesses: diabetes, asthma, and AIDS.

Erkki Liikanen, the European commissioner behind the proposal, insisted that the idea recognised that many patients already obtain fragmented information from the internet and stressed that it would not lead to US-style direct advertising to patients.

His arguments did not convince the MEPs, who rejected the proposal by 494 votes to 42 in Strasbourg last week.

High court rules out ‘designer baby’

Parents who want to create a “designer baby” to try to save the life of their sick child had their hopes dashed last month when a high court judge ruled that the human fertilisation and embryology authority (HFEA) has no legal power to authorise such treatment.

The pro-life campaigner Josephine Quintavalle won a victory in her battle to stop the “ethically objectionable” screening of test-tube embryos to provide donor siblings for sick children. The ruling will be a blow to Raj and Shahana Hashmi, the first couple given the go-ahead by the HFEA to use embryo selection to try to have a baby matching their sick child’s tissue type. Three-year-old Zain has a rare genetic blood disorder, and his parents hoped stem cells from a new sibling’s umbilical cord would save his life.

Mr Justice Maurice Kay ruled that the HFEA had no legal power to license embryo selection by “tissue typing” to help sick brothers or sisters.

He said the legislation had been “tightly drawn” so that the ground rules “restrict the potential for misuse of science and technology”. Under the legislation, technology could be used only to help women with reproductive difficulties to conceive and carry a baby to term.

Guardian Weekly, 2–8 January 2003
Public use of automatic defibrillators: a bolt from the blue

Despite improvements in therapy for coronary artery disease and its risk factors, sudden dysrrhymic death remains an unresolved health problem, with at least 400,000 events occurring each year in the USA. Most of these events occur outside the hospital and are medically unattended. Most of these arrests are due to ventricular fibrillation or pulseless ventricular tachycardia for which prompt defibrillation is the most important determinant of survival and is an early link in the chain of survival from cardiac arrest. Even a few minutes’ delay in receiving defibrillation leads to major reductions in survival rates.

Increased public access to automatic external defibrillators is inevitable. Legal and administrative barriers need to be abolished. Widespread education about automatic external defibrillators as a means of increasing public acceptance of lay-person use must be a priority.

Lancet 2002;360:1712

Not worth the paper. Printed scientific journals will soon be irrelevant?

The Web offers many advantages for disseminating new science. It is more democratic and more efficient. Electronic preprints can reach almost everyone at the same time, and more people read them. They have a (perhaps spurious) aura of immediacy. An exciting idea from a student in, say, India can trigger a flood of emails within 24 hours from scientists around the world. With printed journals such a response could take a year.

Electronic publishing may render the traditional printed journal redundant.

New Scientist, 23 November 2002

The web can complement libraries, but not replace them

Not everything published is on the web, despite its description as “a gigantic digital library, a searchable 15 billion word encyclopedia”. Only about 8% of all journals are online and only a fraction of books are available. Thus, the web is a useful research tool but it is no substitute for a library. Library services have been greatly improved by computer automation and use of the web, but the web cannot replace all of the services offered by a good library.

Rather than seeing the web as a replacement for their services, many academic and public libraries have embraced the web and its possibilities to enhance their services and improve resource sharing. But the web is merely one of the many ways of accessing information, all of which should be consulted when thoroughly researching a subject.

Finally, the idea that the web can be a replacement for a library ignores the most important characteristics of a library. A library is not merely a collection of books, or some vast warehouse of words, books, and journals; it is part of our cultural, historical and scientific memory.

Nature 2002;420:19
Antimicrobial treatment in diabetic women with asymptomatic bacteriuria

In women with diabetes, treatment of asymptomatic bacteriuria has been recommended to prevent complications. In this trial, 55 women with diabetes and asymptomatic bacteriuria were randomly assigned to receive antimicrobial therapy and 50 to receive placebo. After a mean follow-up of 27 months, the rates of symptomatic urinary tract infection were similar: 42 percent in the treated group and 40 percent in the placebo group. There were also no significant differences between the two groups in the rates of pyelonephritis or hospitalization for urinary tract infection, although the 95 percent confidence intervals for these differences were wide.

Among women with diabetes, a policy of screening for and treating asymptomatic bacteriuria leads to many courses of antibiotics but does not appear to prevent complications. The findings of this controlled study call such a policy into question.


Medical funding group calls for clamp-down on hype

Researchers who talk to the press prematurely about unpublished research could soon face harsher sanctions than the odd disapproving glance from a colleague. Under research misconduct guidelines just released by an association of British medical charities, they could be blacklisted for funding, the head of the association says.

Diana Garnham, chief executive of the London-based Association of Medical Research Charities (AMRC), which issued the guidelines on 17 October, says its members are fed up dealing with the fallout from over-hyped or misleading results. “Scientist don’t do their work in a vacuum,” she says. “There is an audience for whom their work is directly relevant, and they need to bear that in mind.”

The guidelines state simply that researchers should be “especially careful” when discussing incomplete work, and are intended to coax universities and other research institutions into drawing up their own rules. They also point out that the aim of disseminating research “should not be primarily to seek publicity for the researcher, the research institution or the funder”. From January next year, the AMRC says it will recommend that its members fund only researchers at institutions that have published specific standards for sound scientific conduct.

Nature 2002;419:769

A requiem for chloroquine

The recent development of widespread chloroquine (CQ) resistance in Plasmodium falciparum, the most dangerous of the four malaria parasite species, has contributed significantly to escalating mortality rates in Africa and to the resurgence of malaria as an immediate public health priority. Several pressing scientific questions have emerged within the context of this humanitarian disaster: What is the molecular basis for CQ resistance, and how has this influenced the dynamics of resistance? Why did
CQ remain effective for 20 years, yet its immediate replacement sulfadoxine-pyrimethamine (SP) last less than 5 years? Has the widespread deployment of CQ jeopardized the use of other drugs targeting the same parasite biochemical pathways? Sidhu and colleagues have obtained data relevant to all three questions by creatively exploiting the pfcrt gene, which encodes a putative transporter protein in the digestive vacuole membrane of the malaria parasite. They replaced the endogenous pfcrt gene in a CQ-sensitive strain of P. falciparum with a pfcrt gene from each of three CQ-resistant strains. All such replacement strains (“constructs”) showed CQ resistance in vitro, demonstrating that pfcrt mutations are sufficient, within their selected genetic background, to encode resistance.

Now it appears that the application of modern genetic technology may enable CQ to leave one more valuable legacy: a detailed genetic, clinical, and epidemiological epitaph that can be used to inform the deployment of its successors.

Science 2002;298:74–5
General practitioners’ views on cancer treatment, home care and oncologists: an Italian survey

In consideration of the high number of advanced cancer patients expected each year, a home care programme, called SAOD, was coordinated by the District Hospital (DH) in Latina, Italy. The team consisted of four oncologists and two nurses. In view of their crucial role in palliative care,¹ the views of general practitioners (GPs) were explored as part of the project. Data available from 256 patients in a 20-month period were collected. Home death and re-hospitalisation rates were 83% and 9.4%, respectively. An opinion survey was planned in order to explore areas of concern to the GPs in the district and a dedicated questionnaire was developed.

One hundred GPs were mailed questionnaires and 60 (60%) responded. On average, the number of patients per practice was 1200 (range 300–2500), with 9 cancer patients cared for in each practice per year (range 1–40), and 1 patient enrolled in the SAOD per GP (range 1–4). The majority of patients (67%) were diagnosed for cancer and cared for by the DH. GPs were asked what factors influenced patients’ choice of cancer centres over DH. They ranked these factors as follows: reputation of national and international institutions (36%); patients’ desire to exhaust all possible treatments (18%); relatives’ preferences (14%); distrust in local facilities (14%); GPs’ advice (5%); other (13%).

Problems in communication with the DH were experienced by 30% of GPs and mainly arose from the lack of detail of discharge letters and the difficulties in telephone correspondence. This is in agreement with other studies,²–⁵ and with an earlier report, in which GPs revealed that many of them thought that a follow-up telephone call served as a good opportunity for them to assess their role in patient management and surveillance.⁶ GPs expressed their opinions on oncologists and the DH, complaining about the poor collaboration with their practice (35%), the excessive centralisation of the Hospital and inaccessibility of facilities (15%), the lack of a referral specialist for each cancer patient and the fragmented follow up (7%). GPs felt they should have more involvement in their patients’ management (41%); and that there should be a network between all the care givers (professional nurses and volunteers included) (23%); an improvement in written communication from specialists (17%); and an improvement in state referral guidelines and programmes for cancer prevention (11%).

Seventy one per cent of GPs were satisfied with the SAOD team’s intervention; 80% considered “good” the integration of SAOD in the community setting and 95% were pleased with the medical support provided. Since the SAOD programme entailed the collaboration of all care providers, a significant improvement in the GP–specialist relationship was achieved. Only 13% of GPs, in fact, continued to experience problems in communication with oncologists in the home care setting.

Although the sample group was small, the questionnaire easily identified the aspects that need to be improved for better cooperation between GPs and specialists, and suggested areas in which progress could be made. It is clear that communication may
benefit from teamwork between specialists and generalists, which fosters an awareness of each other’s skills, and that such collaboration may benefit patients and their families.

We thank the participating general practitioners in Latina District who gave so freely of their time to make this research possible.

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References:

Dissemination of guidelines on medical practice

The literature that examines the effect of new guidelines on medical practice rarely addresses the issue of the actual process of dissemination. The release of the recently published New Zealand Guideline for the Diagnosis and Treatment of Adult Asthma deserves comment. The initial method of dissemination was to enclose the Guideline with the 9 October 2002 issue of *NZ Doctor*, which goes to all New Zealand general practitioners (GPs). Two weeks later, a simple fax-back questionnaire was sent to all GPs in three Independent Practitioner Associations (*n* = 729). 422 responses were received, giving a 58% response rate.

The results are described in the table below.

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>n = 422</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Have you received the Guideline within the last 3 weeks?</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>292</td>
</tr>
<tr>
<td>No</td>
<td>121</td>
</tr>
<tr>
<td>Don’t know</td>
<td>9</td>
</tr>
<tr>
<td><strong>If yes, where is it located at the present time?</strong></td>
<td></td>
</tr>
<tr>
<td>In desk drawer</td>
<td>29</td>
</tr>
<tr>
<td>In pile on desk</td>
<td>89</td>
</tr>
<tr>
<td>On the office shelf</td>
<td>68</td>
</tr>
<tr>
<td>In rubbish bin</td>
<td>15</td>
</tr>
<tr>
<td>Don’t know</td>
<td>30</td>
</tr>
<tr>
<td>Circulating in practice (amongst staff)</td>
<td>7</td>
</tr>
<tr>
<td>Other*</td>
<td>63</td>
</tr>
<tr>
<td>Missing                        †</td>
<td>121</td>
</tr>
<tr>
<td><strong>Have you:</strong></td>
<td></td>
</tr>
<tr>
<td>Read them in detail?</td>
<td>51</td>
</tr>
<tr>
<td>Put in future reading pile?</td>
<td>84</td>
</tr>
<tr>
<td>Skim-read them?</td>
<td>133</td>
</tr>
<tr>
<td>Not read them at all or have no intention of reading them</td>
<td>24</td>
</tr>
<tr>
<td>Missing†</td>
<td>130</td>
</tr>
<tr>
<td><strong>Do you think the Guideline will change your practice?</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>83</td>
</tr>
<tr>
<td>No†</td>
<td>155</td>
</tr>
<tr>
<td>Don’t know</td>
<td>42</td>
</tr>
<tr>
<td>Missing‡</td>
<td>142</td>
</tr>
</tbody>
</table>

* Responses included: “in guideline file”, “beside my bed”, “in pile on floor”, “in back of car”, and “in Snowy’s hutch helping to keep floor dry”
†Values include those who did not receive Guideline
‡Respondents were not asked to explain their response, but some voluntarily commented that they were already practising according to the Guideline recommendations.

Doctors in New Zealand have, of late, been inundated with guidelines and other therapeutic information. Despite all GPs being sent the New Zealand Asthma Guideline, almost one third of this sample had no recollection of receiving it. The
results of this survey may reflect the administrative workload of GPs with resultant time constraints, or may indicate that some are in a situation of “guideline burnout”.

These results do not in any way reflect on the document itself. However, this study indicates that the implementation of the recommendations for the diagnosis and treatment of adult asthma as detailed in the Guideline may be impaired by the method of dissemination and/or lack of acceptance of guidelines by doctors. Any evaluation of the effect of a new guideline must include a process evaluation of its entry into general practice.

Our grateful thanks to Erica Amon, Pinnacle Group Ltd; Chris Tod, South Link Health Ltd; Bronwyn McKenzie, Rotorua General Practice Group.

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James J Reid
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Reference:

Respiratory illness, deprivation and smoking: a small area study in Te Tairawhiti

It is widely acknowledged that both adults and children in lower socioeconomic groups are at an increased risk from communicable infectious diseases, particularly respiratory infections.\(^1\) An examination of respiratory infections can therefore provide a valuable, albeit crude, measure of deprivation-related illness in an area, and among population subgroups. In addition, respiratory illnesses can provide an indication of the negative consequences of smoking, which is in turn influenced by socioeconomic position. The importance of respiratory diseases ought not to be underestimated, as they represent 6.1\% of all public hospital day and inpatient discharges in New Zealand.\(^2\) Thus, they constitute almost as many discharges as those caused by cancer (6.6\%), and the same proportion as all neuropsychiatric conditions. The relative risk among Maori and Pacific Islands People of being hospitalised for a respiratory disease is substantially higher than for Pakeha.\(^2\)

Respiratory diseases are of vital importance in Te Tairawhiti, because of their association with both deprivation and smoking. It should be remembered that Gisborne District had the highest smoking rate of any territorial local authority in the 1996 Census, as well as being a severely economically deprived area.

Hospital discharge data relating to residents in Tairawhiti for the financial years 1996–1999, citing ICD codes 460–519 (Diseases of the Respiratory System) in any of the first five diagnosis columns, were accessed from NZHIS. Age- and gender-standardised hospital discharge rates were calculated for both the Maori and NZ European/Pakeha ethnic groups (based on the total district population).\(^3\)

Results indicated a substantially higher rate of hospital discharges citing respiratory disease among Maori. Pakeha rates for both genders were approximately 30 per 1000, per year (male = 31.42, female = 30.65). However, Maori male rates were roughly 50\% higher (46.31), while Maori female were rates almost double (57.82).

Area-based (ecological) analysis of the region’s 22 Census Area Units highlighted the importance of deprivation and respiratory illness in Tairawhiti. Stepwise multiple regression analysis (using both current group smoking rates and NZDep96 raw scores as potential predictors), revealed that for Maori of both genders, deprivation was the only significant predictor of hospital discharge rates citing respiratory disease. Among Maori males, NZDep96 raw scores predicted 22.7\% of the variance in hospitalisation rates for respiratory illness, while predicting 32.9\% of the variation among Maori females.

However, among Pakeha females, current smoking rate was the only significant predictor of hospital discharge rates citing respiratory disease (predicting 70.3\% of the variance). Among Pakeha males, deprivation was the most significant predictor of hospital discharge rates citing respiratory disease (predicting 35.6\% of the variance).
These findings suggest that attention needs to focus on alleviating poverty to improve respiratory health in Te Tairawhiti.

Frank Houghton
Bruce Duncan
Public Health Unit, Tairawhiti District Health

References:


Beyond Ashburton: junior hospital doctor employment in New Zealand

I was pleased to see the responses from Alma Rae (on behalf of the Resident Doctors’ Association)\textsuperscript{1} and John Jarvis,\textsuperscript{2} to the article “Time to revisit Ashburton?”\textsuperscript{3} from the Resident Medical Officers Advisory Committee at Christchurch Hospital (of which I am a member). I agree with the sentiments expressed – that retrospectivity and apportioning blame are no way to make progress. In addition, I strongly support the desire to discuss, among and between senior and junior medical staff, how further progress might be made.

I worked as an RMO before and after the 1985 changes, and I am immensely grateful to those who determinedly led us in a stand against the vicious and destructive exploitation of junior medical staff. We must continue to fight for conditions that are fair, good for our workforce, and good for our patients, as the unchecked influence of our public health system on its workforce continues to cause erosion and exploitation.

I hold the view that postgraduate medical education (in the early postgraduate years and in vocational training) is based on the apprenticeship model of learning, and this is dependent on relationships between apprentice, supervisor and patients, which are safe, formative and ongoing. However, I perceive an undermining of this model as a consequence of the loss of continuity of relationships between the apprentice and his or her supervisor, and between the apprentice and his or her patients. In addition, I perceive implications for satisfaction of work and quality of patient care as the traditional team relationships are weakened. I perceive also, that these woes are well advanced, to the extent that we are nearing a crisis. We could, and should, debate the details of these perceptions and the evidence for their veracity, but suffice it to say in this forum, they are perceptions shared by a great many senior medical staff in New Zealand. I believe these senior medical staff are well meaning, supportive and strongly on the RMOs’ side, and that they hold these perceptions with a sense of genuine concern. The cause of these woes is multifactorial. None of us is the cause, but we are all part of it, and we all need to contribute to a resolution.

Of course I may be wrong and, if so, I should be persuaded of that by rational and respectful argument, motivated by a desire to see good patient care delivered by a strong and content medical workforce. To work towards a common end, significant players in this debate should meet and interact in a meaningful and cooperative manner. Such a meeting could, perhaps, be sponsored by an interested but relatively impartial group such as the Medical Council of New Zealand, or the New Zealand Medical Association. We do not want to go back to Ashburton, but we do need to go somewhere.

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References:


Inequities in referred services expenditure

Professor Malcolm’s recent paper (http://www.nzma.org.nz/journal/115-1167/273/) on inequities in referred services expenditure raises many more questions than it answers. The paper presents a classical observation of area variation in the population rate of expenditure on pharmaceuticals and laboratory tests, adjusted for age and sex according to a formula developed by the Health Funding Authority and the Ministry of Health.

Several crucial aspects of the analysis are not described in detail. For example, extracting expenditure attributable to general practitioners from national databases is not a straightforward task. The author used “various lists of GPs, including the Medical Council list”, although he does not specify how he identified GPs from the Medical Council list. How were the ambiguities between junior hospital doctors and general practitioners managed?

Similarly, the author attributed expenditure to DHBs according to the location of GPs, but gives no details. If addresses from the medical register were used, the resulting attribution of expenditure to areas will be very inaccurate. Such addresses are given for the purpose of receiving correspondence from the Medical Council and may not reflect the area in which a GP practises. The misattribution of numbers of GPs and their associated expenditure to geographic areas could create an artefactual relationship of the kind observed in Figure 2 of the paper.

A second technical issue concerns the weightings that were used to determine the equitable distribution of expenditure. In Figure 1 of the paper, Professor Malcolm presents a bar graph showing that the national mean level of expenditure is above the equitable level for both pharmaceuticals and laboratories. This is a nonsensical result, and implies that the weightings used to determine the equitable level have not been appropriately applied.

The paper suggests that the first stage in reducing the perceived inequity of geographic variations should be made by reducing the variability between individual clinicians, or small groups of clinicians in practices. These findings demonstrate the all too common tendency to leap from an observation of area-level variation to the conclusion that reduced variability among individual clinicians within areas will necessarily make for more equitable resource allocation. However, the variability of a group of clinicians per se is not necessarily associated with inappropriate care at an aggregated level.1 Care must be exercised when drawing conclusions about patterns of practice among individual clinicians upon the basis of area-level observations – an example of the atomistic fallacy.2

Finally, the underlying concept of equity upon which the paper is based remains undefined. The weightings developed by Sutton used in the paper are based upon a national average expenditure upon laboratories and pharmaceuticals per person in categories of age, sex and subsidy card status. This is one view of equity, but far from a definitive one. If there are historically inappropriate levels of use of pharmaceuticals and laboratory tests across the age, sex and card holding groups, then these
weightings will build such inappropriate levels into the nominally equitable level used as a benchmark in this paper.

Overall, this paper draws sweeping conclusions from data that have not been transparently analysed, and from assumptions that have not been made explicit.

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References:


Inappropriate examination

Charges:

A Complaints Assessment Committee laid four charges against Dr Ford. The charges were laid at the level of professional misconduct (Ms D and Ms W) and conduct unbecoming a medical practitioner and that conduct reflects adversely on the practitioner’s fitness to practise medicine (Ms R and Mrs S).

Ms D

Charge: The particulars were as follows:

1. When Ms D was presenting with a persistent sore throat Dr Ford performed a breast examination which was inappropriate and unnecessary.
2. At the end of the examination he watched as she undressed and assisted to do up her bra.
3. In telling Ms D that she would have to have a breast examination given the symptoms with which she presented, he did not obtain her informed consent for that examination.

Background: It was the patient’s evidence that this was the only occasion on which she saw Dr Ford and that she went to see him for a sore throat. At the time of the consultation she was 18 years old and went to see Dr Ford because she was living in Whangarei at the time and her own GP was some distance away.

Finding: The Tribunal found Dr Ford guilty of conduct unbecoming a medical practitioner and that conduct reflects adversely on his fitness to practise medicine.

The Tribunal was satisfied Particular 1 was established and on its own warranted sanction. The Tribunal considered that, notwithstanding the then current practice of conducting opportunistic examinations in some cases, the carrying out of breast examinations in the circumstances of Ms D’s consultation was inappropriate and unnecessary; it was not warranted as an opportunistic examination, it was not requested, Ms D was not a regular patient, no explanation was given, and Dr Ford was not involved in her gynaecological care.

When considering Particulars 2 and 3 the Tribunal was satisfied that they were not established. The Tribunal’s finding in relation to Particular 2 was unanimous. In relation to Particular 3, the finding was a finding of the majority of the Tribunal members.

In relation to Particular 2, Dr Ford conceded that he may assist a patient to dress if she was having difficulty, particularly if the patient was elderly for example and the Tribunal considered it extremely difficult to make a finding adverse to Dr Ford in relation to such assistance, which he may or may not have provided to Ms D some 18 years ago. The Tribunal was satisfied it would be unsafe to make any finding adverse to Dr Ford in circumstances where he does not recall the consultation in any detail.
and his motives for offering such assistance as is now complained of, may have been quite innocent.

The majority of the Tribunal also applied that reasoning in relation to Particular 3, particularly in the circumstances that present in relation to this charge. All of the medical practitioners who gave evidence at the hearing acknowledged that accepted practice in relation to the giving of information to patients, and obtaining their consent to carry out examinations, is now very different to practices which were acceptable in 1984. It was the minority view (two Tribunal members) that what was at issue in relation to Particular 3 was not so much the giving of information about risks, or the duty to inform the patient or draw to their attention some danger or risk which may be inherent in the care and/or treatment offered. Rather, the allegation was that Dr Ford offered no explanation at all prior to carrying out an intimate examination on a young woman who:

(a) was not a regular patient;
(b) with whom he did not have an established doctor/patient relationship;
(c) without a chaperone;
(d) without giving her any explanation; and
(e) which the Tribunal is satisfied was unnecessary and inappropriate.

The minority considered on that basis, the 1984 standards against which Dr Ford’s conduct should be judged were not so significantly different to those which are currently accepted. It was, therefore, the minority view that Dr Ford’s conduct in this regard fell below the standards reasonably expected of an experienced general practitioner.

Ms W

Charge: The particulars were as follows:

1. Dr Ford performed an unnecessary and inappropriate breast examination on Ms W who was then aged 16 who had consulted him for a prescription for the contraceptive pill.

2. During the examination Dr Ford made an inappropriate comment that “a nipple would become erect in this way if it was aroused” or words to that effect.

Background: Ms W saw Dr Ford only once when she was about 16 years old. At that time she wanted to go on the contraceptive pill and because she was afraid that her family doctor would tell her parents that she was on the pill, she went to see Dr Ford.

Finding: The Tribunal was satisfied that the particulars of the charge were established but, overall, the charge was not established.

The Tribunal considered the professional standards against which Dr Ford must be judged were those which were accepted at the time of the events giving rise to the charge. The Tribunal accepted that it was considered good practice for all women to have a breast examination and an internal examination when the oral contraceptive pill was prescribed.

The Tribunal was satisfied that Dr Ford did carry out the breast examination and he did make the comment alleged in Particular 2, and that both particulars were
established. However, the Tribunal was not satisfied that the established particulars warranted the sanction of an adverse finding.

Ms R

**Charge:** The particulars of the charge were as follows:

1. When Ms R presented with a sore throat Dr Ford required her to take off all her clothes apart from her underpants which was both inappropriate and unnecessary.
2. After performing an examination and Ms R had dressed, Dr Ford commented that “she was developing nicely” or words to that effect.

**Background:** Ms R was 16 years old when she consulted Dr Ford on the occasion giving rise to the charge. At that time he was her family doctor but this was the first occasion on which she visited Dr Ford on her own. Previously she had been accompanied by her mother. Ms R went to see Dr Ford because she had a sore throat. In the course of the consultation Dr Ford asked her to take her clothes off so he could examine her. Ms R was wearing her school uniform at the time and she was shocked and embarrassed by Dr Ford’s instruction. She did not know why she needed to take off her clothes for a sore throat but was too shy and embarrassed to object. Dr Ford did not offer any explanation, nor did he offer her any privacy. Ms R lay on the examination bed for the examination, during which time she was fully exposed to Dr Ford being clothed only in her underpants. In carrying out the examination Dr Ford checked the glands under Ms R’s arm but did not examine her throat in any way or carry out any other examination. As she was getting dressed he made the comment that she was “developing nicely”. Ms R never returned to see Dr Ford.

**Finding:** The majority of the Tribunal were satisfied that Dr Ford was guilty of conduct unbecoming a medical practitioner and that conduct reflects adversely on his fitness to practise medicine. One member of the Tribunal departed from the majority because, notwithstanding that he was satisfied that the factual basis of the charge was established and that Dr Ford’s conduct towards Ms R was inappropriate, he was not satisfied that the threshold for a professional disciplinary offence was reached.

The Tribunal was satisfied both particulars were established and that Dr Ford’s conduct towards Ms R was insensitive, and, given her symptoms unnecessary and inappropriate. The Tribunal considered, even in 1984, patients especially young, vulnerable, female patients were entitled to have their privacy and particular needs respected.

Mrs S

**Charge:**

1. When Mrs S was presenting with ear pain Dr Ford asked inappropriate and unnecessary questions about her sex life “so you enjoy sex then” or words to that effect.
2. Against the patient’s wishes Dr Ford insisted on carrying out an examination for melanoma which required her to undress the top half of her body. In the context of a consultation for ear infection this examination was unnecessary and inappropriate.
3. In carrying out this examination Dr Ford failed to obtain the patient’s informed consent.

**Background:** Mrs S went to see Dr Ford with ear pain. Dr Ford checked her ears and said they both seemed fine. He suggested that she should see a dentist for a dental examination and she agreed.

Dr Ford then proceeded to ask questions of a more general and sexual nature, particularly about her late husband and they discussed his death from melanoma. Mrs S alleged that Dr Ford insisted in carrying out an examination for melanoma although this was against her wishes. Dr Ford’s nurse came in to the consultation room as a chaperone during the examination.

**Finding:** The Tribunal found Dr Ford guilty of conduct unbecoming a medical practitioner and that conduct reflects adversely on his fitness to practise medicine.

When considering Particular 1, the Tribunal was satisfied that Dr Ford did make the alleged comments and that they were inappropriate and offensive.

In relation to Particulars 2 and 3, Dr Ford was adamant that he carried out a chest examination and listened to her heart and lungs because she had complained of a cough and dizziness. He claimed Mrs S misunderstood the whole purpose of the examination of her chest.

The Tribunal was satisfied that although the factual basis of the particulars was established, it was not able to determine, to a requisite standard of proof, that the examination was “unnecessary and inappropriate”. Given that Mrs S complied with Dr Ford’s instruction to disrobe and to get on to the examination table, the majority of the Tribunal members were not satisfied that Dr Ford failed to obtain Mrs S’s proper informed consent prior to carrying out the examination. Two Tribunal members departed from the majority. The minority considered that, notwithstanding the examination occurred in 1999, some 15 years after Ms D’s consultation, the Tribunal was satisfied that Dr Ford did not offer Mrs S any explanation for the examination, or, especially, for requiring Mrs S to remove her bra. It is the minority view that, while Mrs S acquiesced and permitted Dr Ford to examine her, she did not give her “informed consent”. The minority members considered there is a difference between “consent” and mere acquiescence. Mrs S could not give her “informed consent” because she was given no “information” about the reason for the examination, or why it was necessary to take her bra off.

**Overall Finding in relation to all four charges:**

The charges laid against Dr Ford in relation to Ms D, Ms R and Mrs S were established and, in respect of each of those charges, Dr Ford was guilty of conduct unbecoming and that reflects adversely on his fitness to practise.

The charge laid against Dr Ford in relation to Ms W was not upheld and the Tribunal was satisfied that Dr Ford is not guilty of the charge notwithstanding that certain of the particulars of that charge were established.

**Penalty:** The Tribunal ordered as follows:

1. Dr Ford be censured in relation to each of the three established charges.
2. Dr Ford to pay fines in the following amounts:
(a) as to the charge concerning Ms D: $450.00 (maximum $1,000);
(b) as to the charge concerning Ms R: $600.00 (maximum $1,000);
(c) as to the charge concerning Mrs S: $2,000.00 (maximum $20,000).

3. For a period not exceeding three years from the date of the penalty decision, Dr Ford is to practise medicine only in accordance with the conditions set out below:
   - Dr Ford is required to have a chaperone present for all intimate examinations undertaken on female patients and is to ensure that the entitlement all patients have to have a chaperone or support person present during consultations if they wish, is notified to them by means of a notice to that effect in the reception area and all consultation rooms used by him at his practice rooms, and any after hours practice or medical centre attended by him;
   - Dr Ford is to provide an explanation of the purpose of the examination to the patient concerned in the presence of the chaperone or support person;
   - Except in an emergency situation, in the event that a female patient declines a chaperone and/or a support person to be present, or no appropriate person is available or willing to act in this capacity, then Dr Ford is to refer the patient to another practitioner. That is, the intent of these conditions is that Dr Ford is not to perform intimate examinations on female patients in the absence of either a chaperone provided by him, or a support person whom the patient requests to accompany her, for example, a parent, friend, partner or spouse;
   - Dr Ford is to be referred to the Medical Council’s Health Committee for assessment and such assistance as the Committee may consider necessary;
   - Dr Ford is not permitted to undertake any teaching in general practice, either to his peers or junior practitioners. The Tribunal is satisfied that given the nature and circumstances of his offending, it is not appropriate for him to be undertaking such a role in a professional context.

4. Dr Ford to pay costs in the sum of $36,769.87.

5. Dr Ford to be referred to the Medical Council’s Sexual Misconduct Assessment Team to undergo evaluation and any subsequent counselling, treatment and/or monitoring that the Team may consider necessary and appropriate. Any report of the Sexual Misconduct Assessment Team to be referred to the Medical Council’s Health Committee for such assistance as the Committee may consider necessary.

6. A report of the Tribunal’s Substantive Decision and the Penalty Decision is to be published in the New Zealand Medical Journal.

The full decisions relating to the case can be found on the Tribunal web site at www.mpdt.org.nz Reference No: 01/84C.
Failure to provide the necessaries of life

Charge: A Complaints Assessment Committee charged that Dr Ian Scott Little was convicted of the following offences each being an offence punishable by imprisonment for a term of three months or longer:

1. Failure to provide the necessaries of life, section 151 Crimes Act 1961;
2. Advertising the availability of Exoderm Facial Peel before consent or provisional consent of the Minister to the distribution of Exoderm had been notified, section 20(2) Medicines Act 1981 (2 counts).

The charge alleged that the circumstances of the offences reflected adversely on Dr Little’s fitness to practise medicine.

Dr Little pleaded guilty to the three charges above. Dr Little had pleaded guilty to a charge of failing to provide the necessaries of life in the High Court at Christchurch and was fined $30,000. Dr Little was discharged pursuant to s347 of the Crimes Act in relation to a charge of manslaughter. In relation to the two convictions against the Medicines Act, the District Court fined Dr Little $5,000 on each charge plus costs.

Background: In 1999, Dr Little was practising as a general practitioner specialising exclusively in the field of appearance medicine. In approximately April 1998, Dr Little was approached by the New Zealand distributor of a phenol-based preparation known as “Exoderm” which was marketed as a safer alternative to other phenol-based preparations used in appearance medicine. Dr Little advised that he had been doing chemical face peels since 1993 and he therefore had considerable experience in carrying out the procedure.

Phenol (also known as carbolic acid) produces a chemical peeling effect when applied to the face. One of the known side-effects of phenol is that it can cause cardiac arrhythmia and, on occasions, cardiac arrest. As a result, doctors using phenol-based preparations regard continuous cardiac monitoring and the availability of appropriate resuscitative drugs and emergency equipment as essential when carrying out chemical face peeling procedures.

Dr Little entered into an exclusivity arrangement with the distributor of Exoderm. Dr Little was apparently assured that there was no risk of cardiac arrhythmia occurring, such as was present with the existing chemical peel procedures. Dr Little performed ten Exoderm procedures without incident. The tenth of these procedures was filmed and shown on the Holmes television programme as a marketing exercise. In some but not all of the ten procedures undertaken, Dr Little used a pulse oximeter (which monitors oxygen levels in the blood and also the patient’s pulse). The use of a pulse oximeter was recommended by the developer of Exoderm and was used in the procedure shown on the Holmes show.

The procedure that was the subject of the charge was also carried out as a marketing exercise. Dr Little performed the procedure in the presence of a photographer who was taking photos for publication in an article in the New Idea women’s magazine.
The patient had a number of risk factors for cardiac disease. However when she presented for the procedure she was symptom free and in apparently good health.

Dr Little had ordered a resuscitation kit and a pulse oximeter but at the time of the procedure neither had arrived. The patient signed a consent form prior to the procedure, but the form did not indicate to her that Dr Little intended to carry out the procedure in a way which did not conform either to the recommendation that pulse oximetric monitoring be maintained during the procedure or to the ANZCA guidelines for “Sedation for diagnostic and surgical procedures”.

In sentencing Dr Little, the High Court Judge remarked that “rational communication” with the patient was lost from the outset of the procedure and he should not have resumed the procedure unless another doctor was available to monitor the patient and to take responsibility for further sedation, analgesia or resuscitation. There was also no continuous monitoring of “the level of consciousness and cardio-respiratory function of the patient” which was required under the guidelines, particularly as there was no pulse oximeter.

The evidence provided to the sentencing Judge was that during the procedure the patient appeared to be in a deep sleep. She did not grimace or moan or respond when spoken to. There was evidence that the patient snored during the procedure. About 30 minutes into the operation, the patient gave a bit of a start and took a gasp of breath and then seemed to sigh. Dr Little responded by administering morphine. The patient then gave a loud sigh or groan and it was at about this time that it became apparent that there was a major problem. Dr Little called out to the patient but there was no response. Dr Little attempted to rouse the patient but there was no response and it was then discovered that she had no pulse and was not breathing.

Dr Little and his nurse attempted resuscitation. However, no artificial airway was available as it had been left in Dr Little’s car. Dr Little had no oxygen available nor did he have a suction device or manual resuscitator. An ambulance was summoned and with their equipment the ambulance officers were able to continue resuscitation attempts but were unsuccessful. After approximately 30 minutes or so, the ambulance officers formed the view that the situation was hopeless. Dr Little instructed the officers to continue resuscitation in the ambulance on the way to hospital and eventually the patient was successfully resuscitated in the ambulance to the extent that full cardiac activity was restored. However, by then she had suffered irretrievable brain damage and she died in hospital three weeks later.

Finding: The Tribunal was satisfied the convictions reflected adversely on Dr Little’s fitness to practise medicine. The Tribunal expressed concerns about the level of insight Dr Little truly had about the nature of his failure to provide adequate care to the patient and the degree to which he fell short of acceptable standards of care. The Tribunal considered he seemed to still blame others for what happened. The Tribunal was satisfied in terms of his professional obligations towards the patient on the day of the procedure, and especially in the course of administering and managing her sedation, there could be no suggestion that others could, or should, have done more to keep his patient safe.

The Tribunal put to one side the fact that Dr Little’s conduct was also the subject of the other proceedings in other contexts. It is required to adhere to the statutory purpose of the Act, and to take into account the fact that the patient’s death had
occurred squarely in the context of a doctor-patient relationship. The Tribunal considered as her doctor, Dr Little owed obligations to the patient over and above any obligations he owed as a citizen, and that he failed to take responsibility for his care of the patient in the following respects:

1. He did not act in the patient’s best interests in that he failed to have regard to either her particular interests as his patient, or her interests relative to his own;

2. Pre-procedure - He failed to make an adequate pre-procedure assessment of the patient’s needs in terms of:
   - her suitability to undergo the procedure,
   - the presence of known risk factors in the context of the procedure,
   - the likelihood that the risks known to be associated with phenol-based procedures might eventuate, and/or
   - the need to ensure her safety during the procedure and in event of an emergency;

3. During the procedure - His management of the major sedation he administered could only be described as “abysmal”. He lacked basic equipment, and basic knowledge. The Tribunal did not accept his evidence that the patient was ‘rousable’, i.e. “conscious” as required under the relevant guidelines, during the procedure. His shortcomings in this regard is exacerbated by his unapproved use of a medicine with serious potential side effects.

4. Emergency care - His instruction to the ambulance officers to continue resuscitation was not in the best interests either of the patient or her family and greatly increased their subsequent suffering and distress.

The Tribunal further considered it was also relevant that the procedure was elective, so there was no clinical reason why the procedure had to occur at that time, or even at all.

The Tribunal was satisfied that Dr Little was motivated to carry out the procedure by commercial considerations and he failed to turn his mind to keeping his patient safe. His failure to provide proper care to the patient constituted the most serious departure from professional standards.

**Penalty:** The Tribunal ordered that Dr Little be censured, that his name should be removed from the register and that he may not apply for restoration to the register for a period of not less than six months. Dr Little was also ordered to pay 50% of the costs and expenses of and incidental to any or all of the CAC’s inquiry and prosecution of the charge and the hearing by the Tribunal.

The Tribunal further ordered that if Dr Little’s name is restored to the register after six months, then for a period of three years from the date of the Tribunal’s Decision he is to practise under the following conditions:

(a) Dr Little is not to undertake procedures that involve sedation; and
(b) Anaesthesia is to be restricted to local anaesthesia; and
(c) In order to ensure compliance of this condition, Dr Little is to keep a log of procedures including medication that is to be countersigned by a registered nurse who has knowledge of the procedures performed. That log is to be available for regular review; and

(d) In the event that any procedures requiring the administration of sedation are undertaken at any clinic owned and/or operated by Dr Little, then an appropriately trained medical practitioner other than the practitioner carrying out the procedure must be present and be responsible for the administration of sedation and monitoring the patient; and

(e) If there is a risk of loss of consciousness during any procedure undertaken by or under the supervision of Dr Little, then an anaesthetist must be present to care exclusively for the patient.

In a supplementary order the Tribunal ordered publication of the hearing in the New Zealand Medical Journal.

The full decisions relating to the case can be found on the Tribunal web site at www.mpdt.org.nz Reference No: 02/92C.
Mutyala Satyanand

Mutyala Satyanand, or “Saty” as he was known in the profession and the community, an Auckland general practitioner for 50 years, died at Hillsborough in Auckland aged 89, at the end of October 2002.

Saty was born in Fiji in 1913, and first came to New Zealand in 1927 on a Fiji government scholarship, to attend Wanganui Technical College. He went to Otago Medical School, which he attended from Knox College, graduating MB ChB in 1938. He was the first Fiji-born Indian medical graduate and his initial intention was to return and practise medicine in Fiji, after undertaking a house surgeonship at Auckland Hospital under Charles Burns and Frank Gwynne. The outset of World War II and the resultant manpower regulations kept him in the employment of the Auckland Hospital Board, and his return to Fiji became postponed. He took up practice in Grey Lynn, initially with FCM Shortt.

After the end of the War, Saty elected to remain in New Zealand, although retaining his lifelong interest in and connection with Fiji and its people. In the late 1940s, he commenced practice in Ponsonby and over the next decade became widely known in the community as both a general practitioner and as someone involved with what was then not called ‘sports medicine’. Over a lengthy period, there were many cricketers, rugby league players and jockeys who were treated by “Dr Saty”.

A period of ill health in the mid 1950s caused him to effect changes to a wide-ranging practice, and he shifted to Auckland’s estern suburbs. From consulting rooms in Glen Innes and Glendowie, he left behind such things as tonsillectomies and confinement of babies, but maintained his abiding interests in sport, the profession and the community. Many very long connections with practitioners in sporting matters, such as Leo Cooney, Cal Ring, Ash Symmans and Minas Elias, were the result, as were associations with the Auckland Faculty Board Undergraduate Education Committee, the Catholic Doctors Guild, and the Auckland Medico Legal Society.

Saty retired from full-time sole practice in 1985, but kept up with current medical literature. He also did general practice locums, often with GP friends such as Kanu Patel and Rajiv Sood, until late in his 70s he finally retired to the Hillsborough Heights Village in Auckland.

He had been a role model and friend to many – in medicine, and in the Indian community, as well as more generally. His citation in becoming an honorary fellow of the Royal College of General Practitioners was recalled in part in an obituary printed by the NZ Weekend Herald: “a high professional reputation among his general practitioner and specialist colleagues as well as a great personal popularity among the public, based on a dignified and sympathetic personal manner and a well established
professional integrity.” He was awarded an OBE in New Zealand in 1985 and the Order of Fiji in 1999.

Mutyala is survived by his wife, Tara, and children, Anand and Vijay.

We are grateful to Judge Anand Satyanand for this obituary.
Erratum


The NZMJ apologises to the family of Dr Bruce Cornish for the error in his recent obituary. Dr Cornish’s third son is named Philip, not Stephen, as previously published.

Please refer to the above URL to view the corrected copy of the obituary.
Management of perinatal infections


I would like to strongly recommend this publication to all GPs, paediatricians and obstetricians. I believe it would also be useful reading for all lead maternity carers.

This slim A4 booklet uses algorithms to beautifully summarise the current “best practice” in managing women during pregnancy who develop a range of infections, especially where there is any concern that the passenger (the fetus) is at risk of suffering from the infection as well. There are up to six different algorithms for each condition, depending on the different decision points reached in the clinical management. Some cover the management of the newborn baby who is affected (or potentially affected).

The critical points are backed up with appropriate references. I found it particularly useful to look up the management of suspected parvovirus infection in pregnancy – an area of special interest – and fully agreed with the management strategies suggested!

The important infections covered are CMV infection, Enterovirus infection, hepatitis B and C, herpes simplex virus, HIV, listeria, TB, parvovirus, rubella, group B Streptococcus, Toxoplasma, syphilis, and varicella-zoster virus. Each section has been written by an Australasian expert in the relevant infection. They are certainly the people that I would call upon should I have a clinical query in these areas. I suspect they’ll have fewer phone calls as a result of this publication.

I strongly recommend this booklet to all practitioners looking after women during pregnancy.

Barry Taylor
Professor of Paediatrics and Child Health
Dunedin School of Medicine
**This Issue in the Journal**

**Ischaemic heart disease, Type 1 diabetes, and cow milk A1 β-casein**  
M Laugesen, R Elliott

A1 β-casein in the per capita food supply was correlated with Type 1 diabetes in 10 countries by Elliott (1997). It was also correlated with ischaemic heart disease (IHD) ten years later in 17 countries by McLachlan (2001). Both papers were largely based on estimates from herd tests of cow breeds. This paper demonstrates that A1 β-casein and milk protein correlated more strongly with IHD five years later than did other food supply variables, but only in affluent countries (20 countries). A1 β-casein is also correlated strongly with Type 1 diabetes (19 countries).

**Estimated folic acid intakes from simulated fortification of the New Zealand food supply**  
T Green, R Newton, D Bourn

The consumption of folic acid from dietary supplements and/or fortified foods has been shown to reduce the risk of neural tube defects (eg, spina bifida) in babies. Using computer modelling, our study evaluated the impact of fortifying food with folic acid on folic acid intakes. It is impossible to fortify food at a level that ensures the majority of women receive the recommended amount of folic acid/day (400 µg/day) without exposing some people to excessive amounts of folic acid.

**The use of complementary/alternative medicine by cancer patients in a New Zealand regional cancer treatment centre**  
K Chrystal, S Allan, G Forgeson, R Isaacs

The use of alternative cancer treatments was surveyed in 200 patients attending a major cancer treatment centre in New Zealand. Almost 50% used a variety of alternative treatments, either to improve quality of life, or to increase the chances of cancer cure. While most felt such treatments had been of some benefit, only a minority had discussed the use of these treatments with their specialist. This is of concern, as there are potential interactions between alternative therapies and conventional treatment.

**Understanding of pulse oximetry among hospital staff**  
G Davies, A Gibson, M Swanney, D Murray, L Beckert

Pulse oximetry is widely used to assess patients’ oxygenation in a hospital setting. This study investigates the understanding of pulse oximetry among doctors and nurses at Christchurch Hospital. Strengths and training needs are identified in comparison to a similar study at Exeter, UK. The results are presented, comparing nurses’ knowledge of oximetry with that of doctors.
Alcohol and injury among attendees at a New Zealand emergency department
G Humphrey, S Casswell, DY Han

This WHO-sponsored study is the first in New Zealand to examine the relationship between alcohol and injury among people attending an Auckland emergency department. Thirty five per cent of injury cases were found to be alcohol-related, which is high by international standards. Alcohol was shown to increase the risk of injury; the more alcohol consumed, the greater the risk. Young males were over-represented among the ED attendees – a finding consistent with other New Zealand alcohol consumption statistics showing young men under 30 as heavy drinkers.