Are we meeting cardiovascular risk targets 3 years after acute coronary syndrome? An evaluation in West Auckland, New Zealand

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Abstract

Aim Several studies have shown poor achievement of cardiovascular targets in high risk patients. We measured these targets in patients with Acute Coronary Syndrome, three years after discharge from Waitakere Coronary Care Unit.

Method A retrospective observational study was performed. All patients discharged in 2006 were included. Admission data was extracted from computerised records and patients were subsequently invited for appointment. Data collected included: blood pressure, lipid profile, BMI, smoking status, HbA1c, medications and contraindications, and lifestyle factors. Results were analysed and compared with national targets.

Results Data was collected on 112 patients (22 patients died, 18 excluded and 18 lost to follow up). There was good compliance with blood pressure (mean 120/70 mmHg), smoking cessation and medication targets. However 22% of patients were not prescribed an ACE inhibitor at follow-up. Lipid profile improved, although only 52% of patients met LDL targets. There was no difference between admission and follow-up BMI. HbA1c had increased slightly, however this was not statistically significant. Eight diabetic patients (n=27) had an HbA1c of less than 7% at follow-up.

Conclusion Although a small sample population, results showed mixed compliance but not as poor as previously reported. More effort is needed to attain LDL, HbA1c and BMI targets, and ensure ACE inhibitor initiation.

Cardiovascular disease remains the leading cause of mortality in New Zealand. The modification of cardiovascular risk factors has been proven to reduce mortality. Subsequently national guidelines have been devised to improve cardiovascular risk factors. The New Zealand Guideline Group (NZGG) published extensive guidelines in 2003 which were updated in 2009.

This guideline outlines the most important targets with respect to: smoking, weight, diabetic control, diet and exercise, blood pressure, cholesterol and pharmacological treatment. The targets for patients with established cardiovascular disease and high risk patients are:

- Blood pressure less than or equal to 130/80 mmHg
- BMI less than 25, but in patients with a BMI less than 35 an initial goal of 10% weight loss is more realistic
- Lipids
  - Total Cholesterol less than 4 mmol/L
- HDL more than 1 mmol/L
- LDL less than 2.0 mmol/L
- Cholesterol ratio less than 4.0
- Triglycerides less than 1.7 mmol/L

- All patients should be prescribed the combination of aspirin, beta-blocker, ACE Inhibitor and statin unless contraindicated
- Minimum of 30 minutes of moderate intensity physical activity on most days of the week
- Smoking cessation should be strongly and repeatedly recommended
- HbA1c less than 7%
- At least 3-4 portions of fruit and 3-4 servings of vegetables per day

In New Zealand, several studies have suggested that compliance with targets is poor, especially among certain population groups. El-Jack et al, audited patients in South Auckland with established coronary artery disease that had recently been discharged from hospital. They reported that 37% of patients failed to reach total cholesterol of less than 5 mmol/l and 55% had a LDL of more than 2.6 mmol/l. In addition, over 40% of patients had a blood pressure greater than 140/90 mmHg. Thirty-four of patients were prescribed ACE inhibitors, and 45%, prescribed beta-blockers. Selak et al reported that only 28%, increasing to 32% in 2003, of people with established vascular disease were on blood pressure and cholesterol lowering medications. Peris et al found better compliance, 78.1% of high risk patients were prescribed anti-hypertensive medication, 71.9% lipid lowering and 65.3% anti-platelet agents. With increasing numbers of patients throughout New Zealand being admitted with ACS, compliance is of growing importance.

In view of this reported poor compliance in high risk patients we have evaluated patients 3 years following discharge from Waitakere Hospital after admission with Acute Coronary Syndrome (ACS). Waitakere Hospital provides secondary healthcare for over 180,000 people. Patients admitted with acute coronary syndrome receive education from doctors and nurses while in hospital. After discharge patients attend an outpatient appointment for review by a cardiologist or cardiology registrar. They are invited to attend a cardiac rehabilitation program.

This comprehensive programme consisting of six sessions, during which patients are educated regarding their condition, new medications, secondary prevention and the importance of risk factor modification. The aim of our study was to measure attainment of NZGG targets and highlight any areas of weakness.

**Methods**

Local ethics committee and Nga Kai Tataki Maori Research Committee approval was obtained. Each patient gave written consent before participation. Patient details were obtained from the Coronary Care Unit (CCU) admission book. All patients discharged from Waitakere CCU in 2006 with acute coronary syndrome were included. All discharge summaries from 2006 were analysed and a study population was identified. Acute coronary syndrome was defined as unstable angina, non-ST elevation myocardial infarction or ST elevation myocardial infarction. Patients were excluded if the troponin rise was attributed to a cause other than myocardial infarction, if they had relocated or could not attend clinic.
The following admission variables were recorded from the computerised records (Concerto) or cardiac rehab database; coronary angiography report, age, sex, diabetic status, admission and discharge dates, diagnosis, lipids, HbA1c, BMI, discharge medications and contraindications, ejection fraction, past medical history of depression or hypertension and attendance at cardiac rehab. No admission blood pressure was collected. The authors felt measurements would not have been a true reflection of long term hypertension due to treatment effects and the acute phase response during ACS.

Patients were then invited to attend a research appointment (April to May 2010) with a follow-up range of 41-53 months. The following variables were collected; blood pressure (complying with NZGG guidelines\(^8\)), BMI (complying with NZGG guidance\(^8\)), smoking status, family history (first degree relative younger than 55 years for male or 65 years old for female), current medication and known contraindications, lifestyle habits and employment. Contraindications for beta-blockers were obstructive airway disease, peripheral vascular disease, bradycardia, hypotension, heart block, decompensated heart failure and allergy.

For aspirin contraindications were previous gastrointestinal bleed, hypercoagulability and allergy. Liver disease or allergy were contraindications for statins. And finally, contraindications for ACE inhibitors were bilateral renal artery stenosis, electrolyte disturbance, symptomatic hypotension and allergy. If patients did not tolerate a medication because of side effects they were included in the contraindicated group. Exercise was classified as more than a total of 30 minutes of activity per day; enough to cause the patient to be slightly short of breath. Follow-up lipids levels and HbA1c were recorded from Concerto. If levels had not been recorded in the previous six months blood tests were rechecked. Data was analysed using paired t-test in SPSS (version 17.0, 2007).

Results

Patients—A total of 369 patients were discharged from CCU in 2006 (see Figure 1). 170 patients were diagnosed with ACS. Twenty-two patients had died at follow-up. Eighteen patients were excluded and 18 patients were lost to follow-up, leaving 112 patients. Cardiac rehabilitation was defined as attending at least two of six rehab session. Sixty-seven patients met this definition.

Patient demographics are shown in Table 1. Most patients were male (n=86) and the mean age was 66.73 years. NZ Europeans comprised the majority of the participants. Over 20% of patients suffered from diabetes and a considerable number had a family history of cardiovascular disease (49.1%) or hypertension (59.8%).

Only one patient did not have lipids checked on admission and this was due to a laboratory strike. Thirteen patients had not received lipid levels measurements in the six months prior to follow up. Twelve of these patients attended a blood test upon request. Four patients did not have HbA1c checked on admission. Only one patient had not had their HbA1c checked in the six months prior to follow-up. Admission BMI was unavailable for two patients.
Figure 1. Flow chart showing included and excluded patient

Table 1. Patient demographics

<table>
<thead>
<tr>
<th></th>
<th>Mean age (SD)</th>
<th>66.73 years (11.92)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>86 pts (76.8)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>26 pts (23.2)</td>
<td></td>
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<tr>
<td><strong>Diagnosis (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSTEMI</td>
<td>73 pts (59.8)</td>
<td></td>
</tr>
<tr>
<td>STEMI</td>
<td>31 pts (27.7)</td>
<td></td>
</tr>
<tr>
<td>Unstable Angina</td>
<td>8 pts (7.1)</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZ Europeans</td>
<td>69 pts (61.1)</td>
<td></td>
</tr>
<tr>
<td>Indian</td>
<td>10 (8.9)</td>
<td></td>
</tr>
<tr>
<td>Pacific Island</td>
<td>6 pts (5.4)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>3 (2.7)</td>
<td></td>
</tr>
<tr>
<td>Maori</td>
<td>5 pts (19.6)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>19 pts (16.9)</td>
<td></td>
</tr>
<tr>
<td><strong>Diabetes (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-insulin requiring DM</td>
<td>22 (19.6)</td>
<td></td>
</tr>
<tr>
<td>Insulin requiring DM</td>
<td>6 (5.4)</td>
<td></td>
</tr>
<tr>
<td><strong>Family history (%)</strong></td>
<td></td>
<td></td>
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<tr>
<td>Cardiovascular disease</td>
<td>55 (49.1)</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>67 (59.8)</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>7 (6.3)</td>
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</table>

Blood pressure, smoking status, BMI, HbA1c and lipid targets—Median systolic blood pressure was 120 mmHg (range 78-180 mmHg, SD 15.08) and median diastolic blood pressure was 70 mmHg (range 50-90 mmHg, SD 8.02). Eighty-five patients (75.9%) had a blood pressure less than 130/80 mmHg.

On admission 24.1% (n=27) of patients were current smokers, 41.1% (n=46) ex-smokers and 34.8% (n=39) had never smoked (see Figure 2). At follow-up 51.9% (n=14) of the smokers had stopped. Three patients who were ex-smokers on admission re-started smoking by follow-up.
Median BMI on admission was 28.4 (range 18.8-44.9, SD 4.6). At follow-up median BMI was 27.8 (range 20.5-48.9, SD 5.1). There was no statistical difference between admission and follow-up (p value 0.58, 95% CI -0.02, 0.90). At follow-up 27 patients (24.1%) had a BMI of less than 25 and 74 patients (66.1%) had a BMI less than 30, as seen in Figure 2. Twenty-two patients (20.0%) lost more than 5% body weight, eight patients (7.3%) lost more than 10% body weight and 16 patients (14.5%) gained more than 5% bodyweight.

The median HbA1c in patients with diabetes was 6.8% (range 5.7-13.4, SD 1.8) on admission and 7.6% (range 5.8-12.3, SD 1.6) at follow-up. Figures 2 show that on admission 16 patients (total =24) had a HbA1c of less than 7% and at follow-up only eight (total =27) had a HbA1c of less than 7%. There was no significant statistical difference between admission and follow-up (p value 0.79, 95% CI -1.14,0.07).
Table 2. Admission and follow-up lipids

<table>
<thead>
<tr>
<th>Lipids</th>
<th>Admission (SD)</th>
<th>Follow-up (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol</td>
<td>4.7 (1.2)</td>
<td>3.9 (1.1)</td>
</tr>
<tr>
<td>(mmol/L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDL (mmol/L)</td>
<td>1.1 (0.3)</td>
<td>1.1 (0.3)</td>
</tr>
<tr>
<td>LDL (mmol/L)</td>
<td>2.8 (1.1)</td>
<td>2.0 (0.8)</td>
</tr>
<tr>
<td>Ratio</td>
<td>4.2 (1.2)</td>
<td>3.4 (1.3)</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>1.6 (0.9)</td>
<td>1.4 (1.0)</td>
</tr>
</tbody>
</table>

Lipid results are shown in Table 2 and Figure 3 show the number of patients who met targets at follow-up. Eighty-two patients (73.9%) met HDL targets but only 58 pts (52.3%) met LDL targets at follow-up. Over 60% of patients met targets for total cholesterol (62.2%), ratio (64.9%) and triglycerides (64.0%).

There was a significant statistical difference in total cholesterol levels (p value <0.001, 95% CI 0.38, 0.87), LDL (p value <0.001, 95% CI 0.34, 0.77), ratio (p value <0.001, 95% CI 0.42, 0.90) and borderline significant difference in triglycerides (p value 0.05, CI 0.0002,0.39). There was no significant statistical difference between admission and follow-up HDL (p value 0.82, CI -0.90,0.01).

Figure 3. Patients who met lipid targets at follow-up

![Figure 3](http://www.nzma.org.nz/journal/124-1343/4879/)

Medications—One patient on discharge and one at follow-up were not prescribed aspirin without contraindication (see Figure 4). Only one patient on discharge and three patients at follow-up were not prescribed a statin without contraindication. Three patients (2.7%) were not prescribed a beta-blocker on discharge and seven (6.3%) at follow-up without contraindication. Thirty-one patients (27.7%) were not prescribed an ACE inhibitor or ARB on discharge and 25 (22.3%) were not prescribed an ACE inhibitor or ARB without contraindication at follow-up. On discharge 74
patients (66.1%) were not prescribed GTN spray; however at follow-up 30 patients (26.8%) were not prescribed GTN.

Figure 4. Discharge and follow-up medications

Figure 5: Follow-up exercise and diet responses
Exercise and diet—Nineteen patients (17.0%) at follow-up were performing 30 minutes of exercise more than five times per week. Twenty patients (17.9%) claimed not to be performing any exercise (see Figure 5). Most patients either consumed 1-2 or 3-4 portions of fruit and vegetables (36.6% and 39.3% respectively). Only four patients had seven or more portions. Approximately half of patients (47.3%) consistently reduce their salt intake and 8.9% never attempted to reduce salt consumption (see Figure 5). Seventy-two patients (64.3%) consistently reduced dietary fat and there were no patients who never attempted to reduce their intake of fat.

Discussion

Our results show mixed achievement of NZGG targets, but this was not as poor as previous reported studies. Our results show considerable improvement, despite higher targets, compared with El-Jack et al.\textsuperscript{10} Hopefully this improvement reflects better clinical management, reflected in other previous studies.\textsuperscript{11} However the differences in health inequalities cannot be excluded.

The most comparable study by El Jack et al.,\textsuperscript{10} was performed in South Auckland; a population with a higher percentage of Pacific Island and Maori peoples\textsuperscript{14}. Whereas there is a higher percentage of New Zealand European peoples in the west Auckland region surrounding Waitakere Hospital.\textsuperscript{14} Unsurprisingly our results show improved lipid management compared to Ellis et al in 1998.\textsuperscript{15} In a study of 641 patients they found a mean total cholesterol of 5.7 mmol/l, although only 32% of patients were prescribed lipid lowering medications.

Collecting data directly from patients, in combination with computerised records system, provides high quality data; although inaccuracies of patient reported smoking status, exercise and diet are well known.\textsuperscript{16} Guidelines were followed when measuring blood pressure and BMI at follow-up, providing consistently accurate results. However admission BMI was collected from a range of sources, such as clinic letters and angiogram reports. Sixteen percent of patients were lost to follow up which may result in a small selection bias. Twenty-two patients died over the three year follow-up period.

The resulting survivor bias may have lead to an over estimation of compliance. There were eighteen patients who were lost to follow-up, this may have led to further bias if these patients were less compliant. It should also be noted that a considerable proportion of patients may have previous cardiovascular disease. Therefore many of them may have already been prescribed blood pressure or lipid lowering medications. If all patients with previous established cardiovascular disease had been excluded there may have been a greater improvement in target compliance. Admission medication histories were taken from discharge summaries and therefore should be accurate. However we suspect that many patients were prescribed GTN spray on discharge and this was omitted from the discharge summary.

We compared results with current guidelines issued in 2009. However patients’ primary care provider, usually a general practitioner, may still be using 2003 guidance. Although a detailed lifestyle questionnaire was not completed, we believe our results show the need for further efforts to improve diet and exercise.
Although only a small number of patients were included, our data is more consistently accurate compared with large population studies. Validity was further improved by including all patients discharged from 2006. Only patients admitted to CCU were included. Although it is hospital policy to admit all patients with ACS to CCU there may have been patients in non-CCU wards who had ACS and were not included in our study. We did not face the same problems of missing data as reported in other studies measuring compliance.

In our study we recorded patients who had a documented contraindication or were able to provide a contraindication or intolerance at clinic appointment. This may reflect our better compliance with medication targets. Undoubtedly our population is composed of patients who have had considerable interaction with secondary care. It is therefore unsurprising, that compliance in our population is better.

Blood pressure control was surprisingly good, with nearly 76% of patients achieving target blood pressures. Despite the potential “white coat effect” median blood pressure was 120/70 mmHg. Similarly lipid levels show good compliance with targets. Ninety-seven percent of patients were taking statins. Only 58% achieved LDL target suggesting inadequate uptitration after discharge. At follow-up over 70% of patients met targets for HDL, over 60% targets for total cholesterol and triglycerides and over 80% target for cholesterol ratio. Only HDL did not show a statistically significant improvement. The attainment of blood pressure and lipid targets is due to patient education. This requires contribution from cardiac specialists, nurse specialists, cardiac rehabilitation team (specialist, nurse specialist, pharmacist, dietician and physiotherapist) and general practitioners post discharge.

Compliance in aspirin, statin and beta-blockers prescription are excellent. Prescriptions of ACE inhibitors require improvement. ACE Inhibitors have been shown to benefit patients post ACS but perhaps more so the subgroups with left ventricular impairment and/or hypertension. Normotensive subjects may get postural hypotension potentially making it difficult for the clinician to establish the patient on this therapy. Prescription of beta-blockers and statin decreased marginally over the follow up period. This may reflect contraindications which were not documented. Alternatively, three years following an event, medication compliance may decrease as patients no longer appreciate the importance of secondary prevention.

High rates of smoking cessation were achieved (51% of smokers stopping). This demonstrates the effective use of smoking cessation advice. Improvements could still be made. Slightly concerning was the finding that three patients had restarted smoking during follow-up. This highlights the need for continual smoking cessation support for months and years post ACS.

Undoubtedly weight reduction continues to be challenging. It was pleasing to see that most patients were making a concerted effort with dietary and exercise regimens. Despite this, the majority of patients remained overweight or obese. One in five patients had lost 10% body weight. Current advice is that in the immediate period after a cardiac event patients should aim to maintain the same weight. We have found that even after three years patients still struggle to lose weight.

Over three years HbA1c increased. Although this increase is not statistically significant it is clinically significant. Only eight patients had an HbA1c of less than
7%. This increase probably reflects disease progression rather than poor management. The important role of diabetic control in cardiovascular risk is well known. Policy makers and clinicians need to increase efforts at tighter glycaemic control within a well structured multidisciplinary team.

Our study shows that compliance within West Auckland is better than reported, for patients who remain alive at 3 years follow-up and are able to attend follow-up clinic. However there is still a large treatment gap, especially in relation to BMI, HbA1c and lifestyle. Compliance with blood pressure and lipid targets are very good, although there is room for improvement in relation to ACE inhibitors. Further study is needed to conclude if these differences reflect differences in data quality, health inequalities or improved public health measures.

Competing interests: None.

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References: