Quality of life of patients with chronic stable angina before and four years after coronary revascularisation compared with a normal population

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INTERVENTIONAL CARDIOLOGY AND SURGERY

Objective: To assess the impact of coronary revascularisation on the health related quality of life (HRQOL) of patients with chronic stable angina compared with data from “community” norms four years following revascularisation.

Design: Prospective survey and review of medical records.

Setting: Seven of the eight public Swedish heart centres that performed coronary artery interventions.

Subjects: 827 patients aged 55–79 years with chronic stable angina who underwent coronary artery revascularisation in 1994 or 1995 and completed the four year HRQOL survey.

Main outcome measures: Five components of the Swedish quality of life survey.

Results: Compared with age and sex adjusted population norms, patients at baseline had significantly lower mean scores on all five functioning and wellbeing scales (p < 0.001). Four years after revascularisation, the mean levels of functioning and wellbeing were similar to those in the normative population (p > 0.05) except for quality of sleep (p < 0.001). The improvements were the same across age groups and for men and women. However, 36% of men and 55% of women were not completely free from angina by four years (p < 0.001). Men without angina after four years had better HRQOL than their community norms (p < 0.001) on all dimensions except quality of sleep (p > 0.05). Women without angina had less pain (p < 0.01) and better general health perception (p < 0.05) but similar physical functioning, quality of sleep, and emotional wellbeing compared with their community counterparts. Both men and women who had suffered at least one anginal attack during the preceding four weeks had significantly worse HRQOL by four years than their community norms (p < 0.01).

Conclusions: By four years following revascularisation, three fifths of patients with chronic stable angina were free of angina and their HRQOL was the same as or better than that of the general Swedish population. However, fewer than half of all women and two thirds of men who underwent revascularisation were angina-free after four years. Among patients with new or persistent angina, the HRQOL was worse than that in community norms.

Randomised controlled trials have shown that coronary artery bypass graft (CABG) surgery improves survival for patients with severe coronary artery disease. Patients with less severe disease often elect to undergo coronary revascularisation to reduce their angina and to improve their quality of life. An important question for these patients, and for their physicians, is how effective will coronary intervention be in improving their quality of life?

The quality of life of patients with coronary artery disease may be assessed with a variety of validated instruments. Some of these instruments, such as the Seattle angina questionnaire and the physical activity score, are specific for coronary disease. Others, such as the medical outcomes study short form 36, the Nottingham health profile (NHP), and the Swedish quality of life survey (SWED-QUAL), provide a more generic assessment and allow comparisons with normal populations.

Although there have been several reports on the quality of life of patients following coronary revascularisation, there have been few reports comparing the outcomes in these patients with population norms and, when they have been done, they often represent very select populations. Brown and colleagues compared the functioning and wellbeing of myocardial infarction survivors with normative data and found that patients under age 65 years had lower scores and those over age 65 had similar scores compared with community norms.

As part of the SECOR/SBU (Swedish coronary revascularisation-Swedish Council on Technology Assessment) study, a prospective study to assess the appropriateness of the use of coronary revascularisation, we examined the quality of life of a population based cohort of Swedish patients who underwent revascularisation through a four year follow up. We examined whether the functioning and wellbeing of patients with chronic stable angina improved to a level similar to that of the general Swedish population.

METHODS

Patients

The SECOR/SBU study design and data collection have been reported previously. In brief, we screened 4398 patients who underwent coronary angiography in seven of the eight public Swedish heart centres in 1994 and 1995. Patients were excluded if they declined to participate or deferred intervention (n = 62), had a previous CABG (n = 291), had undergone percutaneous transluminal coronary angioplasty (PTCA) within the previous six months (n = 184), were referred for evaluation of congestive heart failure, arrhythmia, or possible cardiac transplantation.

Abbreviations: CABG, coronary artery bypass graft; HRQOL, health related quality of life; NHP, Nottingham health profile; PTCA, percutaneous transluminal coronary angioplasty; RITA, randomized intervention treatment of angina; SECOR/SBU, Swedish coronary revascularisation—Swedish Council on Technology Assessment; SWED-QUAL, Swedish quality of life survey.
that assesses positive and negative affect; and (e) a single item scale with somnolence; (d) emotional wellbeing, a 12 item scale addressing problems with sleep initiation, maintenance, and adequacy; (c) quality of sleep, a six item scale that addresses sleeping discomfort; and (b) relief from pain, a six point Likert scale ranging from none to four or more times a day during the preceding four weeks. Frequent angina symptoms were explicitly defined and have been previously published. Patients who died were identified by computerised linkage to the Swedish national discharge register. The remaining 1142 patients with chronic stable angina were asked to participate in this observational study and to complete standardised questionnaires regarding their symptoms, functioning, and wellbeing before coronary angiography and six months, 21 months, and four years following revascularisation. This report focuses on a comparison between baseline and four year results. Among the 1013 patients (88.7%) who answered the baseline questionnaire, 757 had undergone CABG and 256 had undergone PTCA. For this report, we combined the patients who received CABG and PTCA into a single group since we previously found that by four years following revascularisation there were no differences in health related quality of life (HRQOL) between patients who underwent these procedures.

RESULTS

Among the 1013 patients who answered the baseline questionnaire, 827 (82%) completed the four year follow up questionnaire. Fifty nine patients (6%) died during follow up and 127 of the survivors (13%) did not respond to the four year survey. Among responders, 649 were men and 178 were women.

Before entry into the study, significantly more of those who later died had sustained a myocardial infarction, peripheral vascular disease, congestive heart failure, or reduced left ventricular function (p < 0.01 for all comparisons). Surviving responders and non-responders had a history of myocardial infarction, symptom severity (according to the Canadian Cardiovascular Society classification system), and angina frequency similar to those reported by the patients (p > 0.05). While there was a trend towards higher comorbidity among non-responders the only significant differences were a higher rate of stroke or transient ischaemic attack (p < 0.001) and worse physical functioning (p < 0.05) (table 1).

Patients who had surgery and angioplasty differed with respect to subsequent interventions. Within two years after the primary intervention, 2% of the 615 surgical patients and 33.5% of the 212 angioplasty patients had undergone additional revascularisation procedures (p < 0.001). At both the six month and the 21 month follow up surveys, surgical patients reported significantly better physical functioning (p < 0.01), less pain (p < 0.01), better quality of sleep (p < 0.05), and a more positive general health perception (p < 0.001), but similar emotional wellbeing compared with angioplasty patients. These results are in accord with previously published results from this study on patients with one or two vessel disease. However, since there were no significant differences at baseline or four years in functioning and wellbeing between patients referred for CABG and those referred for PTCA (p > 0.05), we present the results for all patients who underwent revascularisation as one group.

Comparison of HRQOL of patients with population norms

Figure 1 shows the mean HRQOL scores (and their 95% confidence intervals) of patients with chronic stable angina who survived four years following coronary revascularisation compared with the Swedish population norms adjusted for age and sex. At baseline, before revascularisation, the patients' mean scores on all domains were substantially lower, implying poorer quality of life, than Swedish population norms.
The mean difference in scores ranged from 13–16 points on a 100 point scale for four of the five domains. A smaller difference was found for the domain of emotional wellbeing. By the four year follow up, the levels of functioning and wellbeing among patients had improved to the same level as population norms (p > 0.05) for all domains except quality of sleep, which was still lower than community norms (p < 0.001). The level of improvement we found in physical functioning, increasing from 66 at baseline to 78 at four year follow up, would have occurred if the proportion of respondents who either could not walk 100 m or could walk that distance only with difficulty before revascularisation were able to walk that same distance without difficulty following revascularisation.

Subgroup analysis by sex
We next examined whether there were any differences between the patients who had undergone revascularisation and the normative population by sex while controlling for age differences. At baseline, both male and female patients had significantly lower mean scores for all HRQOL domains than their population norms (p < 0.001). By four years, male and female patients reported levels of relief of pain, emotional wellbeing, and general health perception similar to the population norm (p > 0.05). However, male patients reported significantly better physical functioning (p < 0.05) and female patients significantly worse physical functioning (p < 0.05) than the population norm.

Subgroup analysis by age
We then compared patients’ HRQOL by age group (that is, ages 55–62, 63–70, and 71–79 years) with that of the population norm while controlling for sex. We found that patients, irrespective of age group, had systematically lower scores at baseline (p < 0.001). By four years, with the exception of quality of sleep, which was still lower among patients aged 63 or older (p < 0.05), and emotional wellbeing, which was lower in those aged 63–70 years (p < 0.05), there were no longer any significant differences in HRQOL between patients and the normative population (p > 0.05).

Effect of angina on HRQOL
Before revascularisation, 97% of patients were classified as having Canadian Cardiovascular Society angina class II or

### Table 1

Characteristics of Swedish patients with chronic stable angina who underwent coronary revascularisation and survived at least four years, by response to four year follow up questionnaire

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Responders to baseline and four year questionnaire (n=827)</th>
<th>Surviving non-responders to four year questionnaire (n=127)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>66.0</td>
<td>66.6</td>
<td>0.33</td>
</tr>
<tr>
<td>Male sex [%]</td>
<td>78.5</td>
<td>73.2</td>
<td>0.19</td>
</tr>
<tr>
<td>Angina class III/IV [%]</td>
<td>60.1</td>
<td>59.1</td>
<td>0.82</td>
</tr>
<tr>
<td>Comorbid illness [%]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior myocardial infarction</td>
<td>43.2</td>
<td>46.5</td>
<td>0.49</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>16.2</td>
<td>22.0</td>
<td>0.10</td>
</tr>
<tr>
<td>Stroke/transient ischaemic attack</td>
<td>6.7</td>
<td>16.5</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Renal disease</td>
<td>1.5</td>
<td>3.1</td>
<td>0.17</td>
</tr>
<tr>
<td>Peripheral vascular disease</td>
<td>7.5</td>
<td>10.2</td>
<td>0.29</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>8.6</td>
<td>12.6</td>
<td>0.14</td>
</tr>
<tr>
<td>Chronic obstructive lung disease</td>
<td>3.9</td>
<td>4.7</td>
<td>0.65</td>
</tr>
<tr>
<td>Hypertension</td>
<td>37.4</td>
<td>46.5</td>
<td>0.05</td>
</tr>
<tr>
<td>Very positive stress test</td>
<td>69.3</td>
<td>69.4</td>
<td>0.98</td>
</tr>
<tr>
<td>Left ventricular ejection fraction &lt;50%</td>
<td>23.8</td>
<td>26.0</td>
<td>0.60</td>
</tr>
<tr>
<td>Severity of coronary artery disease [%]</td>
<td></td>
<td></td>
<td>0.21</td>
</tr>
<tr>
<td>Left main or 3 vessel stenosis</td>
<td>55.6</td>
<td>52.8</td>
<td></td>
</tr>
<tr>
<td>1 or 2 vessel stenosis involving the PLAD</td>
<td>18.3</td>
<td>14.2</td>
<td></td>
</tr>
<tr>
<td>1 or 2 vessel stenosis not involving PLAD</td>
<td>26.1</td>
<td>33.1</td>
<td></td>
</tr>
<tr>
<td>Angina frequency and HRQOL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angina attacks ≥ 3 times a week</td>
<td>69.5</td>
<td>68.5</td>
<td>0.82</td>
</tr>
<tr>
<td>Physical functioning</td>
<td>69.9</td>
<td>66.2</td>
<td>0.03</td>
</tr>
<tr>
<td>Relief from pain</td>
<td>63.2</td>
<td>60.8</td>
<td>0.27</td>
</tr>
<tr>
<td>Quality of sleep</td>
<td>57.2</td>
<td>57.5</td>
<td>0.89</td>
</tr>
<tr>
<td>Emotional wellbeing</td>
<td>66.1</td>
<td>63.6</td>
<td>0.26</td>
</tr>
<tr>
<td>General health perception</td>
<td>55.6</td>
<td>52.2</td>
<td>0.12</td>
</tr>
</tbody>
</table>

*Angina class as defined by the Canadian Cardiovascular Society.

HRQOL, health related quality of life (minimum score is 0; maximum score is 100); PLAD, proximal left anterior descending coronary artery.

![Figure 1](http://heart.bmj.com/)

Mean (95% confidence interval (CI)) Swedish quality of life survey (SWED-QUAL) scores at baseline and by four years for patients with chronic stable angina who had undergone coronary revascularisation compared with age and sex adjusted Swedish norms (minimum score is 0; maximum score is 100).
higher by their cardiologist. At the same time, 98% of patients reported that they had angina attacks at least once during the preceding four weeks and 68% reported frequent angina (angina three or more times a week). By four years, 60% of patients reported that they were free from angina, 28% that they had angina fewer than three times a week, and 12% that they had frequent angina (p < 0.001).

When we compared HRQOL by angina frequency among patients, we found a strong effect on all five HRQOL domains (p < 0.001) (table 2). For example, mean physical functioning among patients without angina during the preceding four weeks was 88 compared with 76 among those with angina fewer than three times a week and 66 among those with frequent angina (p < 0.001). Compared with age and sex adjusted population norms, patients without angina had better physical functioning, quality of sleep, and emotional wellbeing compared with their population counterparts.

Both male and female patients who had experienced at least one anginal attack during the preceding four weeks had significantly worse HRQOL by four years than their population norms (p < 0.01) (fig 5). The strong effect of angina was also present when we compared age groups. Irrespective of age group, patients without angina had similar or better HRQOL and patients with angina had similar or worse HRQOL compared with the population norm. Table 3 summarises the results of the comparisions by sex and age group. Female patients with and without angina had lower physical functioning scores than male patients four years following revascularisation (p < 0.01 for all comparisons). There were no significant differences between male and female patients for the other four HRQOL domains.
population sample in the six major domains from part I of the
patients were found to have similar functioning to a general
outcomes after elective bypass surgery of 84 male patients
paring patients undergoing coronary revascularisation with
results are similar to three other reports in the literature com-
still found to be significantly lower among patients. Our
year follow up. The exception was quality of sleep, which was
lation norms in four of the five domains examined in the four
that patients improved their HRQOL to levels similar to popu-
55–79 years at the time of intervention and four years follow-
In this study we compared the health related functioning and
functioning and wellbeing of Swedish patients with chronic stable angina aged
55–79 years at the time of intervention and four years follow-
coronary revascularisation with those of a population
based cross sectional cohort of Swedish citizens. We found
patients who had undergone coronary revascularisation and reported angina at the four year follow up
compared with age adjusted Swedish norms, by sex (minimum score
is 0; maximum score is 100).

DISCUSSION
In this study we compared the health related functioning and wellbeing of Swedish patients with chronic stable angina aged
55–79 years at the time of intervention and four years follow-
coronary revascularisation with those of a population
based cross sectional cohort of Swedish citizens. We found
patients who had undergone coronary revascularisation and reported angina at the four year follow up
compared with age adjusted Swedish norms, by sex (minimum score
is 0; maximum score is 100).

Figure 5  Mean (95% CI) SWED-QUAL scores for patients with
chronic stable angina who had undergone coronary
revascularisation and reported angina at the four year follow up
compared with age adjusted Swedish norms, by sex (minimum score
is 0; maximum score is 100).

We also found that the HRQOL patients achieve following
revascularisation is strongly influenced by whether they
experience angina. In our study, patients who experienced
angina had lower HRQOL scores than community norms
while those without angina had higher scores. More than half
the women in our study had angina on four year follow up
compared with one third of the men. Similar findings have
been reported regarding patients who have undergone
revascularisation.10

In contrast to a study from western Sweden, which reported
that men experienced better HRQOL than women following
revascularisation,6 we found similar outcomes after control-
ling for angina and age. Although the HRQOL scores for men
in our study, irrespective of anginal status, were generally
higher than for women, these differences reached significance
only for physical functioning. This makes intuitive sense since
the scale that measures physical functioning includes
questions such as “Can you perform strenuous activities
(such as heavy manual work, strenuous sports) without diffi-
culty?” There may be several explanations for these contrast-
results. Our study was restricted to patients with chronic
stable angina and we followed outcomes through four years.
The western Swedish study included all patients who
underwent bypass surgery, except those also receiving valve
surgery, and outcomes were followed for only two years. In
addition, the western Swedish population had a much higher
prevalence of left main or three vessel coronary artery disease
than our patients (80% vs 55%). Thus, their population was less
homogeneous, had more severe disease, and was followed for
less time.

One unique finding of our study was that the quality of
sleep was the same for patients without angina and the popu-
lation norm. This was in contrast to the better HRQOL in the
other four domains for patients without angina compared
than community norms. Among patients with angina, the
quality of sleep was significantly worse than community
norms. This may indicate that the adverse quality of sleep
experienced by patients with angina is a direct effect of their
angina while their quality of sleep in patients without angina
is not improved compared with community norms.

Table 3  Summary of statistical tests of differences in HRQOL between Swedish
population norms and patients with chronic stable angina who underwent coronary
revascularisation, by angina status, sex, and age four years following
revascularisation

<table>
<thead>
<tr>
<th>Characteristics of patients</th>
<th>Physical functioning</th>
<th>Relief from pain</th>
<th>Quality of sleep</th>
<th>Emotional wellbeing</th>
<th>General health perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>No angina</td>
<td>↑↑↑↑</td>
<td>↑↑↑↑</td>
<td>=</td>
<td>↑↑↑↑</td>
<td>↑↑↑↑</td>
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<tr>
<td>Men</td>
<td>↑↑↑↑</td>
<td>↑↑</td>
<td>=</td>
<td>↑↑↑↑</td>
<td>↑↑↑↑</td>
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<tr>
<td>Women</td>
<td>=</td>
<td>=</td>
<td>=</td>
<td>=</td>
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<tr>
<td>Age 55–62</td>
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<td>=</td>
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<tr>
<td>Age 63–70</td>
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<td>=</td>
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<tr>
<td>All</td>
<td>↑↑↑↑</td>
<td>↑↑</td>
<td>=</td>
<td>↑↑↑↑</td>
<td>↑↑↑↑</td>
</tr>
<tr>
<td>Angina</td>
<td>↑↑↑↑</td>
<td>↑↑</td>
<td>=</td>
<td>↑↑↑↑</td>
<td>↑↑↑↑</td>
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<tr>
<td>Men</td>
<td>↑↑↑↑</td>
<td>↑↑</td>
<td>=</td>
<td>↑↑↑↑</td>
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<td>Women</td>
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<td>Age 55–62</td>
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<td>Age 63–70</td>
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<tr>
<td>All</td>
<td>↑↑↑↑</td>
<td>↑↑</td>
<td>=</td>
<td>↑↑↑↑</td>
<td>↑↑↑↑</td>
</tr>
</tbody>
</table>

↑↑↑, patients have significantly better HRQOL than population norm; ↓↓↓, patients have significantly worse HRQOL than population norm. ↑↑↑, p<0.001; ↑↑, p<0.01; ↑, p<0.05; =, p>0.05.
Patients may also be interested in other outcomes such as cognitive function, employment, and sexual function. Health care administrators and public health specialists might be interested in the relation between a patient’s social class and educational status and the outcomes they experience. Physicians may wonder how effective medical treatment was in patients at low risk with stable coronary artery disease. Unfortunately, we could not address these issues in this study.

Ultimately, the question that we must address is how this information will best help us to make decisions in the future. Health care decision making, whether by the patient or the physician, is relying to ever greater degrees on the evidence we find in clinical research. We already know that patients with severe coronary artery disease achieve better outcomes with bypass surgery than with medical treatment. Among patients with disease treatable by both bypass surgery and PTCA, pain relief is greater with bypass surgery and there is less chance of undergoing a second revascularisation procedure. Our study extends these findings by providing detailed outcomes data for patients with chronic stable angina, the most common indication for revascularisation in Sweden and many other countries, who could be treated by bypass surgery or angioplasty.

We may counsel patients that by four years after revascularisation, three fifths of them will be free of angina and more than one quarter will experience angina fewer than three times a week. The quality of life for patients without angina will actually be better than or similar to that of people in the community. However, fewer than half of all women and two thirds of men who undergo revascularisation will be angina-free after four years.

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