Contemporary mortality due to acute myocardial infarction, unstable angina and exertional angina in a population in South East London

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Summary

Background: Data on the contemporary mortality of coronary heart disease (CHD) are surprisingly sparse.
Aim: To describe the contemporary mortality of all manifestations of CHD.
Design: Prospective follow-up of patients with a first presentation of CHD in a defined population.
Methods: We studied 537 patients with a first presentation of acute myocardial infarction, unstable angina or new exertional angina in Bromley Health Authority, London (population 295 000). Patients were prospectively monitored for cardiac and non-cardiac mortality for a median of 6 years.

Results: During a median 6 years follow-up, there were 88 (16%) deaths. Survival free from cardiac death was not significantly different between unstable angina (92%) and new exertional angina (94%), but was lower for acute myocardial infarction (84%).

Discussion: Mortality from CHD appears to be falling. However, efforts to prevent myocardial infarction should continue to be a priority, because on-going early mortality remains high. New exertional angina should be diagnosed and managed promptly, as its mortality is similar to that of unstable angina.

Introduction

The government has identified a reduction in mortality from Coronary Heart Disease (CHD) as one of its key targets for the NHS. To this end, a National Service Framework for CHD was published in March 2000.¹

Optimal strategies for reducing CHD mortality require an understanding of its contemporary clinical epidemiology; such data are surprisingly sparse. While trials and registries report event rates, these do not relate to a defined population, and cannot give accurate population mortality data.

Regionally or nationally collected statistics have the advantage of large numbers of events, but individuals are poorly characterized, and accuracy of diagnosis cannot be readily ascertained.

We have previously published data on the contemporary presentation of CHD based on a rigorously identified cohort of all first presentations of CHD in people aged <75 years within Bromley Health Authority.² Bromley Health Authority has a single secondary-care provider for emergency care, and is representative of an urban population. The
SMR for CHD in men aged < 65 years is 72% of that for England overall (BHF statistics), allowing transference of findings to the wider English population and beyond.

This cohort has been followed longitudinally to provide accurate mortality data for incident cases of CHD.

Methods

The study population consisted of patients registered with a General Practitioner working within Bromley Health Authority. At the mid-point of data collection the population was 295,000 (Bromley Health Authority, personal communication).

The coronary register identified all incident cases of coronary heart disease among people in this population aged 25–74 years. The coronary register project was led by a dedicated research nurse working closely with the cardiologists, general practitioners, health authority and coroners covering the study population, and directly supervised by a clinician with training in cardiology and epidemiology (DAW).

Data were collected between September 1996 and August 1997 for men (12 months) and between September 1996 and May 1998 for women (21 months). The longer period of data collection in women was to obtain adequate numbers of incident cases in the face of the lower incidence of CHD in women.

Case ascertainment

1. The rapid-access chest pain clinic
A rapid-access chest pain clinic (RACPC) was in operation throughout the period of data collection. General Practitioners were invited to refer all cases of suspected new exertional angina to the daily RACPC. In addition, patients suspected of having new exertional angina seen in the Emergency department, but not requiring admission, were seen in the RACPC the next working day.

2. In-patient surveillance
All new admissions to Bromley Hospital (which had the only Emergency department within the Health Authority) were screened to detect possible cases of incident CHD. Cases of sudden death brought to the Emergency Department were also identified in this way.

3. Sudden cardiac death surveillance
Surveillance was maintained of the two coroner’s offices serving the Health Authority population. Sudden deaths in the community and hospital deaths reported to the coroner were all investigated as possible cases of incident CHD. This included including Bromley residents who died outside the Health Authority with ICD9 codes for coronary artery disease (410–414).

4. Bromley Health Authority
Bromley Health Authority supplied data on all patients admitted to hospitals in England and Wales with ICD 9 codes for coronary artery disease (410–414). Details of admissions to hospitals outside Bromley Health Authority were obtained, to establish whether these represented incident cases of CHD.

Case definition

Cases were defined on the basis of information obtained on the patient’s history, clinical examination findings, electrocardiogram (ECG), blood tests, exercise stress tests, myocardial perfusion scans, and post mortem information, subject to availability, but not the results of coronary angiography.

All cases were presented to a panel of three consultant cardiologists (DAW, EL, FA) who assessed the available information to see whether cases fulfilled the case definitions used in this study. In cases of disagreement, a majority decision was accepted. Only incident cases were included, and therefore evidence to confirm the absence of a previous presentation with CHD was also sought. The reproducibility of panel decisions was tested by re-presenting 100 (approximately 10% of the total) randomly selected cases.

The case definitions were:

Sudden cardiac death. Death attributed to coronary artery disease generally within 12 h of onset of symptoms, based on review of case descriptions and post mortem findings, or coroner’s categorization as sudden cardiac death.

Acute myocardial infarction. Typical history, resting ECG changes and cardiac enzymes elevated to twice the upper limit of the laboratory normal range (creatine kinase). Troponins were not used in this study.

Unstable angina. Typical chest pain at rest or rapidly worsening exertional pain, no evidence of myocardial damage by enzyme assay (creatine kinase not troponins) with or without ECG changes. This definition was based on the one used by the European Society of Cardiology.

Exertional angina. Typical history, wherever possible with positive results from objective testing for myocardial ischaemia (exercise stress testing or myocardial perfusion imaging).
Audit of case ascertainment

In addition to the systematic methods to ensure completeness of ascertainment described above, we also audited a sample of general practices in Bromley Health Authority, including 8/59 randomly selected practices (14%) (25/151 general practitioners = 17%). Practice computerized prescription records were analysed for all newly initiated prescriptions of nitrates during the data collection period. Patients identified in this way, who were not included in the Coronary Register, had their records examined to see if they were a potential missed case of incident CHD. Only four such missed cases were identified.

Follow-up for mortality

Cases were followed-up through the Office of National Statistics. Notification of deaths and death certification details were obtained at regular intervals through the follow-up period (until June 2003). Cause of death was independently classified by two experienced clinicians into cardiac and other causes based on death certification.

Data analysis

All data were entered on case record forms for the Bromley Register, and transferred to a dedicated Microsoft Access database. Statistical analysis used STATA software.

Results

The reproducibility of panel decisions was excellent. Agreement between the panel diagnosis on initial presentation and re-presentation was 91% (Cohen’s κ = 0.86, p < 0.001).

Over the 21 months, 620 incident cases of CHD were identified: 83 (13%) were sudden cardiac deaths. The remaining 537 patients were therefore followed longitudinally, and their baseline characteristics are shown in Table 1. A total of 2955 person-years at risk were observed, with a median follow-up of 6 years. By June 2003, 88 patients (16%) had died (Table 2). Kaplan-Meier curves for all-cause mortality are shown in Figure 1.

Kaplan-Meier curves for all-cause mortality given survival at 3 months are shown in Figure 2. Although mortality was significantly greater for cases presenting with acute myocardial infarction, this difference disappeared when only those who survived for 3 months were analysed.

Figure 3 shows the Kaplan-Meier curves for specifically cardiac mortality. All cardiac deaths were related to CHD. The age-adjusted hazard ratios for cardiac death by presenting diagnosis are shown in Table 3. The age-adjusted hazard ratio (95% CI) for unstable angina vs. exertional angina was 1.1 (0.5–2.9) (p = 0.79).

Discussion

In this study of the contemporary mortality of coronary heart disease, median 6-year survival free from cardiac death was not significantly different between unstable angina (92%) and new exertional angina (94%), but was lower for acute myocardial infarction (84%).

The population of Bromley Health Authority is well delineated, being served by a single Emergency department and a single RACPC. The population has a lower proportion of ethnic minorities than other urban health authorities, and is perhaps marginally more affluent, but is otherwise representative of an urban population. The SMR for CHD in men <65 years is 72% that for England overall (BHF statistics: [http://www.heartstats.org/temp/Tabsp1.7spweb04hs2hs.xls]). There was inevitably some population movement during the study,

Table 1  Baseline characteristics of Bromley Coronary Register by diagnosis (n = 537)

<table>
<thead>
<tr>
<th></th>
<th>New exertional angina</th>
<th>Unstable angina</th>
<th>AMI</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>284 (53%)</td>
<td>79 (15%)</td>
<td>174 (32%)</td>
<td>537 (100%)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>157 (55%)</td>
<td>48 (61%)</td>
<td>121 (70%)</td>
<td>326 (61%)</td>
</tr>
<tr>
<td>Female</td>
<td>127 (45%)</td>
<td>31 (39%)</td>
<td>53 (30%)</td>
<td>211 (39%)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;50</td>
<td>25 (9%)</td>
<td>6 (8%)</td>
<td>27 (16%)</td>
<td>58 (11%)</td>
</tr>
<tr>
<td>50–59</td>
<td>77 (27%)</td>
<td>23 (29%)</td>
<td>36 (21%)</td>
<td>136 (25%)</td>
</tr>
<tr>
<td>60–69</td>
<td>121 (43%)</td>
<td>30 (38%)</td>
<td>63 (35%)</td>
<td>214 (40%)</td>
</tr>
<tr>
<td>≥70</td>
<td>61 (21%)</td>
<td>20 (25%)</td>
<td>48 (28%)</td>
<td>129 (24%)</td>
</tr>
</tbody>
</table>

Data are numbers (percentages). *Percentage of all patients; **Percentage of diagnostic group.
but less so than if an inner-city population had been chosen.

Extensive efforts were made to ensure completeness of ascertainment, as described in Methods. Assiduous hospital surveillance was backed up by multiple visits and contacts with coroner’s officers, the health authority and neighbouring hospitals. Most importantly, the RACPC was extremely effective at identifying all new cases of exertional angina, as evidenced by the audit of general practices. The use of nitrate prescriptions (short- or long-acting) provides a reasonable and readily available, if imperfect, marker of angina cases in general practices using computerized prescribing.

Despite these efforts, there will inevitably have been under-ascertainment: for example, a non-fatal acute myocardial infarction treated at home would have been missed. However, this would seem a relatively unlikely scenario amongst those aged <75 years, the age band for this study. Similarly there may be patients who have angina and do not present to health services at all. If they die, they may be categorised as sudden cardiac death without recognition of the antecedent angina. Epidemiological data suggest that unrecognized angina does not have a lower mortality than clinically diagnosed angina. A further limitation is that the low mortality means that there were only 88 deaths, and this is reflected in the confidence intervals for the hazard rations.

Comparative data on the contemporary epidemiology of CHD are few. Trials represent highly selected groups, and registries do not identify a population (denominator) to enable calculation of event rates. A number of longitudinal cohorts do exist, but many of these are quite old and predate...
These studies have also tended to report only one manifestation of CHD (myocardial infarction or angina), whereas this study has investigated mortality across the spectrum of presentation of CHD.

Despite these concerns, it may still be useful to note registry outcomes. Our data do show
similarities to recently published data from the GRACE registry (approximately 12% 6-month mortality for ST and non-ST elevation myocardial infarction, and 6% 6-month mortality for unstable angina). A possible explanation for our lower mortality is that the GRACE registry is drawn from selected secondary and tertiary care hospitals, and may not reflect true population data; it also includes prevalent cases. The Euro Heart Survey on Acute Coronary Syndromes reported 3-month mortalities of 8.4% for ST elevation acute coronary syndromes and 3.5% for non-ST elevation acute coronary syndromes, approximating to our categories of acute myocardial infarction and unstable angina.

Data from the Oxford Myocardial Infarction incidence study derive a 28-day hospital mortality for myocardial infarction of 16% for a cohort (all ages) collated over 12 months in 1994/5. This appears higher than our 1-year cardiac mortality of 9% for myocardial infarction cases. However, using historical controls, they report a trend from 1966 of falling case fatality rates, and our data are therefore consistent with an ongoing similar trend.

In terms of comparative studies of exertional angina, the Framingham study, a true comprehensive longitudinally studies cohort, reports outcomes, but from 1971. The mortality of angina was approximately 4% per annum; substantially higher than in our study. More recently, a cohort of new exertional angina patients similarly rigorously identified in Southampton identified a 2.3% annual mortality amongst cases. This is not significantly different from our data (M. Gandhi, personal communication), and also supports a falling CHD mortality.

One recent study has investigated trends in the incidence of both angina and myocardial infarction. Reporting on men only and relying on recorded diagnoses, the British Regional Heart Study described a falling incidence and mortality from acute myocardial infarction, although a rise in angina incidence was seen over a 22 year period.

This study has three main findings. First, the early mortality of acute myocardial infarction remains substantial, but survivors fare reasonably well in the longer term. Second, the prognosis of unstable angina and new exertional angina are similar. Third, mortality rates for unstable and new exertional angina are low (although based on limited numbers of events) and appear to have fallen compared with previous reports. Care for patients with CHD in Bromley included prompt access to diagnostic and treatment services through the RACPC, aggressive use of coronary intervention for acute coronary syndromes, and a comprehensive and proven-effective programme of secondary prevention for all patients at first presentation with CHD.

These findings have important practical implications. First, efforts to prevent acute myocardial infarction should remain a high priority. Second, the assessment, investigation and treatment of new exertional angina should be pursued with the same rigour as that for unstable angina, and thus rapid-access clinics offering prompt diagnosis and risk stratification, combined with early medical treatments and revascularization where appropriate, are needed. Third, while the falling mortalities are likely to be due to both changing epidemiology of disease, as well as improved treatment, current approaches to treatment with aggressive risk factor reduction and revascularization seem justified.

## Conclusions

These data provide contemporary information about 6-year cardiac mortality across the complete spectrum of incident CHD. In this rigorously identified and monitored cohort, median 6-year survival free from cardiac death was not significantly different between unstable angina (92%) and new exertional angina (94%) but was lower for acute myocardial infarction (84%), due primarily to deaths in the first 3 months after the event.

## Acknowledgements

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References


