Gender differences in management after acute myocardial infarction: not ‘sexism’ but a reflection of age at presentation

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Abstract

Objective To test whether women receive less intensive treatment and fewer risk stratification tests following acute myocardial infarction (MI), than men.

Methods A retrospective study of medical records in all district general hospitals and tertiary referral centres for cardiology in Wales was performed. Patients (n = 1595, of which 989 were men) admitted to hospital over 4 months with a diagnosis of acute MI had their case notes reviewed for treatment, stratification of risk factors and secondary prevention. Data were analysed for differences in treatment between men and women and whether these could be attributed to age at presentation.

Results Women were older than men at presentation [mean age 75 (SD 11) versus 66 (12) years, \( p < 0.01 \)]; fewer women received thrombolysis (34 versus 44 per cent) and low molecular weight heparin (63 versus 71 per cent) (both \( p < 0.001 \)); and women had higher 30 day mortality (28 versus 17 per cent, \( p < 0.001 \)). Fewer women received cardiac catheterization, investigations to identify high risk, drugs for secondary prevention on discharge and referral to cardiac rehabilitation. However, intensities of treatment, investigation and secondary prevention were strongly related to age and, after adjusting for age, gender differences remained only for thrombolysis and exercise testing.

Conclusion Although women receive fewer investigations and treatments than men, this potential gender bias can be explained by age. The lower use of treatment and investigation among older patients draws attention to the lack of direct evidence of effectiveness for these patients. Further studies are needed to confirm effectiveness of investigations and treatments in older patients.

Keywords: acute myocardial infarction, management, age not sex

Background

Age-standardized death rates for coronary heart disease (CHD) have fallen progressively since the late 1970s, yet acute myocardial infarction (MI) remains common, particularly in the elderly. The time trend in mortality can be attributed both to improvements in risk factor profile (and incidence) and to treatment.2 Many randomized controlled trials have demonstrated that treatments with thrombolysis, aspirin, beta blockade, angiotensin converting enzyme inhibitors and statins, reduce mortality and morbidity both acutely and in the long term.3–6

Recommendations for use of these treatments are summarized in European and national guidelines.7–15 However, the evidence for practice is drawn largely from trials of relatively young patients, often under age 65, and predominantly in men. Primary trials also routinely exclude patients with co-morbidities. Thus, the effectiveness of treatment of older patients, including higher proportions of women, and patients with significant co-morbidities, is partly deduced by extrapolation of the findings of trials in younger patients.

A number of studies have suggested that the diagnosis of MI is more difficult in women and in older patients.16 Studies have also reported that women with heart disease are treated less intensively than men.17–21 Few of these studies have separated the influences of gender and age19,22 and the consensus in a recently updated text prevails, that women remain disadvantaged.23 The present study examines inequalities in investigations and treatment of MI in men and women and relates these to differences in age.

Methods

The study was based on all 19 district general hospitals or regional specialist centres in Wales. All patients with a diagnosis of acute MI during 4 months in January, February, July and August 1999 were included, irrespective of age. The study included patients who infarcted in hospitals and those with co-morbidities, as well as those admitted with primary diagnosis of MI. Trained research assistants read the clinical records and extracted data on to standard forms. Data were reviewed for accuracy (by I.W. and A.B.) and then transferred to computer
by an optical reading scanner for analysis, using the Statistical Package for Social Sciences (SPSS Version 10, Chicago IL, USA).

All patients were included in the comparisons of early treatment and patients discharged and living at 30 days were included in the comparisons of risk stratification and secondary prevention. Differences in simple proportions were compared by $\chi^2$ test and multiple logistic regression was employed to investigate the contribution of gender and age. Results are given as odds ratios, comparing older to younger decades and women to men. A probability of $<0.05$ was considered significant.

**Results**

The records of 1595 patients were analysed. Sixty-two per cent of patients were male, with a mean age of 66 (SD 12) years; and 38 per cent were female, with a mean age of 75 (SD 11) years ($p < 0.01$) (Fig. 1). More than one half (53 per cent) of the patients, 41 per cent of men and 73 per cent of women, were aged over 70 years. Sixteen records (1 per cent) of patients, identified by discharge diagnosis in hospital administration systems, were unavailable.

Higher proportions of women had a past history of hypertension (41 per cent compared with 36 per cent of men, $p < 0.05$) and of cerebrovascular accident (7 versus 4 per cent, $p < 0.05$). Slightly more women had diabetes mellitus (20 per cent compared with 16 per cent) and slightly fewer had undergone previous coronary artery bypass surgery (1.5 per cent compared with 3 per cent) (both not significant). Significantly fewer women reported smoking cigarettes (28 versus 35 per cent, $p < 0.01$). There were significant differences between women and men in the presence of arrhythmias; atrial were more frequent in women (15 versus 10 per cent, $p < 0.005$) and ventricular less frequent (10 versus 14 per cent, $p < 0.05$) but there were no other significant differences in recorded complications.

Significantly higher proportions of older patients, aged 70 and over compared with those aged under 70, had histories of ischaemic heart disease (50 versus 34 per cent, $p < 0.001$), hypertension (46 versus 39 per cent, $p < 0.01$), and previous MI (25 versus 20 per cent, $p < 0.05$), but significantly fewer older patients were current smokers (18 versus 51 per cent, $p < 0.001$). Thirty day mortality was higher in women (28 per cent compared with 17 per cent, $p < 0.001$) but this difference was fully explained by their older age distribution. Age-adjusted mortality was 21 per cent for both men and women.

Fewer women were treated with thrombolysis (34 versus 44 per cent), even when allowing for contraindications (41 versus 53 per cent), or low molecular weight heparin and IV nitrates, and fewer women received investigations to stratify subsequent risk, such as exercise testing, echocardiography, cardiac angiography or cholesterol analysis (Table 1). Fewer women, treated with thrombolysis, received TPA or other expensive agents (25 versus 37 per cent). But among those with documented contraindications to thrombolysis, similar proportions presented late (4 per cent) or with non-diagnostic electrocardiograms (5 per cent). Fewer women were prescribed drugs for secondary prevention and fewer were invited to cardiac rehabilitation. All these differences except the prescription of

![Fig. 1 Numbers of patients admitted with acute MI by age and sex.](https://academic.oup.com/jubhealth/article-lookup/264/1540978)
ACE inhibitors were statistically significant. However, women were on average 9 years older than men and, when results were compared after adjusting for age, most of these differences disappeared.

Multivariate analysis showed highly significant associations with age for all treatments and investigations, except echocardiography. Table 1 presents odds ratios for four age groups, indicating less treatment or fewer investigations with increasing age, except for echocardiography and ACE inhibitors. Significant gender differences remained only for thrombolysis and exercise testing.

Discussion

In this study of representative patients from the whole of Wales, women had higher 30 day mortality after acute MI than men. Very similar rates have been reported in comparable studies for example in Yorkshire, where mortality was 30 per cent in women and 19 per cent in men. While adjustment for age in the Yorkshire study reduced but did not eliminate the gender difference in mortality, the gender difference in this study was entirely attributable to age differences: after adjustment, male and female mortalities were identical. The Yorkshire study and others have shown that adjustment for acute phase treatment explained the gender difference in mortality, implying undertreatment of women but adjustment for acute phase treatment was not necessary in this study to explain higher early mortality in women.

The frequencies of providing early reperfusion therapy, performing investigations and prescribing drugs for secondary prevention were consistently lower in women than in men, suggesting a possible gender bias in management but the likelihood of this interpretation was much reduced, when the data were compared after adjusting for age. There were no gender differences in age-adjusted secondary prevention, and among the investigations, differences remained only for exercise testing.

There is an extensive literature suggesting gender bias in management of patients with coronary artery disease, with women being treated less intensively than men. Our primary findings are similar to those reported by others; for example, in the Yorkshire study, 37 per cent of women compared with 46 per cent of men received thrombolysis, and 33 per cent compared with 47 per cent received beta blockade on discharge. However, few studies have made appropriate adjustment for the large and well-known difference in age between typical samples of women and men with MI, which occurred in this study at mean ages of 75 and 66 years, respectively. Our data suggest that differences between men and women in investigation and in prescribing for secondary prevention were mostly attributable to age alone.

It is clear that women following MI receive fewer investigations and fewer treatments than men, but these gender differences are mostly explained by age differences. This turns a ‘gender-bias’ into an ‘age-bias’. Discussion should therefore...
focus on whether or not less treatment and less investigation of older patients can be justified or is indicative of 'under-treatment' and 'under-investigation'. For example, lower rates of reperfusion among older patients could be rationalized on grounds of higher frequencies of contraindications (bleeding diathesis, time from onset of chest pain to presentation >12 h, atypical history with non-diagnostic ECG, etc.). Indeed an age trend in contraindications for thrombolysis was observed (13–19 per cent) but, even after allowance for recorded contraindications, a strong age trend in use of thrombolysis remained.

The present study is observational, reporting typical practice in a large sample of typical patients, before introduction of the National Service Frameworks and it is not judgmental. Reporting these findings is not endorsement as good practice. In fact, the purpose of an audit is to seek variation from evidence-based guidelines. This study shows age-adjusted rates lower for thrombolysis and exercise testing among women. A lower rate of thrombolysis, without apparent justification on grounds of complications, is important, since evidence of effectiveness of thrombolysis is strong. A relatively lower rate of utilization of stress testing, coronary arteriography and exercise-based cardiac rehabilitation in older patients of either sex may be explained by the relative lack of evidence on which to base these investigations and treatments, because most studies have excluded the elderly.

In some investigations and treatments extrapolation of good evidence from younger to older patients may be justified, as for example in thrombolysis. However, where evidence is weak, as for example in cardiac rehabilitation, studies of investigations and trials of treatment should be conducted specifically in patients aged >70 years to establish evidence on which standards can be based and against which services can be audited.

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