Comparison of case fatality in south Asian and white patients after acute myocardial infarction: observational study

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Abstract

Objective—To compare mortality in south Asian (Indian, Pakistani, and Bangladeshi) and white patients in the six months after hospital admission for acute myocardial infarction.

Design—Observational study.

Setting—District general hospital in east London.

Patients—149 south Asian and 313 white patients aged <65 years admitted to the coronary care unit with acute myocardial infarction from 1 December 1988 to 31 December 1992.

Main outcome measure—All cause mortality in the first six months after myocardial infarction.

Results—The admission rate in the south Asians was estimated to be 2.04 times that in the white patients. Most aspects of treatment were similar in the two groups, except that a higher proportion of the south Asians received thrombolytic drugs (81.2% v 73.8%). After adjustment for age, sex, previous myocardial infarction, and treatment with thrombolysis or aspirin, or both, the south Asians had a poorer survival over the six months from myocardial infarction (hazard ratio 2.02 (95% confidence interval 1.14 to 3.56), $P=0.018$), but a substantially higher proportion were diabetic (38% v 11%, $P<0.001$), and additional adjustment for diabetes removed much of their excess risk (adjusted hazard ratio 1.26 (0.68 to 2.33), $P=0.47$).

Conclusion—South Asian patients had a higher risk of admission with myocardial infarction and a higher risk of death over the ensuing six months than the white patients. The higher case fatality among the south Asians, largely attributable to diabetes, may contribute to the increased risk of death from coronary heart disease in south Asians living in Britain.

Introduction

The prevalence of and mortality from coronary heart disease is higher for south Asians (Indians, Pakistanis, and Bangladeshis) living in Britain than for white people.¹⁻³ In 1979-83 the standardised mortality ratio for coronary heart disease in south Asians living in England and Wales was 136 in men and 146 in women, and, in contrast with other racial groups, south Asians showed an appreciable increase in coronary mortality (6% in men and 13% in women) between 1970-2 and 1979-83.³ Their susceptibility to coronary disease has been difficult to explain in terms of the three major reversible risk factors—cigarette smoking, hypercholesterolaemia, and hypertension^{2,4,5}—and consensus is growing that insulin resistance and its metabolic consequences may be important.⁶⁻⁸

The increased risk of coronary death in south Asians is generally assumed to reflect their higher prevalence of disease compared with the white population, but it is not known whether differences in case fatality after acute myocardial infarction contribute to the increased risk. We report a comparison of mortality in the six months after myocardial infarction of white and south

Asian patients admitted to the coronary care unit of a district general hospital in east London.

Methods

STUDY POPULATION

The study was based in Newham General Hospital, the only acute district general hospital in Newham borough (fig 1). In the 1991 census, the population of the London Borough of Newham was recorded as 212 170, of whom 22.8% were south Asian. The study population comprised all 149 (32.3%) south Asian and 313 (67.7%) white patients aged <65 years admitted with acute myocardial infarction to the hospital's coronary care unit from 1 December 1988 to 31 December 1992. We excluded 12 patients of other racial groups. If a patient was admitted twice during the study period, we used only data relating to the first admission in our analysis.

During the study period it was hospital policy to admit all patients with suspected acute myocardial infarction to the coronary care unit. The diagnosis of myocardial infarction was based on any two of the following three criteria: typical chest pain, >0.1 mV ST elevation in at least one standard or two precordial leads, and a rise in serum creatine kinase concentration to more than 400 IU/l (upper limit of reference range 200 IU/l).

DATA COLLECTION

Baseline data—including clinical and smoking history, examination findings, electrocardiographic data, cardiac enzyme concentrations, chest radiography findings, and details of treatment—were collected prospectively by a clinician and entered on to a specially designed database.⁹ We recorded racial group in all patients from their response to a direct question. We recorded a diagnosis of diabetes if the patient needed insulin, oral hypoglycaemic drugs, or dietary sugar restriction. We recorded left ventricular failure if the patient needed diuretics and had symptoms of breathlessness accompanied by the physical findings of basal crepitations or a third heart sound, or both. Results from chest radiography, echocardiography, or special investigations were not needed for the diagnosis of left ventricular failure. We did not record the blood cholesterol concentrations.

We recorded clinical outcome during admission prospectively when possible and otherwise by review of case notes. We obtained data on inpatient survival for all 462 patients used in this analysis. We obtained data on follow up after discharge by a postal questionnaire to the patients whose data on six month follow up were not available from outpatient notes or from inpatient notes after readmission to the coronary care unit. The patients who failed to respond to the questionnaire were, when possible, contacted by telephone. Details of readmissions were obtained from the case records of the relevant hospital. We obtained details of out of hospital deaths from general practitioners. The main purpose of follow up for this study was to define all cause mortality in the first six months after infarction. Last available follow up was a month or less from infarction for 13

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Table 1—Patients' characteristics and treatment by racial group. Values are numbers (percentages) unless stated otherwise

	South Asian patients (n=149)	White patients (n=313)	P value
Median (interquartile range) age	54 (49-59)	57 (50-60)	0.01
Men	129 (86.6)	259 (82.7)	0.29
Diabetes	57 (38.3)	34 (10.9)	<0.001
Smoking history:			
Non-smoker	51 (34.2)	37 (11.8)	<0.001
Former smoker	32 (21.5)	41 (13.1)	
Current smoker	66 (44.3)	235 (75.1)	
Known hypertension	46 (30.9)	86 (27.5)	0.6
Previous myocardial infarction	34 (22.8)	68 (21.7)	0.79
Median (interquartile range) time from onset of pain to admission (minutes)*	120 (64-215)	113 (60-222)	0.79
Regional ST elevation in electrocardiogram	135 (90.6)	277 (88.5)	0.60
Q waves in electrocardiogram	116 (77.9)	243 (77.6)	0.96
Treatment with aspirin or thrombolysis, or both:			
Neither	10 (6.7)	22 (7.0)	0.05
Aspirin alone	18 (12.1)	60 (19.2)	
Thrombolysis alone	8 (5.4)	32 (10.2)	
Both	113 (75.8)	199 (63.6)	
Discharged taking aspirin:			
Yes	115 (77.2)	239 (76.4)	0.92
No	13 (8.7)	31 (9.9)	
Not relevant or no information	21 (14.1)	43 (13.7)	
Discharged taking β blocker:			
Yes	61 (40.9)	129 (41.2)	0.99
No	67 (45.0)	141 (45.0)	
Not relevant or no information	21 (14.1)	43 (13.7)	
Left ventricular failure	37 (24.8)	60 (19.2)	0.16

*Not recorded in 11 south Asian and 12 white patients.

patients; three months or less for 21 patients; and six months or less for 46 patients.

ADMISSION RATES

We calculated admission rates only for the electoral wards which, from the distribution of cases and the location of hospitals, seemed to be served predominantly by Newham General Hospital. We calculated the admission rates, stratified by five year age group and sex, using data from the 1991 census (the ward of residence of each case being identified from the postcode of residence). From these we calculated a summary rate ratio for the 40-64 year age group using Mantel-Haenszel methods.¹⁰ This is only an approximate

estimate because our method of classifying race did not precisely correspond with that used in the 1991 census and because the recording of cases may still have been incomplete for some wards.

STATISTICAL METHODS

Survival was calculated by the Kaplan-Meier method¹¹ and survival probabilities expressed as percentages with 95% confidence intervals. Survival curves were compared by the log rank test. Multivariate predictors of survival were based on a proportional hazards model,¹² with tests of improvement in model fit based on the likelihood ratio. The assumption of proportional hazards was examined by inspecting log cumulative hazard curves and testing for improvement in the model with the inclusion of log time interaction terms. The distribution of discrete variables between groups was compared by the χ^2 test, and continuous variables (age and time to admission) were compared by Wilcoxon's rank sum test.

Results

PATIENT CHARACTERISTICS AND TREATMENT

Table 1 shows the patients' characteristics and treatment by racial group. Over 80% of the patients of both groups were men. The south Asians were younger; a greater proportion of them did not smoke (had never smoked or were former smokers), and a substantially greater proportion were diabetic (38.3% v 10.9%). The time from onset of pain to admission to the accident and emergency department was similar for both groups, but a slightly greater proportion of the south Asian patients received thrombolytic drugs (81.2% v 73.8%). In other respects treatment was similar, particularly with regard to the proportion of each group discharged taking aspirin and β blockers. Infarction showed a non-significant tendency to be more severe in the south Asian patients, as judged by the proportion of patients who developed left ventricular failure. No differences were found, however, between the groups in ST elevation and in Q wave development.

STANDARDISED ADMISSION RATIO

Two wards (one with four admissions and one with seven) in the northwest corner of Newham borough

Fig 1—Percentage of south Asians aged 40-64 years in wards in Greater London (area around Newham General Hospital is boxed) and in London Borough of Newham. The numbers of admissions with acute myocardial infarction are shown in the detailed map. Admission rates were calculated for the 21 wards outlined by the continuous thick line (ED-LINE and Crown copyright)

Table 2—Hazard ratios (all cause mortality) for south Asian patients compared with white patients

Adjustment	Hazard ratio (95% confidence interval)	Likelihood ratio (χ^2)*	P value
Unadjusted	1.53 (0.89 to 2.65)	2.27	0.13
Adjustment for age, sex, previous infarction, and treatment†	2.02 (1.14 to 3.56)	5.60	0.018
Adjustment for previous factors and diabetes	1.26 (0.68 to 2.33)	0.52	0.47
Adjustment for previous factors and left ventricular failure	1.44 (0.79 to 2.61)	1.39	0.24

*Df = 1.

†Aspirin or thrombolysis, or both.

seemed to be on the border of the catchment area for the hospital and were excluded from the analysis of admission rates (fig 1). In the remaining 22 wards the age and sex adjusted admission rate in the south Asians was 2.04 (95% confidence interval 1.63 to 2.54) times that in the white patients.

SURVIVAL

Survival probabilities in the south Asian and the white patients were, respectively, 89.2% (82.9% to 93.2%) and 92.6% (89.1% to 95.0%) at 30 days, and 84.8% (77.9% to 89.8%) and 89.9% (85.9% to 92.8%) at six months (log rank $\chi^2 = 2.38$, $P = 0.12$) (fig 2). Table 2 shows the hazard ratios—that is, the relative risks. After adjustment for age, sex, previous infarction, and treatment with thrombolysis or aspirin, or both, the south Asians had a significantly higher mortality over the six months from infarction. Additional adjustment for diabetes removed much of their excess risk. Inclusion of left ventricular failure in the model produced no further reduction in the hazard ratio.

Discussion

We have found no previous reports of increased case fatality in south Asian patients with acute myocardial infarction. It has generally been assumed that the higher prevalence of coronary heart disease in south Asians in Britain than in the white population accounts for their greater risk of myocardial infarction and higher coronary mortality.¹⁻³ In our analysis the admission rate for myocardial infarction was around twice as high for the south Asians as for the white patients, though this estimate is imprecise because of the difficulty of defining the catchment population and because of potential differences between our study and the census in the definition of racial groups. Nevertheless, it suggests an appreciably higher risk of myocardial

Fig 2—Kaplan-Meier survival curves (all cause mortality) for south Asian and white patients

Key messages

- South Asians living in Britain have a high mortality from coronary heart disease
- This study shows that south Asians have high mortality in the first six months after a heart attack
- This may contribute to the high standardised mortality ratios for coronary disease in south Asians living in the Britain
- Diabetes may be an important contributor to this excess risk
- The high prevalence of diabetes and relatively poor prognosis after myocardial infarction in south Asian patients are important to consider in clinical management

infarction that accords with experience elsewhere in London and other parts of Britain.¹³⁻¹⁸

Our data also suggest, however, that south Asians have a higher mortality than white people in the first six months after infarction. This contrasts with a recent, smaller study from Birmingham that suggested no significant difference in survival over a four year period after myocardial infarction.¹⁹ We do not have information, however, on case fatality before admission, and the risk of sudden cardiac death is known to be highest in the first few hours after coronary occlusion. Our results relate therefore only to patients who survived long enough to reach hospital.

If the case fatality of south Asian patients is higher than that of white patients it is important to identify potential causes amenable to modification. Our data provide no evidence of different management strategies that might disadvantage south Asian patients. A slightly higher proportion of the south Asians than the white patients were treated with thrombolytic drugs, and they did not present significantly later, when thrombolysis is known to be less beneficial.²⁰⁻²¹ As for secondary prevention, although similar proportions of patients in both groups were discharged taking aspirin and β blockers, we had no information about the adequacy of advice on lifestyle, particularly with regard to its delivery and its comprehension. Nevertheless, significantly fewer south Asian patients were smokers at the time of admission, and continued cigarette smoking after discharge from hospital is therefore unlikely to have contributed importantly to the higher case fatality rate in this group.

The most likely explanation is the high prevalence of diabetes in south Asians. South Asians in Britain are known to be prone to non-insulin dependent diabetes, which, together with hyperinsulinaemia, hypertriglyceridaemia, reduced plasma concentration of high density lipoprotein cholesterol, and hypertension, seems to be a manifestation of insulin resistance.⁷⁻²²⁻²³ Diabetes is a major independent predictor of morbidity and mortality in acute myocardial infarction, probably through its associations with pre-existing left ventricular dysfunction and diffuse and rapidly progressive coronary atherosclerosis.²⁴ We found that adjusting for diabetes in the survival analysis was sufficient to remove much of the apparent excess risk in south Asians.

In conclusion, south Asians were overrepresented in our coronary care unit relative to their numbers in the catchment population. This is consistent with national data showing an increased risk of coronary heart disease in this racial group. Compared with white patients, they also had a higher case fatality in the first six months after admission for acute myocardial infarction, which seems to be largely attributable to their higher prevalence of diabetes. This may contribute to the high mortality from coronary heart disease in south Asians living in Britain.

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Radiology services for remote communities: cost minimisation study of telemedicine

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Abstract

Objectives—To determine the social costs of providing a rural population with radiology services under three different systems: the existing system (a small x ray unit at the remote site and all other examinations at the nearest radiology department (the host site)); a teleradiology system (most examinations at the remote site and more advanced examinations at the host site); and all examinations at the host site.

Design—Cost minimisation study.

Setting—Primary health care in a remote community in Norway.

Subjects—A randomly selected sample (n=597) of all patients (n=1793) having radiological examinations in 1993.

Main outcome measures—Annual direct medical costs, direct non-medical (travel) costs, and indirect costs (lost production) of the three options.

Results—After exclusion of costs common to the three systems the direct medical, direct non-medical, and indirect costs of the three options were, respectively, £9000, £51 000, and £31 500 (total £91 500) for the existing system; £108 000, £2000, and £13 500 (total £123 500) for the teleradiology option; and £0, £75 000, and £42 000 (£117 000 in total) for the "all at host" option. Sensitivity analyses indicated that the existing system is the least costly option except when lost leisure is valued as highly as lost production.

Conclusion—The teleradiology option did not seem to be cost saving in the study community. Such systems, however, may be justified on the grounds of equity of access and quality of care.

Introduction

Increasingly, health care systems are under pressure to reduce costs and at the same time to improve the quality of

their services.^{1,2} Teleradiology is a technology which, it is claimed, meets both these ends simultaneously.^{3,4} It entails the transmission of diagnostic images between two locations⁵ within or between institutions. The latter ("interfacility") technology entails transmission from remote sites to radiology centres ("host sites") where the images are interpreted by radiologists.

We examined the possible introduction of an inter-facility teleradiology system⁶ in the municipality of Alta in north Norway. Most (14 000) of the population live in the town itself, the rest (4000) in the surrounding rural area. Like the United Kingdom, Norway has a public (and mainly free) health care system in which general practitioners and hospitals are the core. Currently, most examinations requested by general practitioners in Alta are performed at Hammerfest (general) Hospital, located about 140 km away. Additionally, the Alta Medical Centre (a small rural hospital) carries out some examinations, mainly of the peripheral skeleton, with a small x ray unit. Taken by nurses, the radiographs are interpreted by the general practitioners as there are no radiologists at Alta.

Teleradiology represents an alternative option. With this technology, only a minority of the patients referred by general practitioners would be transferred to Hammerfest. A third option is to perform all radiological examinations at Hammerfest (the "all at host" option).

We determined the costs to society of these three options. Radiology examinations associated with inpatient and outpatient hospital services were disregarded as their costs are equal under the three options. We assumed that the three options have the same health consequences (see discussion below). A so called cost minimisation study was then appropriate.⁷

Methods

Through the computerised patient record system at Alta all referrals (n=1793) to Hammerfest for radiologi-

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