PAPERS AND SHORT REPORTS

Mortality from coronary heart disease in the British army compared with the civil population

PETER LYNCH, B J OELMAN

Abstract

A study was carried out in which mortality from coronary heart disease during 1973-7 in men aged under 55 years in the British army was compared with that in men in the civilian population. An inverse relation was found between mortality from coronary heart disease and rank in the army similar to that seen among the civilian social classes, but soldiers aged under 40 years had a significantly higher mortality than their civilian counterparts irrespective of the civilians' social class. Correspondingly, officers had a significantly lower mortality, which suggests that strenuous exercise and other exigencies of military life per se, with the possible exception of cigarette consumption, are not to blame.

Possibly the extremes of risk in the army are due mainly to factors associated with the identification of subgroups of high and low risk within the social classes and to the higher prevalence of cigarette smoking among soldiers.

Introduction

Coronary heart disease is an important cause of death in the British army as in Britain generally. We carried out a study to determine whether Service life confers any advantage or disadvantage with regard to this disease by comparing the mortality of men in the army with that of civilians.

Cardiac Department, Queen Elizabeth Military Hospital, London SE18 6XN
PETER LYNCH, MRCP, major, Royal Army Medical Corps
Stats G(4), Ministry of Defence, Stanmore, Middlesex
B J OELMAN, BSC, statistician

Subjects and methods

We examined the deaths of men aged under 55 years in the British army during 1973-7 diagnosed as being due to coronary heart disease and coded 410-414 in the eighth edition of the *International Classification of Diseases*. The data were obtained from the medical statistics branch of the Ministry of Defence and their completeness confirmed by reference to the casualty list of the Ministry of Defence, which is compiled independently. It is highly unlikely that any deaths were missed. Review of all deaths from all causes in the period confirmed that no coronary deaths had been wrongly classified.

The diagnosis was made or confirmed at postmortem examination in 130 (88%) of the 148 cases. Postmortem examinations were carried out mainly by coroners but also by military and civilian pathologists in the United Kingdom; some military postmortem examinations were done abroad. Of the 18 men whose death was not confirmed by postmortem examination, eight had clinical and electrocardiographic evidence of acute infarction before they died and nine had a history of old infarction, of whom seven died with chest pain. One case was diagnosed on clinical grounds alone. The army population aged over 55 years is small: the eight cases that occurred in this age group were not included. Civilian statistics were obtained from published data from the Office of Population Censuses and Surveys, the Scottish Home and Health Department, and the Northern Ireland Office.

Results

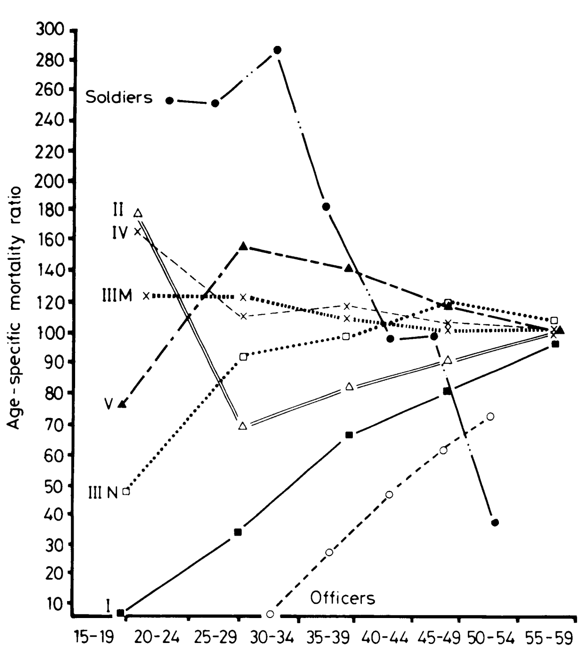
The standardised mortality ratio for men in the British army compared with the civilian male population in the United Kingdom was 100 (table I). This, however, was made up from an excess number of deaths in the age group 20-39 years and a reduced number in the age group 40-54 years. Since most of the young men in the army were soldiers, there being relatively more officers with increasing age, standardised mortality ratios were calculated separately for officers and soldiers. Table I shows a standardised mortality ratio of 148 for soldiers and 54 for officers ($p < 0.001$). Furthermore, the standardised mortality ratio for soldiers aged under 40 years was significantly higher ($p < 0.01$) than the highest ratio among the civilian social classes (class V), and that for officers of all ages was significantly lower ($p < 0.01$) than the lowest ratio among these classes (class I). When the officers were separated into direct-entry officers and those promoted from the ranks, and soldiers divided into senior non-commissioned officers on the one hand and junior non-commissioned officers and privates on the other, there was a gradient of increasing mortality with decreasing rank (table II).

TABLE I—*Mortality from coronary heart disease by age and rank in men in British army compared with civilian male population of United Kingdom, 1973-7*

		Officers			Soldiers			All ranks		
Age group (years)	Civilian mortality/1000 male population	Population ($\times 10^3$)	No of deaths expected in 5 years	No of deaths observed	Population ($\times 10^3$)	No of deaths expected in 5 years	No of deaths observed	Population ($\times 10^3$)	No of deaths expected in 5 years	No of deaths observed
15-19	0·002	0·1	0	0	25·2	0·3	0	25·4	0·3	0
20-24	0·007	1·8	0	0	45·2	1·7	4	47·0	1·7	4
25-29	0·029	2·6	0·3	0	32·9	4·0	10	35·6	4·3	10
30-34	0·102	2·3	1·2	0	17·6	9·0	26	20·0	10·2	26
35-39	0·335	2·7	4·3	2	12·1	20·3	36	14·7	24·7	38
40-44	0·942	3·0	14·4	6	4·3	20·4	19	7·4	34·8	25
45-49	2·043	2·7	26·8	14	1·1	11·0	11	3·7	37·8	25
50-54	3·719	1·5	28·6	19	0·3	6·3	2	1·9	35·0	21
Total		16·8	76	41	139·9	72·9	108	155·6	149	149
Standardised mortality ratio			54			148			100	

TABLE II—*Standardised mortality ratios for different army ranks compared with male population of United Kingdom, 1973-7*

	Population ($\times 10^3$)	No of deaths expected in five years	No of deaths observed	Standardised mortality ratio
Direct-entry officers	13·5	49	17	33
Officers promoted from ranks	3·3	25	24	100
Senior non-commissioned officers	31·4	56	69	123
Junior non-commissioned officers and privates	107·4	19	39	205
Total	155·6	149	149	100



Age-specific mortality ratios by social class in male civilians in the United Kingdom (1971) and by rank in men in the British army (1973-7).

The figure shows the age-specific mortality ratios in soldiers and officers compared with those in the civilian social classes and suggests a trend of diminishing difference in mortality with age between soldiers and officers similar to that among the civilian social classes. Thirty-eight (26%) of the 148 men who died survived long enough to reach hospital, but only seven of those aged under 40 years did so.

Discussion

The differences shown here are large and appear to be real. In view of the completeness of data collection in the army and the fact that officers and soldiers show patterns that are in opposite directions the differences between servicemen and the general population are unlikely to be due to bias. Soldiers are recruited disproportionately from areas of the country with a high incidence of coronary heart disease (table III), but standardisation shows that this bias accounts for less than 2% of the observed differences between soldiers and civilians. Recruiting also tends to polarise social class, some officers being recruited from public schools and universities and some soldiers enlisting by default of local employment. This social selection may account for much of the observed difference between the civilian social classes and the army ranks. Possibly recruits to the army may be disproportionately of the time-urgent type A personality, a known risk factor for coronary heart disease.[1] If this was an important determinant, however, it might be expected to increase mortality among officers since officer recruits would be expected to show the same bias, and this is manifestly not the case.

TABLE III—*Recruiting of men into British army compared with population and incidence of ischaemic heart disease (IHD) by region (1973-6)*

Region	Percentage of population aged 15-19 years	Percentage of recruits	Civilian regional standardised mortality ratio for IHD
North	5·9	7·5	113
Yorkshire and Humberside	8·8	10·6	107
East Midlands	6·5	7·9	91
East Anglia	3·0	2·5	77
South-east	28·7	19·6	87
South-west	7·3	9·0	90
West Midlands	9·3	9·7	97
North-west	11·6	14·9	115
Wales	4·8	5·0	117
Scotland	10·7	11·1	120
Northern Ireland	3·4	2·2	123

Potential recruits are screened on entry to the Service; those with hypertension, cardiomegaly, renal disease, Cushing's syndrome, diabetes, or gross obesity are likely to be detected and excluded, although hyperlipidaemia is not actively sought and a family history of coronary heart disease is no bar to enlistment. Similarly, routine medical examinations every four years are likely to detect these diseases if they occur later in life and, while not all such diseases lead to discharge from the Service, treatment is likely to be started earlier. Obesity is actively discouraged, and in the grosser cases the men are downgraded to a lower medical category, which may result in delayed promotion. Such factors, common to all ranks, might have been expected to lower mortality. Standards of medical care after a coronary event are less relevant since, of the 38 men who eventually died but survived long enough to reach hospital, 18 were treated in civilian establishments. Only a few in the age group 20-39 years survived to reach hospital, indicating that the deaths in this age group were sudden and unexpected. The process of medical discharge from the Service is an important source of bias, especially since it affects officers more than soldiers. In the period studied 19 officers and 20 soldiers were medically discharged with a diagnosis of coronary heart disease. On the unlikely assumption that all these men would have died had they remained in the Service the standardised mortality ratios for officers and soldiers become 79 and 178 respectively, still appreciably different from those for the civil population.

Army social habits differ considerably in some respects from those of civilians. Servicemen are more likely to undertake strenuous physical exercise, and all ranks must perform a minimum of one three-mile run every six months. While exercise is reputed to raise the concentration of high-density lipoprotein,[2] its value in protection from coronary heart disease is still controversial.[3 4] Similarly, the role of strenuous exercise in precipitating a coronary event in those at risk is also not clear.[5-7] The increased mortality among soldiers is unlikely to be due to strenuous exercise since there is no similar increase among officers. The prevalence of cigarette smoking is higher among soldiers than civilians, and per caput consumption is also greater.[8] This may be a factor in the soldiers' higher mortality. No similar data are available for officers, though anecdotally their consumption is much less. Differences in diet may be relevant, but 53% of soldiers are married and eat food similar to any other British household. Army catering, in offering a large choice of menus, reflects social preference, so that unmarried soldiers eat a normal British diet.[9] Social stresses peculiar to army life include moving house frequently, periods of separation from spouse and family, and the Northern Ireland campaign. The effects of military discipline are more difficult to assess since, although authority is more overt, there is an increased security of employment and housing in the Service and a strong fraternal bond in the regimental system.

Thus British soldiers under the age of 40 years represent a high-risk group and officers a low-risk group for coronary heart disease. The decrease in mortality with increase in rank in the army is similar to the decrease in mortality with increase in social class seen among civilians. Possibly the extremes of risk in the army are due mainly to factors associated with the identification of subgroups of high and low risk within the social classes and to the higher prevalence of cigarette smoking among soldiers.

References

1 Heller RF. Type A behaviour and coronary heart disease. *Br Med J* 1979; ii:368.

2 Miller NE, Rao S, Lewis B, Bjørsvik G, Myhre K, Mjøs OD. High-density lipoprotein and physical activity. *Lancet* 1979;i:111.

3 Morris JN, Everitt MG, Pollard R, Chave SPW. Vigorous exercise in leisure time; protection against coronary heart disease. *Lancet* 1980;ii: 1207-10.

4 Jarrett RJ. Exercise and the heart. *Lancet* 1981;i:36.

5 Opie LH. Sudden death and sport. *Lancet* 1975;i:263-6.

6 Lynch P. Soldiers, sport and sudden death. *Lancet* 1980;i:1235-7.

7 Yater WM, Traum AH, Brown WG, Fitzgerald RP, Geisler MA, Wilcox BA. Coronary artery disease in men 18 to 39 years of age. *Am Heart J* 1947;**36**:334-73.

8 Crowdy JP, Sowden RR. Cigarette smoking and respiratory ill-health in the British army. *Lancet* 1975;i:1232-4.

9 Crowdy JP. The soldiers' food. *Practitioner* 1974;**212**:560-9.

(*Accepted 18 June 1981*)

SHORT REPORTS

Mesangiocapillary glomerulonephritis type I associated with immunoglobulin deficiency

Mesangiocapillary glomerulonephritis with subendothelial deposits (type I) is not a homogeneous disease. Peters *et al* suggested that the development of such nephritis may be due to defective clearance of antigen by antibody, a type of immune deficiency syndrome.[1] We report on a patient with mesangiocapillary glomerulonephritis and immune deficiency, probably of late origin.

Case report

A 55-year-old man presented with a fainting attack. His blood pressure was 170/100 mm Hg. Routine urine examination showed 1+ proteinuria. Plasma urea concentration was 7·9 mmol/l (474 mg/100 ml), plasma creatinine 160 μmol/l (1·8 mg/100 ml), and total serum protein 67 g/l and serum albumin 43 g/l (both normal). Serum IgG was 7·55 g/l (normal 9·5-16·5 g/l), IgA 0·35 g/l (normal 0·90-4·50 g/l), and IgM 0·34 g/l (normal 0·65-2·0 g/l). Urinary IgG excretion was 0·13 g/l, when he was excreting 1·8 g protein/24 hours. Autoantibody, antistreptolysin O titre, Rose-Waaler, Venereal Disease Research Laboratory, Reiter's complement fixation, Treponema pallidum immobilisation, and haemagglutination tests were normal or negative. Serum C3 concentration was 1·18 g/l, C4 0·60 g/l, and CH_{50} 950 U/ml (all normal).

Two months later he had heavy proteinuria after an influenza-like illness and was admitted for renal biopsy. Biopsy specimens showed mesangiocapillary glomerulonephritis with subendothelial deposits. Electron microscopy showed round endoplasmic particles of uncertain nature. Immunofluorescence tests using monospecific antisera showed deposits of IgG and C3 in the glomeruli of lobular pattern and subendothelial distribution.

A further determination of serum immunoglobulin five months later confirmed that concentrations of all three classes were low: IgG 5·2, IgA 0·2, and IgM 0·35 g/l. Serum albumin was 37 g/l, and he was excreting 4·6 g protein/24 hours. His renal function declined rapidly and he reached end-stage renal failure within four months. After an anaesthetic for insertion of a fistula he developed ventricular fibrillation and died a few hours later.

Comment

Our patient had hypogammaglobulinaemia G, A, and M when his proteinuria was only 1+ on Labstix and serum protein and albumin concentrations were both normal. Although IgG may be lost through the urine in glomerulonephritis,[2] losses of IgA and IgM are usually small and do not normally result in any change in plasma concentrations.[3 4] Measured excretion of IgG in our patient was only 0·13 g/l, when his urine volume was between one and two litres a day.

Generalised immunoglobulin deficiency is usually present at birth and associated with a recurrent infection. Our patient gave no history of early childhood infection, and probably his immunoglobulin deficiency was acquired in adult life but before his presentation at the age of 55. Having developed nephritis he ran an unusually rapid downhill course to death within six months.

Mesangiocapillary glomerulonephritis type I is a heterogeneous disease caused by several extrinsic and intrinsic antigens, but in most cases the infectant is not identified. It has been suggested that the development of this type of immune complex nephritis may be due to defective clearance of antigen by antibody, and the course of the disease in our patient would support this. We are unaware of any previous description of the association between immunoglobulin deficiency and mesangiocapillary glomerulonephritis, but the two conditions are sufficiently rare that coexistence is unlikely to be a coincidence.

1 Peters DK, Williams DG, Charlesworth JA, *et al*. Mesangio-capillary nephritis, partial lipodystrophy and hypocomplementaemia. *Lancet* 1973;ii:535-8.