

## The incidence of myocardial infarction

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**SUMMARY.** I studied 183 patients with myocardial infarction including sudden deaths related to ischaemic heart disease occurring in general practice during a period of four years.

The figures are examined by age, sex, history of event, and place of treatment. The ratio of male to female infarctions was 2:1, males having a mean age of 63 years and females 71 years.

The total death rate for all myocardial infarctions was 46 per cent, but if sudden deaths are excluded, the rate becomes 24 per cent.

The annual incidence of myocardial infarction per 1,000 in the practice population of 11,195 was 4.1 and the total annual death rate per 1,000 was 1.9.

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### Introduction

Evidence from recent surveys originating in geographically widely-separated areas clearly shows significant differences in the incidence of myocardial infarction (Lloyd, 1975). Even in the United Kingdom large differences are to be seen in the reported incidences from different areas.

McWhinney (1968) found an incidence of 7.5 per 1,000 practice population a year, whereas a Doncaster survey (Smyllie *et al.*, 1972) reported a yearly incidence of 2.75 per 1,000 practice population.

Other surveys have been restricted to certain age groups or social groups and discriminate between the sexes. Certainly for the purposes of comparison, the age, sex, and social characters of the population concerned in the survey should be specified. Such factors as geographical situation, hardness of the water supply, eating, and smoking habits—all of which may play a part in determining the incidence of ischaemic heart disease and its consequences—are much more difficult to quantify and take into account.

An Edinburgh survey (Armstrong *et al.*, 1972) reported the incidence in the 20–69 age group to be 9.3 per 1,000 a year for men and 3.25 per 1,000 a year for women. A large number (171) of Edinburgh general practitioners took part and notified all those in whom a coronary heart attack was suspected. Accuracy checks indicated under-reporting of at least 25 per cent. The combined incidence a year from this survey was 6.0 per 1,000 population.

A similar study in Oxford (Kinlen, 1973) cross-checked reports from general practitioners with other sources of information and included reports from 135 general practitioners. This gave the annual incidence in men of the 30–69 age group the 4.5 per 1,000 and in women 1.1 per 1,000.

In the population studied by Miall and Chinn (1974) in Rhondda Fach and Vale of Glamorgan during the years 1954 to 1971, the rate per 1,000 patient years for men over 35 was 11.2 and for women over 35 was 5.8—a combined rate of 8.0 per 1,000 patient years.

TABLE 1  
 MYOCARDIAL INFARCTIONS: INCIDENCE AND DEATH RATES BY AGE-GROUP AND SEX. (FOUR YEAR TOTALS)

Age		20-29	30-39	40-49	50-59	60-69	70-79	80+	20-69	Total population
Males	Mean population	778	644	603	564	505	253	75	3,094	5,279
	Number of infarcts	—	2	10	19	48	30	7	79	116
	Rate/1,000/year	—	0.78	4.15	8.42	23.76	29.65	23.30	6.38	5.49
	Number of fatal myocardial infarcts	—	—	2	8	22	14	6	32	52
	Rate/1,000/year	—	—	0.83	3.55	10.89	13.83	20.00	2.58	2.46
Females	Mean population	809	674	658	611	664	467	173	3,416	5,916
	Number of infarcts	—	—	1	4	21	27	14	26	67
	Rate/1,000/year	—	—	0.38	1.64	7.91	14.45	20.23	1.90	2.83
	Number of fatal myocardial infarcts	—	—	1	1	8	11	11	10	32
	Rate/1,000/year	—	—	0.38	0.41	3.01	5.89	15.90	0.73	1.35
Totals	Mean population	1,587	1,318	1,261	1,175	1,169	720	248	6,510	11,195
	Number of infarcts	—	2	11	23	69	57	21	105	183
	Rate/1,000/year	—	0.38	2.18	4.89	14.76	19.79	21.17	4.03	4.09
	Number of fatal myocardial infarcts	—	—	3	9	30	25	17	42	84
	Rate/1,000/year	—	—	0.59	1.19	6.42	8.68	17.14	1.61	1.88

### Method

This report is from a group practice in the Borough of Keighley, West Yorkshire. This is an urban community of about 56,000 people with a soft water supply.

The borough includes dormitory areas for those working in Bradford and Leeds, but is predominantly an area of light industry and a diminishing textile industry with an element of foundry work and heavy machine manufacture. The borough also includes a surrounding agricultural area.

The practice population—which during the four years of the survey averaged 11,195—is drawn from all areas of the borough and so covers all social groups without any particular bias. The age-sex structure can be deduced from table 1.

During the four years 1971 to 1975 all events diagnosed as myocardial infarction were recorded. The criteria used to record this diagnosis were strictly adhered to as follows:

(1) Clinical history of a classical attack supported by electrocardiograph and/or enzyme evidence when the patient survived long enough for these measurements to be made.

The ECG criteria were the development of Q waves with QS conformation, raised S-T segment, and inversion of T-wave.

Enzyme criteria were raised SGOT levels e.g. greater than 50 units or raised LDH levels if investigations were delayed.

(2) In the case of sudden death, either

(a) A known clinical history of ischaemic heart disease supported by the history of a classical attack, or,

(b) A post-mortem report indicating death due to ischaemic heart disease.

The term “sudden death” refers to those patients dying instantaneously or within 30 minutes of the onset of the attack.

### Results

During the four years indicated, there were 183 events satisfying these criteria and recorded as myocardial infarctions. This is an annual incidence of 4.1 per 1,000 practice population (males 5.5 and females 2.83).

Confining the population to the 20 to 69 age group, the incidence is 4.0 per 1,000 a year. For males in this age group, the incidence is 6.4 per 1,000 and for females 1.9 per 1,000 per year. These figures and the incidence by age decade with death rates are shown in table 1.

Of the 183 myocardial infarctions, 147 (80.3 per cent) were primary infarcts, and 36 (19.6 per cent) were re-infarctions.

Of all infarcts, 45.9 per cent were fatal within two weeks—re-infarctions being more hazardous (55.6 per cent fatal) than primary infarcts (43.5 per cent fatal).

Of the 84 fatal infarcts, 53 (63.1 per cent) were recorded as sudden death, dying within 30 minutes of the onset. Sixty-one per cent of the primary infarctions and 70 per cent of the re-infarctions suffered this fate (table 2). From table 2 it can be seen that those surviving the first 30 minutes had a better longer-term survival rate if they were in younger age groups but, as far as sudden death was concerned, youth gave no benefit.

Twenty of the fatal infarctions occurred in the group with no known previous history of ischaemic heart disease there were 49 in this category and 12 of the fatal infarcts were “sudden”.

TABLE 2  
 MYOCARDIAL INFARCTIONS: FOUR-YEAR TOTALS BY HISTORY, AGE-GROUP AND SEX. INCIDENCE OF 'SUDDEN DEATH' (TOTALS IN BRACKETS)  
 (FIRST-PRIMARY INFARCT; NPH—NO PREVIOUS HISTORY; RE-RE-INFARCTION)

	30-39		40-49		50-59		60-69		70-79		80+		Total	T. <70
	M	F	M	F	M	F	M	F	M	F	M	F		
First non-fatal	—	—	2	—	7	2	13	9	9	10	—	2	54	33
First fatal	—	—	1	1(1)	1(1)	—	11(6)	4(3)	8(6)	10(5)	2(1)	6(4)	44(27)	18(11)
NPH, non-fatal	2	—	5	—	4	1	7	1	5	2	1	1	29	20
NPH, fatal	—	—	—	—	5(4)	1	4(4)	—	3	—	2(2)	5(2)	20(12)	10(8)
Re-infarction, non-fatal	—	—	1	—	—	—	6	3	2	4	—	—	16	10
Re-infarction, fatal	—	—	1(1)	—	2(2)	—	7(5)	4(2)	3(2)	1	2(2)	—	20(14)	14(10)
Total non-fatal	2	—	8	—	11	3	26	13	16	16	1	3	99	63
Total fatal	—	—	2(1)	1(1)	8(7)	1	22(15)	8(5)	14(8)	11(5)	6(5)	11(6)	84(53)	42(29)
Totals by sex	2	—	10	1	19	4	48	21	30	27	7	14	183	105
Totals by age	2	—	11	—	23	—	69	—	57	—	21	—	183	—
Total fatal	—	—	3(2)	—	9(7)	—	30(20)	—	25(13)	—	17(11)	—	84(53)	42(29)
Deaths/MI	—	—	27%	—	39%	—	43.5%	—	43.8%	—	81%	—	46%	40%
Sudden deaths/fatal MI	—	—	67%	—	78%	—	67%	—	52%	—	65%	—	63%	69%
Deaths/surviving	—	—	11%	—	13%	—	20%	—	27%	—	60%	—	24%	17%

TABLE 3  
 MYOCARDIAL INFARCTIONS: FOUR YEAR TOTALS BY HISTORY, MEAN AGE, SEX, AND MEAN BLOOD PRESSURE  
 (NUMBER OF PATIENTS TO WHICH MEAN BLOOD PRESSURES RELATE ARE IN BRACKETS)

	Total MI.	Mean age	mm. Hg mean SBP DBP (41)	Non fatal MI.	Mean age	mm. Hg mean SBP DBP (24)	Fatal MI.	Mean age	mm. Hg mean SBP DBP (17)	Sudden death	Mean age	mm. Hg mean SBP DBP (13)
Male first	54	64	179 104	31	61	182 104	23	67	174 104	14	68	180 104
Male NPH	38	59		24	56		14	65		9	63	
Male Re-infarction	24	68	173 97 (17)	9	71	173 91 (8)	15	66	172 102 (9)	12	65	173 103 (8)
Female first	44	70	186 103 (38)	22	68	183 99 (22)	21	73	188 108 (16)	13	72	193 116 (11)
Female NPH	11	76		5	69		6	81		2	87	
Female Re-infarction	12	69	176 101 (9)	7	70	191 102 (4)	5	67	164 100 (5)	2	63	170 95 (2)
Total M	116	63	177 102 (58)	64	61	180 101 (32)	52	66	173 103 (26)	35	66	177 104 (21)
Total F	67	71	184 103 (47)	34	69	184 99 (26)	32	74	182 106 (21)	17	73	189 113 (13)
All	183	66	180 102 (105)	98	64	182 100 (58)	84	69	177 104 (47)	52	68	182 107 (34)

### *Home or hospital*

The district hospital with a coronary care unit is conveniently situated about three and a half miles from the centre of the town and from the practice.

One hundred and thirty patients survived long enough to receive further treatment. Eighty-one of these (62.3 per cent) were admitted to hospital, of whom 16 (19.6 per cent) died during their stay in hospital. All the deaths in hospital occurred within six days and nine of them within 24 hours.

The mean age of this group was 64 years. Forty-nine patients with a mean age of 70 years were treated at home. Fifteen of these patients died within two weeks of the attack (30.6 per cent).

Seventy-five per cent of hospital admissions were under 70 years of age and 15 per cent of these died, whereas 27.8 per cent of the under-70-year age group who were treated at home died. In those patients over the age of 70 years, the death rate was the same whether treated at home or in hospital (33.3 per cent).

### *Sex*

*Females.* Table 3 shows that 67 (36.6 per cent) of all myocardial infarctions occurred in female patients. Of these, 55 were primary infarcts.

Thirty two infarctions were fatal (47.8 per cent), 27 of these were primary infarcts—a death rate of 49.1 per cent—and five were re-infarctions (a rate of 41.2 per cent). Seventeen fatal infarcts were “sudden” (53.1 per cent).

*Males.* The men suffered 116 myocardial infarctions, 45.7 (52 per cent) of these being fatal. There were 92 primary infarctions, of which 38 had no known history, and 24 re-infarctions. The male death rate for primary infarcts was 41.3 per cent and for re-infarction 62.5 per cent. Thirty seven of the fatal infarcts (69.8 per cent) died within 30 minutes of the onset.

### *Age*

Table 3 shows the mean ages for sex and for event. For all infarcts the mean age at which such an event occurred in a woman was about eight years older than in the men—whether or not the infarct was fatal. In both sexes, fatal infarcts occurred at a later age than non-fatal by five years.

### *Blood pressure*

Pre-infarct blood pressure recordings were available in 78.4 per cent of those with a previous history and the highest such readings have been used for this survey; that is, the “untreated” pressures, unless higher readings were taken during treatment, are recorded.

These measurements are recorded as mean values in table 3 with the numbers of patients to which they relate. The diastolic readings are made at the fourth phase of the Korotkoff sounds.

Of the patients with pre-infarct blood pressure recordings, 81 per cent were higher than 160 mm Hg systolic and/or 100 mm Hg diastolic.

## **Discussion**

A study of this kind serves not only to provide information, but also as a form of audit of the provision of medical care.

The mean annual death rate from ischaemic heart disease per 1,000 population of the Borough of Keighley for the years 1971, 1972, and 1973 is 3.72 (Medical Officer of

Health, Borough of Keighley, 1971, 1972, 1973). The mean annual death rate per 1,000 population of the group practice for the four years 1971–1975 is 1.88.

The accuracy of reporting from the practice was high and every event diagnosed as a “myocardial infarction” was checked and re-checked for accuracy.

Comparison with Miall and Chinn’s (1974) figures is shown in table 4.

TABLE 4

INCIDENCE OF MYOCARDIAL INFARCTION AND FATALITIES (PER 1,000 POPULATION PER YEAR AGE 35 AND OVER) RHONDDA FACH AND VALE OF GLAMORGAN (1954–1971, MIALL AND CHINN, 1974) COMPARED WITH RATES FOR KEIGHLEY GROUP PRACTICE (1971–1975)

	<i>Males</i>		<i>Females</i>		<i>Total</i>	
	<i>Incidence of infarction</i>	<i>Death rate</i>	<i>Incidence of infarction</i>	<i>Death rate</i>	<i>Incidence of infarction</i>	<i>Death rate</i>
Rhondda and Vale of Glamorgan	11.2	6.8	5.8	3.76	8.0	5.2
Keighley group practice	12.4	5.6	5.7	2.7	8.7	4.0

The practice is particularly meticulous about treatment of ischaemic heart disease and myocardial infarctions. However, this and the increasing use of beta-blockade in treatment (Lambert, 1972, 1974, and 1976) during the four years cannot wholly account for the big difference in incidence of fatal myocardial infarctions between the practice and the borough.

The use of the Coronary Care Unit clearly shows its value in the younger age groups. However, the over 70s suffering a myocardial infarction will no doubt be happier and no more at risk if treated at home.

Forty-nine of the 183 myocardial infarctions (27 per cent) had no known previous history. Twenty of these were fatal—almost 25 per cent of all the fatal myocardial infarctions.

As this group had the lowest mean age of all the men victims, it seems to emphasise the importance of identifying risk factors in men by some method of screening.

Although the fewer number of suitable blood pressure readings reduced the value of the mean readings, and in spite of lack of knowledge at present of the mean blood pressures for the whole population surveyed, the evidence is impressive. It would certainly appear that the population suffering infarctions has a mean blood pressure, both systolic and diastolic, which is higher than that to be expected of similar age and sex groups in the population as a whole (Anderson, 1970; Hawthorne *et al.*, 1974; Hart, 1970).

My own screening of 101 men aged 55–59 (unpublished) produced a mean blood pressure of 139/85 mm Hg.

### Conclusion

This study illustrates one type of practice audit. Aspects of medical care, where the reasonable objectives of preserving not only life but the quality of life are not being achieved, can be identified. Examination of the reasons for lack of achievement can lead to remedial measures.

The identification of those with raised blood pressure seems to be one way of identifying those most at risk of suffering a myocardial infarction, and the risk can undoubtedly

be quantified more accurately by identifying further risk factors. (Kannel and Dawber, 1974).

There are other questions to be answered. In the large proportion of "sudden deaths" would treatment by beta-blockade help to prevent a proportion of these by preventing or reducing the extent and effect of the myocardial infarction? There is rapidly accumulating evidence that this may be so (Fox *et al.*, 1975; Lambert, 1976; Mueller *et al.*, 1974; Pelides *et al.*, 1972; Wilhelmsson *et al.*, 1974; Multicentre International Study 1975). Why is there still a 17 per cent death rate in those under 70 who survive the initial attack? Does this indicate inadequate assessment and follow-up treatment? And finally, does the treatment of even mildly raised blood pressure reduce the risk of a myocardial infarction?

Work currently in progress should show some information on the last of these questions, and no doubt all will be taxing the faculties of many in the profession for some time to come.

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#### Addendum

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### ASTHMA DEATHS IN CARDIFF 1963-74: 90 DEATHS OUTSIDE HOSPITAL

In a detailed study of factors associated with death from bronchial asthma outside hospital 90 patients were investigated. The fatal attack was typically short and was most likely to occur in patients with a long history. Deaths often occurred before effective medical help was obtainable, but occasionally the patient or the doctor underestimated the severity of the attack. Patients especially at risk were those recently discharged from hospital after a previous attack. These deaths might be prevented by better patient education, a self-admission service for selected asthmatics, and by doctors using objective measurements of severity of asthma for the control of treatment. The underuse of corticosteroids is an important factor associated with death.

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