Prevalence of clinical and electrocardiographic evidence of ischaemic heart disease in the older population

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In 487 subjects aged 62 to 90 years who formed a random sample of the 27,000 older people living in a defined area of Edinburgh, the prevalence of positive responses to Rose's questionnaire on angina and infarction and of coded electrocardiographic abnormalities was recorded as part of a clinical survey, including blood pressure, height, weight, skinfold thickness, heart size, and presence of cardiac murmurs. The results were compared with similar data available in younger age groups.

A history of angina was given by 10 per cent of the sample. Electrocardiographic abnormalities strongly suggestive of ischaemic heart disease were present in 6 per cent and others possibly due to ischaemic heart disease in a further 24 per cent. Forty-four per cent of subjects had no codable electrocardiographic abnormality. Electrocardiographic evidence of ischaemic heart disease increased with age. Smoking habits, obesity, and hypertension were unrelated to manifestations of ischaemic heart disease in this group. The pattern of left axis deviation was present in 8.8 per cent and exceeded -45° in 4.4 per cent of the sample.

Age-specific incidence and mortality rates for coronary heart disease increase with age in both sexes, approximately doubling for every 10 years of advancing age (Rose, 1972). Since the natural history of the disease is still largely unknown its prevalence in the elderly as the result of the operation of risk factors, known and unknown, and selective mortality is of interest. It is believed, for example, that 'stable' angina is associated with a relatively long survival (Rose, 1971), while on the other hand sudden death from myocardial infarction or ischaemic arrhythmia may be the first clinical manifestation of the disease (Lovell and Prineas, 1971).

Various risk factors have been more or less certainly identified. These include high blood pressure, raised level of serum cholesterol or triglyceride, a diet rich in saturated fats, a sedentary mode of life, smoking, and carbohydrate intolerance. Most studies relate to patients in middle-age though the maximal incidence of the disease is in the older age groups. Is clinical ischaemic heart disease more prevalent in the old than in the middle-aged, and does it show the same relation to risk factors as has been identified in the latter?

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Numerous studies report the prevalence of manifestations of the disease in various groups. The great majority of these, however, are not representative of the general population but relate to particular industrial or occupational groups (Stamler *et al.*, 1960; Acheson, 1961; Paul *et al.*, 1963) or to patients presenting to general practitioners or in hospital (Painter *et al.*, 1960; Eisenberg *et al.*, 1961). A few large-scale longitudinal studies such as the Framingham one (Dawber *et al.*, 1962) are in progress and report the incidence in family groups followed as age-cohorts. Even here, however, the representative nature of the subjects studied is open to question and the fact that they are under long-term study may influence the outcome. They refer also to a different climatic, genetic, and cultural background from our own. To gain a reliable estimate of the prevalence of ischaemic heart disease, the selection of an unbiased sample of the population in question is crucial but is seldom possible. The setting up of a study of older people living in a defined area of Edinburgh offered such an opportunity.

It is proposed to study over a five-year period a randomly selected sample of the older population over the age of 60. The objectives are:—

- a) to ascertain the prevalence of the various manifestations of ischaemic heart disease at the start of the five-year period;
- b) to measure and record a number of other features including age, sex, weight, height, obesity, heart size, blood pressure, glycosuria, and smoking history, and
- c) to record the incidence of the development of new cardiac manifestations over the five-year period.

The questions which it is hoped to answer are -

- 1) How widespread is ischaemic heart disease in the older population?
- 2) What are the commoner manifestations, and are they the same as those recorded in younger patients?
- 3) Are the risk factors which have been identified in younger groups of hospital patients confirmed in the older population?
- 4) What is the prognosis of ischaemic heart disease in its various manifestations in this age group?

The present paper reports the first part of this study concerned with the prevalence of manifestations of the disease and their relation to other factors.

Subjects and methods

The subjects were 215 men and 272 women aged 62 to 90 years who formed a random sample of the 27,000 older people living in a defined area of the city. The method of sampling, including a comparison of respondents and non-respondents, has been reported elsewhere (Milne, Maule, and Williamson, 1971b). The study took place during a 24-month period.

Standardized validated techniques were used and measurements of reproducibility were obtained.

1) Rose's questionnaire in respect of angina pectoris and possible myocardial infarction (Rose, 1962; Rose and Blackburn, 1968) was administered to all subjects by one medically qualified observer (J.S.M.). Before beginning the study the observer made use of training material supplied by Professor Rose.

2) A 12-lead electrocardiogram was recorded for each subject using a direct writing portable electrocardiograph. The records were read and coded according to the Minnesota classification (Blackburn *et al.*, 1960) by two physicians experienced in electrocardiography (C.P.L. and A.H.K.). They coded the records independently and where the results disagreed (40%) the record was re-examined and an agreed coding supplied.

3) A posteroanterior chest radiograph was carried out using a 6-foot tube-film distance. The Harpenden anthropometer with straight branches was used to measure the maximum transverse cardiac diameter and lateral chest diameter (maximum diameter between inner rib margins). The ratio of these measurements gave the cardiothoracic ratio (CTR).

4) Other measurements recorded were height, weight to nearest 100 g on a lever balance, the skinfold thickness

measured as the sum of the log transformations of triceps, biceps, subscapular and suprailliac skinfolds on the right side using a Harpenden caliper (Edwards *et al.*, 1955), and arterial blood pressure measured with the London School of Hygiene instrument.

5) A questionnaire covering cardiovascular disease and cigarette smoking (Medical Research Council, 1965) was administered to all subjects.

6) A general medical examination of the subjects was carried out and recorded on proforma.

Reproducibility of both questionnaires was previously tested (Milne *et al.*, 1971a). Reproducibility of the measurements of blood pressures, CTR, and skinfold thickness, made by using the same group of persons on two occasions, was tested. The SD of the mean difference in no case exceeded 4.2 per cent of the mean of the dimension concerned. The complete data were coded, stored on magnetic tape, and analysed using standard computer techniques.

Results

1) Angina and probable infarction

The replies to Rose's questionnaire are shown for two age groups of men and women in Table 1. The difference in prevalence of angina between men (10.3%) and women (11.6%) is not significant but a significantly greater proportion of men (10.8%) compared with women (3.4%) gave a history of possible myocardial infarction ($\chi^2 = 10.50$, $P < 0.01$). The severer grade of angina, i.e. that occurring on walking at an ordinary pace on level ground, was present in 6 per cent of men and 4.5 per cent of women. No significant age difference in prevalence was found in either sex for either diagnosis.

TABLE 1 Percentage frequency of manifestations of ischaemic heart disease by age and sex

<i>Age and Sex</i>	<i>No.</i>	<i>Rose's questionnaire</i>		<i>Electrocardiogram</i>	
		<i>Angina</i>	<i>Infarction</i>	<i>Probable*</i>	<i>Possible*</i>
Men					
62-69	122	9.1	10.8	5.0	16.5
70+	93	12.0	10.9	8.4	26.0
All	215	10.3	10.8	7.1	20.5
Women					
62-69	137	11.0	1.5	4.4	19.0
70+	135	12.2	5.4	5.9	32.2
All	272	11.6	3.4	5.3	26.0
Total	487	11.0	6.7	6.1	24.0

* Reid *et al.* (1966b).

2) Electrocardiographic abnormalities

Electrocardiographic data were incomplete in 5 subjects. Two hundred and fourteen cardiographs were completely normal (44%).

Following Reid *et al.* (1966b) the electrocardiographic changes which were recognized as indicative of ischaemic heart disease were as follows.

1) Probable ischaemic heart disease (Type 1) - Minnesota coding (I 1.1-I 2.8 or VII 1).

2) Possible ischaemic heart disease (Type 2) - Minnesota coding (I 3.1-I 3.6 or IV 1-3 or V 1-3).

Broadly speaking Type 1 represents major Q or QS patterns or left bundle-branch block, while Type 2 represents minor Q abnormalities or ST-T changes. Type 1 was present in 6.1 per cent of cardiographs and Type 2 in 24 per cent making a total of 30.1 per cent (Table 1).

The prevalence of various abnormalities is shown in Table 2.

3) Effect of age and sex

The prevalence of electrocardiographic abnormalities increases with age (Table 1). Many more men than women give a history of possible infarction.

4) Cardiothoracic ratio

The numbers of men and women in the sample with cardiothoracic ratio over 50 per cent are

TABLE 3 *Cardiothoracic ratio and ischaemic heart disease*

		Per cent with CTR > 50%	
		Men	Women
History	Angina	15.8	71.4
	No angina	22.7	56.4
	Myocardial infarct	20.0	75.0
	No myocardial infarct	22.2	57.6
Electrocardiogram	Type 1 changes	21.1	69.4
	Type 2 changes	22.2	56.6
	Types 1 + 2	31.9	69.7
	Neither	13.0	48.5

* Significant differences ($P < 0.01$).

shown in Table 3 in respect of the presence or absence of angina, possible myocardial infarction, and electrocardiographic evidence of 'probable' ischaemic heart disease (Type 1) and 'probable + possible' ischaemic heart disease (Types 1 and 2). In the last named category a significantly higher proportion of men ($\chi^2 = 9.91$, $P < 0.01$) and women ($\chi^2 = 11.82$, $P < 0.01$) classed as having ischaemic heart disease had a cardiothoracic ratio > 50 per cent. This difference was not present in the other three categories of ischaemic heart disease.

The sex difference in CTR in this age group shown in Table 3 is associated with changes in the transthoracic rather than in the cardiac diameter (unpublished observation).

TABLE 2 *Prevalence of coded electrocardiographic abnormalities in men and women*

Abnormality	Code	Male (214)	%	Female (268)	%	Total (482)	%
No codable abnormality	—	104	49	110	41	214	44
Major Q/QS patterns	I 1-2	12	5.6	14	5.2	26	5.4
Minor Q/QS patterns	I 3	5	2.3	6	2.2	11	2.3
Left axis deviation	II 1	22	10.2	19	7.1	41	8.5
Right axis deviation	II 2-3	4	1.9	0	0	4	0.8
Left ventricular hypertrophy	III 1	8	3.7	39	14.5	47	9.7
Right ventricular hypertrophy	III 2	7	3.3	5	1.9	12	2.5
ST depression	IV 1-3	28	13	64	24	92	19.1
T inversion or flattening	V 1-3	50	23	80	30	130	27
AV block	VI 1-3	8	3.7	8	3.0	16	3.3
Bundle-branch block L	VII 1	3	1.4	0	0	3	0.6
" " " R	VII 2	5	2.3	6	2.2	11	2.3
" " " R incomplete	VII 3	3	1.4	4	1.5	7	1.5
Atrial fibrillation	VIII 3	5	2.3	7	2.6	12	2.5
Other arrhythmias	VIII	13	6.1	11	4.1	24	5.0
'Probable ischaemic heart disease'*	I 1-2 or VII 1	15	7.1	14	5.3	29	6.1
'Possible ischaemic heart disease'	I 3 or IV 1-3 or V 1-3	44	21.0	71	26.0	115	24.0

* Reid *et al.* (1966b).

5) Association of history and electrocardiographic abnormalities

There was a higher prevalence of electrocardiographic changes in those with a history of angina or infarction (46%) than in those without (28%). However, a large number of subjects with a history suggestive of ischaemic heart disease had a normal electrocardiogram (39/72 = 54%) and a large number of subjects with an abnormal, presumed ischaemic, electrocardiogram gave no corresponding history (115/405 = 28%).

In the presence of pathological Q waves (Type 1) there is little doubt of the existence of ischaemic heart disease. Type 2, however, consists of ST-T changes which might be associated with other conditions, notably hypertension and valvular heart disease, especially aortic. The 115 subjects with Type 2 electrocardiograms were therefore analysed further. Of these 115 subjects only 66 had no explanation other than coronary artery disease for their electrocardiographic abnormality, and of these 55 were asymptomatic. The other cases were, in the majority, patients with left ventricular hypertrophy caused by hypertension or valvular disease.

6) Total prevalence of ischaemic heart disease

If we take as evidence of ischaemic heart disease, (1) a positive history of angina or possible infarction, (2) probable electrocardiographic evidence (Type 1), or (3) possible electrocardiographic evidence (Type 2) not explicable on a basis of hypertension or valvular disease, the prevalence is made up as shown in the Fig. This shows diagrammatically the relation between the three manifestations of ischaemic heart disease considered in this study.

7) Risk factors

Table 4 shows the relative frequency of three known risk factors for ischaemic heart disease between the groups of subjects who had or who had not presumptive evidence of ischaemic heart disease, either historically or electrocardiographically. There was no difference between the two groups as regards smok-

FIG. Relative frequency and correspondence of manifestations of ischaemic heart disease

ing or obesity. Systolic and diastolic hypertension were defined as pressures of 160 or over and 100 or over respectively. There was a higher prevalence of systolic and diastolic hypertension in women (57% and 19%) than in men (38% and 11%). Increasing age raised the prevalence of systolic hypertension in women (46 to 68%) but not in men (41 to 33%). In patients with probable ischaemic heart disease (i.e. those with a history of angina or infarction or pathological Q waves on the electrocardiogram) there was a lower prevalence of diastolic and diastolic+systolic hypertension than in the non-ischaemic group, but no difference as regards systolic hypertension alone.

8) Increased left ventricular voltage pattern

Twelve men and 46 women had the voltage criteria of left ventricular hypertrophy. The majority had hypertension, either systolic (9 men, 32 women), diastolic (4 men, 16 women), or both (4 men, 16 women). Two men and four women had the hypertrophy pattern with normal blood pressures and evidence of myocardial infarction on electrocardio-

TABLE 4 Comparison of subjects with and without evidence of ischaemic heart disease

Percentage frequency of	No.	Smoking		Hypertension				Obesity			
				Systolic		Diastolic		Skinfold*		W/H ² †	
		M	F	M	F	M	F	M	F	M	F
Subjects with evidence of ischaemic disease	144	85	21	38	61	7.8	18	21	65	24	30
Subjects without evidence of ischaemic heart disease	343	93	29	38	55	12	23	28	66	27	34

* Sum of log transformations of 4 skinfold thicknesses.
† Weight/height².

gram or in the history. A systolic murmur was present in two men (1 hypertensive and 1 normotensive) and in 17 women (12 hypertensive and 5 normotensive). One man and six women had the hypertrophy pattern with normal blood pressure, no murmurs, and no evidence of infarction. Systolic hypertension was present in 70/203 men and 124/227 women without left ventricular hypertrophy pattern, while diastolic hypertension was present in 21 men and 42 women.

9) Left axis deviation

The significance of a mean QRS vector of -30° or more is that it may be associated with conduction block in the anterior portion of the left bundle-branch (left anterior hemiblock; Grant, 1956; Rosenbaum, 1970). It may occur acutely in myocardial infarction or chronically in ischaemic heart disease; if associated with right bundle-branch block there is a danger of trifascicular block and idioventricular rhythm. The prevalence of left axis deviation in the general population is unknown. It was present in 44 of the present 477 cardiograms (8.8%). In 22 of these the $\bar{A}_{QRS}$ exceeded -45° and in 8 it exceeded -60° . There were 22 men and 22 women. In 27 of them the cardiogram was otherwise normal, and in 24 there was no history of ischaemic heart disease. In a further 15 cases it was associated with ST-T changes, and 6 of these had an ischaemic history. It was not associated with an increased prevalence of hypertension. In 3 cases there was also incomplete right bundle-branch block.

10) Summary

A history of angina was given by 10.3 per cent of men and 11.6 per cent of women in the sample. Severe angina was present in 6 per cent and 4.5 per cent, respectively. More men than women gave a history of possible myocardial infarction, 10.8 per cent as opposed to 3.4 per cent. 6.1 per cent of the cardiograms showed Type 1 changes while 24 per cent showed Type 2 changes, i.e. possible ischaemic disease.

There was no sex difference in the prevalence of electrocardiographic abnormalities which, however, increased with age while a history of angina or infarction did not. Cardiac enlargement was more frequent in the presence of electrocardiographic changes but no more frequent in those giving a history of angina or infarct. Fifty-four per cent of subjects with a history of angina or infarction had no ischaemic changes in the electrocardiogram, while 28 per cent of subjects with such changes gave no history of angina or infarction. If a history of angina or infarction and/or the presence of Type 1

electrocardiographic changes is taken as evidence of probable ischaemic heart disease, the total probable prevalence in the sample was 18 per cent. If we include in addition Type 2 or possible electrocardiographic changes the figure rises to 28 per cent.

Smoking history, obesity, and hypertension were unrelated to the presence of manifestations of ischaemic heart disease in this group. Hypertension was commoner in women and was associated with voltage changes of left ventricular hypertrophy on the electrocardiogram. Other electrocardiographic abnormalities were rare with the exception of the pattern of left axis deviation present in 8.8 per cent of the sample and marked in 4.4 per cent which is recognized as commonly due to damage or degeneration of the anterior division of the left bundle-branch.

Discussion

We report the response to a standardized angina and infarction questionnaire and the occurrence of specific coded electrocardiographic abnormalities in a randomly selected sample of the older population in a defined area. For comparison two studies in the same age group, using careful sampling methods, are of particular relevance. One is the postal questionnaire carried out by Reid *et al.* (1966a) on a random sample of subjects aged 65 to 74 (Table 5). The main differences are the lower prevalence among women of angina shown by Reid *et al.* and the lesser sex difference shown by them in respect of possible infarction. Our figures confirm the Framingham findings (Dawber *et al.*, 1962) that in men angina and history of infarct are equally common while in women the latter is much less common.

Kennedy and Caird (1972) in an electrocardiographic survey of 400 subjects over 65 forming stratified random samples from two towns in Scotland found a similar prevalence of abnormal electrocardiograms, to that found in the present study (Table 6). They showed a higher prevalence of pathological Q waves and of bundle-branch block both right and left, while non-specific ST and T changes were less common than in the present data.

TABLE 5 *Percentage frequency of history of ischaemic heart disease*

History of	Source	Men	Women
Angina	{ Reid <i>et al.</i> (1966a)	10.4	5.8
	{ Present data	10.3	11.6
Possible infarction	{ Reid <i>et al.</i> (1966a)	7.9	4.0
	{ Present data	10.8	3.4

TABLE 6 Percentage frequency of coded electrocardiographic abnormalities

	Kennedy and Caird (1972)	Present data
Normal	43.0%	44.0%
Left axis deviation	6.5%	8.6%
Left bundle-branch block	2.5%	0.6%
Right bundle-branch block	3.5%	2.3%
Incomplete right bundle-branch block	3.0%	1.5%
Left ventricular hypertrophy (voltage)	7.8%	9.7%
Q (I 1.1-3.6)	9.5%	7.7%
ST-T or T	10.5%	27.3%
Atrial fibrillation	3.0%	2.5%

As regards younger age groups the survey of male postal workers aged 40 to 59 carried out by Reid *et al.* (1966b) affords some comparison with the 215 older male subjects in the present series (Table 7). In the older group of men a majority have a codable abnormality in the electrocardiogram and there are steep rises in the prevalence of major Q/QS patterns, ST-T patterns, and history of myocardial infarction. Comparable studies of the prevalence of ischaemic heart disease in Europe are reported by Rose (1967). Again the present figures show a much higher prevalence of angina (10% as opposed to 0.3-6.3%), possible infarction (10.8% to 1.5-9.6%), probable

TABLE 7 Effect of age on percentage prevalence of electrocardiographic abnormalities in men

	Age group			
	40-49* (374)	50-59* (293)	62-69 (122)	70+ (93)
Electrocardiogram				
No codable abnormality	79	71	56	33
Major Q/QS	1.1	2.0	3.3	7.5
Minor Q/QS	0.5	0.7	0.8	3.7
LV hypertrophy	—	0.7	3.3	3.7
ST depression	3.2	8.2	8.0	17
T inversion or flattening	1.1	4.4	19	26
AV block	0.3	2.4	2.5	4.6
Bundle-branch block	1.8	1.7	5.0	5.6
Probable ischaemic heart disease				
	1.1	2.7	5.0	8.4
Possible ischaemic heart disease				
	4.2	9.2	19	29
History				
Angina		4.0	9.1	11.8
Infarct		2.0	10.8	10.7

* Data from Reid *et al.* (1966b).

ischaemia on electrocardiogram (6.1% to 1.4-2.6%), and possible ischaemia (2.5% to 5.5-12.2%).

How probable is it that the present results validly represent the prevalence of ischaemic heart disease? The first problem is what is meant by ischaemic heart disease. Coronary atheroma which is the underlying pathology of the great bulk of the disease is present at an early age in many clinically healthy people. Its progression to the point of causing symptoms cannot be documented short of serial coronary angiography. The cardinal symptom is angina, yet severe occlusive disease may be present with this symptom which correlates poorly with the extent of the disease. Angina itself is not a risk to survival. Death occurs as a result of myocardial infarction or local critical ischaemia causing arrhythmia, both of which are unpredictable complications of the disease, and which may be its first and only manifestation (Lovell and Prineas, 1971). Silent myocardial infarction may occur without symptoms (Lindberg *et al.*, 1960). Atypical presentations of myocardial infarction occur commonly in elderly people (Pathy, 1967). The resting electrocardiogram is frequently normal in patients at risk of death from

TABLE 8 Final diagnosis of patients admitted to coronary care unit, Western General Hospital, Edinburgh, 1966-68

Condition	No.	%
Myocardial infarction	508	59
Other cardiac:		
ischaemia	143	
arrhythmias	52	
pericarditis	20	
LV failure	17	
dissecting aneurysm	3	
other	12	247 28
Respiratory:		
pulmonary infarct	15	
pneumonia	11	
bronchitis	10	
pneumothorax	3	
other	6	45 5
Gastrointestinal:		
peptic ulcer	10	
oesophagitis	6	
hiatus hernia	5	
other	12	33 4
Skeletal pain	10	1
Miscellaneous:		
syncope	12	
cerebrovascular accident	4	
hyperventilation	2	
other	11	29 3
Total	872	100

ischaemic heart disease. Clearly the identifiable manifestations will yield many false negatives.

False positive responses in terms of ascribing chest pain from other causes to ischaemic heart disease are notoriously common (Rose, 1968; Zeiner-Henriksen, 1972). Pain simulating myocardial infarction but due to other causes and resulting in admission to a coronary care unit is common (Table 8; also Säwe, 1971), and a retrospective history of such pain must include a large number of false positives in patients who are not fully investigated in hospital. Friesinger and Smith (1972) found positive arteriographic evidence of coronary artery disease in 92 per cent of patients with typical angina and 40 per cent of those with atypical pain. In those with pathological Q waves in the electrocardiogram all were positive if there was anginal pain. Similarly with ST-T changes; if accompanied by angina they were always associated with angiographic changes but were so in only a minority of those without pain.

Even the electrocardiographic changes of ischaemic heart disease are not specific. Broad pathological Q waves are the most convincing evidence of previous infarction but Horan, Flowers, and Johnson (1971) report that an isolated broad Q in inferior or anterior leads has only a 50 per cent chance of being associated with an infarct. Horizontal ST depression in the left praecordial leads is likewise highly suggestive in the absence of left ventricular hypertrophy or digitalis. Primary T wave abnormalities however may, in addition to ischaemia, be due to pericarditis, cardiomyopathy, mitral regurgitation, hypokalaemia, drugs such as digitalis or quinidine, or hypertensive crises (Surawicz, 1972). Other changes which may be ischaemic include atrial fibrillation in the absence of rheumatic heart disease (Davies and Pomerance, 1972) and complete AV block particularly in the form of bilateral bundle-branch block. These, however, are rare. Left bundle-branch block has been included in the criteria used here as probable evidence of ischaemic heart disease, yet Haft, Herman, and Gorlin (1971) and Lewis *et al.* (1970) in studies of this abnormality ascribe only some 50 per cent of cases to this cause.

It is of interest that the presence of left anterior hemiblock (Rosenbaum, 1970) was far commoner than either left or right bundle-branch block in this series of elderly patients, and after ST-T changes and left ventricular hypertrophy pattern it was the most common abnormality. The significance of this is not yet fully apparent. It is a common sequel to myocardial infarction but on the other hand may be present in other patients, presumably as a result of degenerative disease of the conducting tissue.

It is clear both that the specificity of the factors

which can be taken as evidence of ischaemic heart disease is low and that the point in the evolution of this common condition at which the disease can be diagnosed as present is vague. Accepting these limitations, the best that can be done is to record the prevalence of various possible manifestations using standard criteria so that comparison may be made with other surveys. The points that emerge from the present survey are the striking increase in the prevalence of all stigmata of ischaemic heart disease with age. Though not unexpected, this represents a remarkable incidence of the disease when it is remembered that the cohorts studied are the survivors of high annual mortality rates from ischaemic heart disease. In this older age group there is little sex difference in prevalence figures, and the well-established relation between blood pressure and ischaemic heart disease brought out in prospective studies of mortality in younger subjects (Morris *et al.*, 1966) is not evident.

Although the true prevalence of the disease in different age and sex groups probably runs parallel with the prevalence of the presumed manifestations, it would be rash to attempt to deduce actual prevalence rates from this or other cardiovascular surveys. The most unequivocal evidence is probably the existence of electrocardiographic abnormalities with angina, and in the present series this occurred in 7 per cent of cases. At the other extreme some 30 per cent have at least one manifestation which is suggestive of the disease. Some cases of serious coronary occlusive disease may be undetected by all of the current methods, and in a population sample such as this which is being studied longitudinally, the incidence of fresh changes may be evaluated much more precisely than the retrospective data.

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