

PROGNOSIS OF CORONARY HEART DISEASE IN MEDICAL PRACTITIONERS

BY

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One of the obstacles to producing general summaries of the prognosis in coronary (ischæmic) heart disease is that it is exceedingly difficult to judge the degree to which any personal or hospital series is representative of the totality of cases, with the widely varying seriousness that does in fact occur (Friedberg, 1949; Katz *et al.*, 1949; Master *et al.*, 1936; Parkinson and Bedford, 1928; Schnur, 1953; Sigler, 1951; Metropolitan Life Insurance Company, 1953; Tudhope and Donald, 1953; White, 1926). Thus, more than half of all deaths from "coronary thrombosis" among middle-aged men are "sudden deaths" and other rapidly fatal *first* clinical attacks (Morris *et al.*, 1952). But such cases, whose inclusion or omission obviously can determine any picture of the prognosis, are quite commonly seen only by general practitioners and coroner's pathologists. This is the kind of situation in which the epidemiological method—aiming to observe all cases in a defined population—can help to complete the clinical picture: each type of case is represented in the experience being analysed in correct proportion (Morris, 1955).

A study based on this principle (though it was not clearly stated there) has already been reported by us and the present study is an extension of it. All male medical practitioner members aged 40–64 years of the Medical Sickness, Annuity and Life Assurance Society, Limited, holding non-cancellable sickness insurance, who suffered a first clinical attack of coronary heart disease between Jan. 1, 1940 and Dec. 31, 1952, were followed up to Dec. 31, 1954. The original study has thus been extended in three ways.

- (1) The 73 first attacks occurring in 1951 and 1952 have been added, to make a total now of 316.
- (2) The period of observation has been lengthened by $3\frac{1}{2}$ years.
- (3) Membership of the Society ceases usually at 65 years of age, and sometimes at 60. In the present study, through the ready co-operation of the General Medical Council, all members no longer on the Society's books were traced till their death or to the end of 1954. There are, thus, no lapses due to loss of contact with cases before the end of the period of observation.

In the previous paper some detailed information is given about the Society and its membership, about the methods of defining and recording morbidity and mortality, and so on. Since this paper is readily available there will be little further reference to such matters. Similarly, the method of estimating the prognosis is described in Appendix 2 of that paper. Readers interested in setting up a prognosis study might refer also to Berkson and Gage (1950), Hill (1955), and Merrell and Shulman (1955).

RESULTS

Table I assembles the data in two ways, (A) describing the mortality at different periods, and (B) the survival rates: it is the obverse of (A). All times are reckoned from the first day of the first clinical attack, the first clinical attack being regarded as the first absence from work, lasting

at least a week, on account of any recognized manifestation of coronary heart disease. The results are presented in three forms (Table I).

(1) All 316 first attacks occurring in 1940-52 (and whatever the detailed diagnosis) are analysed together.

(2) The 252 of the 316 cases where the final diagnosis in the first clinical attack was "coronary thrombosis" (i.e. coronary occlusion or coronary thrombosis or myocardial infarction) are analysed separately.

(3) Similarly, the 52 cases where the final diagnosis in the first attack was *angina pectoris* or *of effort* (ascribed to coronary artery disease or *not* ascribed to any other condition) are also reported by themselves. The prognosis in this angina group is so different from the others that it seemed wise to separate it despite the small numbers.

A group of cases (12 in all of the 316) where the final diagnosis of the first attack was coronary insufficiency, etc., will not be considered further.

TABLE I.
PROGNOSIS FOR LIFE AND DEATH IN CORONARY HEART DISEASE
Male medical practitioners aged 40-64 years. First attacks occurring in 1940-52
(A) CUMULATIVE PROPORTION DYING WITHIN VARIOUS PERIODS FROM THE ONSET OF THE FIRST CLINICAL ATTACK

Mode of presentation	Number of cases	Percentage dying* before the end of the:—													
		1st week	1st m'th	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	11th year	12th year
All first attacks— all manifestations	316	24	29	32	35	39	41	46	51	56	59	59	63	63	63
First attacks of coronary throm- bosis	252	30	36	40	43	45	48	51	54	58	60	61	65	65	65
First attacks pre- sented as angina pectoris	52	0	0	2	6										

(B) PROPORTION SURVIVING

Mode of presentation	Number of cases	Percentage surviving* to the end of the:—													
		1st week	1st m'th	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	11th year	12th year
All first attacks— all manifestations	316	76	71	68	65	61	59	54	49	44	41	41	37	37	37
First attacks of coronary throm- bosis	252	70	64	60	57	55	52	49	46	42	40	39	35	35	35
First attacks pre- sented as angina pectoris	52	100	100	98	94										

Data in Text, Tables, and Figures refer to male members of the Medical Sickness, Annuity and Life Assurance Society, Limited. All men included held non-cancellable sickness and accident insurance of a type providing benefit from the beginning of periods of absence from work because of sickness which lasted seven days or more. The members of the Society are mostly resident in the United Kingdom, though there are a few elsewhere.

The figures in italics are less reliable than the others—see footnote to text.

* The percentages are calculated on a "life-table" basis.

No case was labelled until all the information about the first attack was available; in all cases the most serious diagnosis in this illness (or absence) was accepted.

Prognosis in Coronary Heart Disease. The top line of Tables I(A) and I(B) describes the experience with all recognized clinical manifestations of coronary heart disease included.

Prognosis of "Coronary Thrombosis". The second line of Tables I(A) and (B) deals with the "coronary thrombosis" group of cases. Thirty per cent of these male medical practitioners aged 40-64 (Table IA) died in the first week of their first clinical attack. There is good reason to suppose that they died in the first few days of their illness, but the information on this point is incomplete. Seventy per cent, thus, survived the first week (Table I B, second line). In the next few weeks mortality was much lower, though still high, and by the end of the first month another 6 per cent had died. Thereafter the course was quite different. A further 4 per cent died in the remaining 11 months of the first year, and up to 4 per cent annually afterwards till the end of the twelfth year (Table IA, Fig. 1).

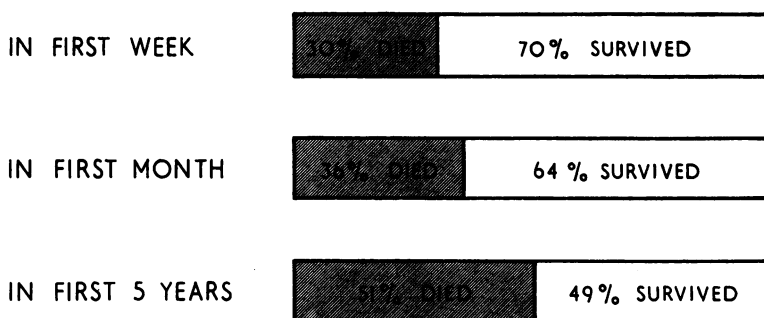


FIG. 1.—Showing the mortality at periods ranging from one week to five years, among male medical practitioners aged 40-64 with coronary thrombosis. The first attacks in this series occurred in the period 1940-52.

These figures, though the experience involved is large, are only reliable within limits. They are all subject to quite substantial "random" error; i.e. the next 252 cases may well show a somewhat different record due to chance effects alone. For practical purposes, however, it is safe to say, on the basis of the figures presented, that, in any similar group of men aged 40-64, the proportion dying in the first week of the first clinical attack of "coronary thrombosis" might be expected to be within 5 per cent of the 30 per cent given in Table IA—i.e. between 25 per cent and 35 per cent. The proportion dying within 5 years was 51 per cent in the experience reported; and again the figures to generalize with would be 46 per cent to 56 per cent. After 5 years the number to be added on each side of the number given in the table becomes a little larger.*

Angina Pectoris. The outlook in this group is very much better. Two per cent of the men first presenting merely with angina (i.e. the final diagnosis in the first illness or absence was angina) died by the end of the first year (Table IA, lowest line); compared with 40 per cent of the men whose first clinical manifestation of the condition was as major occlusion or infarction.

Non-Coronary Deaths. In all there were 166 deaths among the 316 cases being considered, and these 166 were used in calculating the rates which form the basis of Tables I(A) and I(B).

* 25%-35%, 46%-56%, etc., are the 90% "confidence intervals" or *limits*. Regarding the 252 cases that were observed as a sample of the "true" experience, it can be inferred that the proportions dying within the specified times—e.g. 1 week, 5 years, etc.—lie within the *limits* stated. This inference stands a 90 per cent chance of being correct. The narrowness of the limits within which it is possible to make such a statement depends on the numbers of cases available. There are, of course, fewer people who have been followed for a long time after the first attack than for a short time, and hence the confidence that can be attached to the figures in the table declines as the number of years after the first attack increases. For this reason the figures in Table I which can be stated, with 90 per cent confidence, to lie within 5 per cent of the "true" figure are given in ordinary type; while those which cannot be regarded with this degree of confidence are printed in italics. No figures in the table, however, have confidence limits greater than 7 per cent on either side.

Included in the 166 are 15 deaths certified as from conditions unrelated to the present problem (e.g. various cancers), and 2 deaths where the cause is unknown. This makes 17 deaths in all where it is safer to assume that the death was not due to coronary heart disease and its complications; or to assume at any rate, that coronary heart disease did not play the major part in causing death. These cases are too few appreciably to affect the picture given of the prognosis in coronary thrombosis—they accounted for 7 per cent of the deaths in these men—but 7 of the 17 occurred in men where the mode of presentation was angina pectoris; and 5 of these 7 deaths occurred in the first 3 years from the onset. Since the total number of deaths in the 52 men of this angina group during the period of observation was 22, it is obvious that the non-coronary deaths have considerably modified their prognosis. Nevertheless, even with these non-coronary deaths included, as they are in Table I, the prognosis in the angina group is materially better, for the two years that can usefully be reported, than in the cases with a diagnosis of coronary thrombosis.

The Experience at Different Ages. The trend with age was irregular in the first week in the coronary thrombosis group (Table II), but was clear by the end of the first month (Fig. 2): the

TABLE II
PROGNOSIS FOR LIFE AND DEATH IN CORONARY THROMBOSIS
Variation with age at onset of clinical disease. Male medical practitioners
First attacks occurring in 1940–52

Age at onset of first attack	Number of cases	Percentage surviving to the end of the:—						
		1st week	1st month	1st year	2nd year	3rd year	4th year	5th year
40–49	78	74	71	69	68	62	61	56
50–54	65	69	65	62	58	58	56	53
55–59	60	63	58	53	50	48	44	42
60–64	49	69	57	53	47	45	43	40

These percentages are subject to a considerable random error because of the small numbers involved, and generalizations from them can only be approximate. The general tendency for the percentage surviving for a particular period (e.g. 2 years) to decrease with advancing age is, however, most unlikely to be a chance effect (coefficient of concordance $W=0.89$, $P<0.001$).

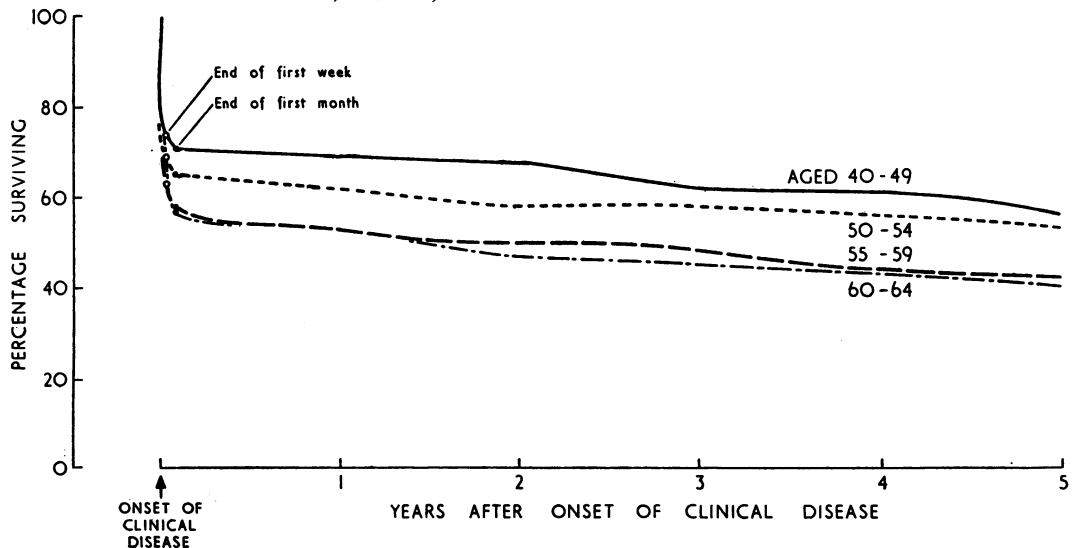


FIG. 2.—Showing the relation between age of onset of coronary thrombosis and length of life in male medical practitioners during the five years following the onset. First attacks in this series occurred in the period 1940–52.

prognosis is somewhat better when the age at clinical onset is 40–49 years than 60–64 (71 per cent surviving the first month in comparison with 57 per cent; 69 per cent surviving the first year against 53 per cent, and so on). This analysis is presented only for the coronary thrombosis group, but the trends are the same when all manifestations are taken together and the total 316 cases broken down by age. The figures in this table are, of course, much less reliable than those in Table I because the numbers of cases in each age-group is relatively small. There is, however, no doubt that the *trend* for mortality to be less among men in their forties is “significant” and most unlikely to be a chance effect. However, death rates in general tend to be lower at younger ages, and the advantage at 40–49 years which is seen in Table II is substantially less than usually found when the general mortality experience of men in their forties is compared with that of men in their early sixties.

CHANGES BETWEEN 1940–46 AND 1950–52

No information is available about the mode of treatment of the individual patients. However, it may be interesting that the cases of coronary thrombosis first presenting in 1950–52 did a little (though not significantly) better than those of 1940–46. The following figures are a fair summary of the data.

CHANCES OF SURVIVING: MALE MEDICAL PRACTITIONERS AGED 45–64 WITH CORONARY THROMBOSIS

Year of first clinical attack	Percentage surviving to the end of the:—						
	1st week	1st month	1st year	2nd year	3rd year	4th year	5th year
1940–46	64	57	53	48	47	45	43
1950–52	73	68	64	62	58	56	51

Deaths from all causes are included in this analysis; but the cases aged 40–44 years have been excluded because of special problems of this group that will be discussed elsewhere. There were 77 first attacks in 1940–46, in men aged 45–64, and 90 in 1950–52. The fact that there were more in the three recent years than in the seven years, 1940–46, is an illustration of the increase of coronary heart disease among middle-aged members which is the most striking feature of the recent morbidity experience of this Society (Morris *et al.*, 1952). There was a rise in the number of members between 1940 and 1952, and some rise in their average age during this period; nevertheless the number of first attacks in 1950–52 would have been very much nearer 40 than 90 if there had been no increase in incidence of the disease, or, at least, in its recognition. It is probable that more cases of ischaemic heart disease that were mild or uncharacteristic were being diagnosed in 1950–52 than in the early 1940s; and this may be improving the outlook of the 1950–52 cases as a whole as well as almost certainly playing a part in increasing the total number certified (Morris, 1951, 1955). However that may be, it seems that if better treatment had anything to do with slightly better prognosis in 1950–52 this must have been effective in the first hours and days of the first clinical attack—e.g. in terms of anti-shock measures—because such improvement as did occur was apparent in the first week, with 73 per cent surviving it in 1950–52 compared with 64 per cent in 1940–46.

SUMMARY AND CONCLUSIONS

The information presented illustrates how the epidemiological method (Morris, 1955), counting all defined cases occurring in a counted population, can help to increase the accuracy of general numerical summaries of the prognosis in such conditions as coronary heart disease. For example, deaths in the first few days of the first clinical attack dominate the picture of mortality in this disease. Thirty per cent of these men who had first clinical attacks diagnosed as coronary occlusion or coronary thrombosis or myocardial infarction died in the first seven days of their illness and a further 30 per cent in the next 7, 8, or 9 years. If the correct proportion of these early malignant, rapidly fatal cases is not included in any series, the picture presented by the series will be unduly

optimistic or pessimistic. Indeed, so much happens from hour to hour and day to day at the beginning of the first clinical attack that it is probably safer not to make any overall statements about the long-term prognosis in coronary thrombosis before the end of the first week of the illness. This does not apply to statements about the outlook in particular defined clinical types (Gilchrist and Tulloch, 1956; Morgan Jones, 1955; Russek and Zohman, 1952). The outlook among the survivors of the first week is relatively good, and is given in convenient form in Table III which thus supplements Tables I and II whose main results are also summarized in the top part of Table III. About 70 per cent of the survivors of the first week survived another 5 years; about 50 per cent survived 10 years. (The reader can easily make the necessary calculations for coronary heart disease as a whole—all first clinical manifestations among these doctors—from Table I.) In passing, it may be remarked that hospital series will usually represent experiences intermediate between those from the beginning of first clinical attack (e.g. Table I), and those from the end of first week (e.g. Table III).

TABLE III
SURVIVAL RATES AT THREE STAGES OF THE FIRST CLINICAL ATTACK OF CORONARY THROMBOSIS
252 male medical practitioners, aged 40–64 years suffering a first clinical attack in 1940–52

Stage	Age at first attack	Proportion surviving 5 years	Proportion surviving 10 years
From the beginning of the first clinical attack ..	40–64	49%	35%
	40–49	56%	
	50–59	48%	
	60–64	40%	
From the end of the first week of the first attack	40–64	70%	50%
	40–49	75%	
	50–59	72%	
	60–64	58%	
From the end of the first month of the first attack	40–64	76%	55%
	40–49	79%	
	50–59	77%	
	60–64	70%	

The percentages for all ages together, 40–64, should if used for generalization, be quoted as “44–54%” and not “49%”, etc. The percentages for individual age groups are subject to a considerable random error.

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REFERENCES

- Berkson, J., and Gage, R. P. (1950). *Proc. Mayo Clin.*, **25**, 270.
 Friedberg, C. K. (1949). *Diseases of the Heart*. London.
 Gilchrist, A. R., and Tulloch, J. A. (1956). *Scot. med. J.*, **1**, 1.
 Hill, A. Bradford (1955). *Principles of Medical Statistics*. London.
 Jones, A. M. (1955). *Brit. med. J.*, **2**, 1613.
 Katz, L. N., Mills, G. Y., and Cisneros, F. (1949). *Arch. intern. Med.*, **84**, 305.
 Master, A. M., Jaffe, H. L., and Dack, S. (1936). *Amer. Heart J.*, **12**, 549.
 Merrell, M., and Shulman, L. E. (1955). *J. Chron. Dis.*, **1**, 12.
 Morris, J. N. (1951). *Lancet*, **1**, 1, 69.
 — (1955). *Brit. med. J.*, **2**, 395 and (1955). *Med. Offr.*, **94**, 251.
 —, Heady, J. A., and Barley, R. G. (1952). *Brit. med. J.*, **1**, 503.
 Parkinson, J., and Bedford, D. E. (1928). *Lancet*, **1**, 4.
 Russek, H. I., and Zohman, B. L. (1952). *Amer. J. med. Sci.*, **224**, 496.
 Schnur, S. (1953). *Ann. intern. Med.*, **39**, 1014.
 Sigler, L. H. (1951). *J. Amer. med. Ass.*, **146**, 998.
 Statistical Bulletin, Metropolitan Life Insurance Company (1953). **34**, No. 10, 1.
 Tudhope, G. R., and Donald, A. C. (1954). *Lancet*, **2**, 465.
 White, P. D. (1926). *J. Amer. med. Ass.*, **87**, 1525.