

## PROGNOSTIC SIGNIFICANCE OF CORONARY ARTERIOGRAPHY

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### SUMMARY

An index of severity of coronary artery disease is described which takes into account the site, severity and number of all lesions in the coronary arteries. A percentage figure is computed with low percentages indicating severe disease. Ten year follow-up for 1050 medically treated patients are given. During the period of observation the overall mortality rate was 6.3%. 68% of deaths occurring in the first year and 97% in the first five years. Survival curves are drawn for five years and indicate significant differences in survival between the four quartiles of the coronary index. In particular, a high risk group is described with a coronary index of 25% or less. Left ventricular abnormalities further decrease the survival rates.

The prognosis in coronary artery disease has been shown to be, not surprisingly, dependant on the severity of the disease as judged by coronary and left ventricular angiography (Oberman et al 1972; Brusckhe et al 1973; Reeves et al 1974). The usual system for analysis of the coronary arteriogram has been to describe patients as falling into one, two or three vessel disease categories. This is a very simple classification which leaves scope for considerable error. Most patients have at least five, and some as many as eight, major arteries supplying the left ventricular myocardium. Patients described as having three vessel disease could be very different, one with three out of eight arteries involved and the other with all eight. The simple system also takes into account only one major stenosis in each vessel system ignoring other stenoses and the site of lesions. The importance of site is demonstrated by the survival curves from 208 medically treated patients shown in Fig. 1. The well known poor prognosis in patients with left main coronary lesions (first generation branch) (Cohen et al 1972; Pichard et al 1973; Webster et al 1974) is seen but also patients with lesions in the main trunks of the right, anterior descending and circumflex arteries (second generation branches), have a worse prognosis than those with peripheral disease (third generation branches) only.

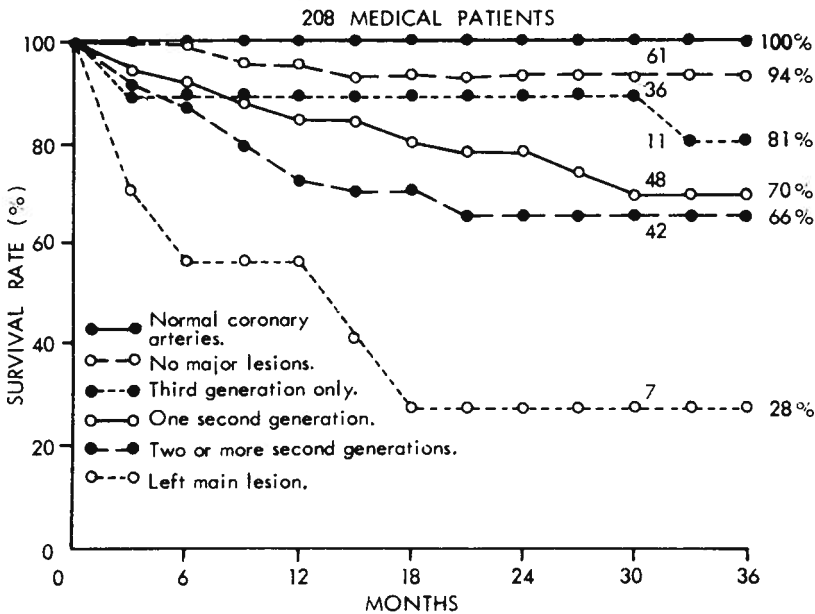


Fig. 1 — Survival curves for 208 medically treated patients drawn according to the site of the coronary arterial lesions.

Patients with minor lesions only have a better prognosis but such lesions cannot be ignored as they may be involved in the causation of sudden cardiac events. Other systems of scoring coronary angiographic abnormalities have been used which attempt to overcome some of these difficulties (Friesinger et al 1970; Gensini, 1975). The system described here has been evolved in an attempt to overcome these difficulties and takes into account the site and severity of lesions in the coronary arteries. Fig. 2 shows a schematic diagram of the coronary arterial circulation. Each of the vessels V1 to V13 is noted at angiographic review and lesions in them recorded on a 0 to 4 scale. 0 is normal, 1 is stenosis involving up to one third of the lumen diameter, 2 is stenosis between one and two thirds of the lumen, 3 is stenosis of more than two thirds of lumen diameter and 4 complete occlusion. These data are recorded on computer Mark Sense cards and an index of severity is then generated. The right and left coronary systems start with a score of 1 which is then reduced according to the number and severity of the lesions. A reduction of 25% is made for each grade of severity. If lesions occur in series, their effect is multiplied, adding weight to these, and if they occur in parallel, they are added. The score for each terminal branch is then added and divided by the number of those branches. This final figure is expressed as a percentage. Low percentages therefore indicate severe coronary disease and high percentages mild disease. The left ventricular angiogram is analysed according to three segments (anterior, apical and inferior) which may contract normally or be hypokinetic, akinetic or dyskinetic. When data collection started in 1970 ejection fraction was not routinely measured and so has not been included in this analysis.

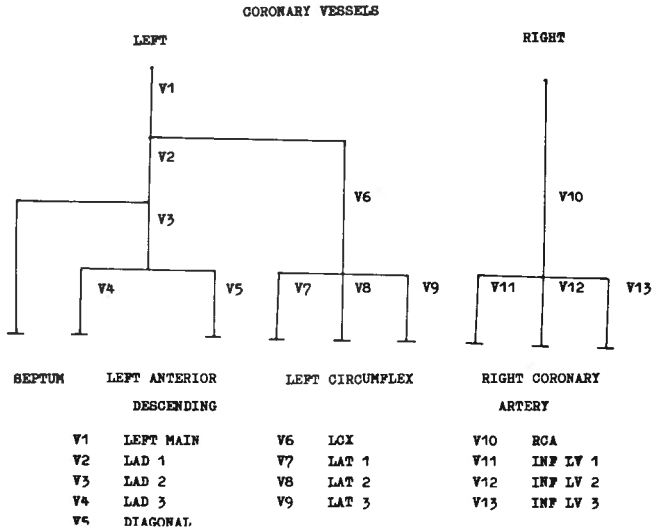


Fig. 2 — Schematic diagram of the coronary circulation showing the vessels identified at angiography.

Fig. 3 shows the angiographic data from the same 208 medically treated patients referred to previously now analysed according to the coronary index. The curves represent patients with indices in the four quartiles. There is a good correlation between severity as defined by the index and survival and perhaps more importantly, a larger group of patients (25 compared with 7) has been defined with a very poor prognosis.

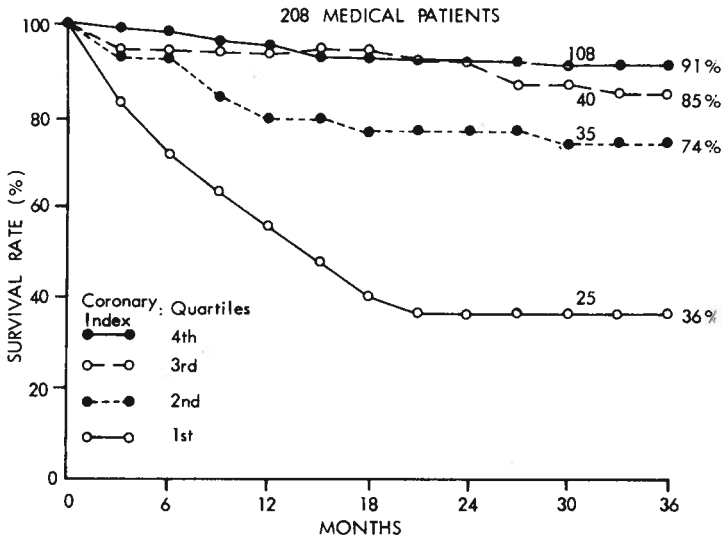


Fig. 3 — Survival curves for the same 208 medically Treated patients shown in Figure 1 analysed according to their coronary index.

Our data bank now consists of 3000 patients investigated for known or suspected coronary artery disease who have been investigated by coronary arteriography between September 1970 and 31st December 1979. For the majority of this time, the policy was to investigate all patients who presented with known or suspected coronary artery disease. The following analysis concerns 1050 patients who were shown to have coronary artery disease and who did not undergo surgery. Accurate information on survival was obtained by indexing the patients with the Registrar General (all deaths in the U.K. have to be recorded with the Registrar General) so that information on mortality is complete. Survival curves are drawn using the actuarial method and statistical comparison is by the Log Rank Test.

## RESULTS

There were 66 (6.3%) deaths during the observation period, 45 (68%) in the first year after study and 64 (97%) in the first 5 years, 36 (54%) of the deaths occurred in patients with coronary indices of 25% or less, 16 (24%) in those with indices of 26-50%, 9 (14%) in the group 51-75% and 5 (7%) in the group 76-99%

Since the great majority of deaths occurred in the first 5 years of follow-up the survival curves have been limited to this period.

Fig. 4 shows survival curves for all the patients divided according to their coronary index quartile. There is a significant difference between curves for 0-25% and 26-50% groups and the others ( $P < 0.001$ ). These two curves are also significantly different from each other ( $P < 0.001$ ). There is a 47.5% difference in 5 year survival between the best and worst groups.

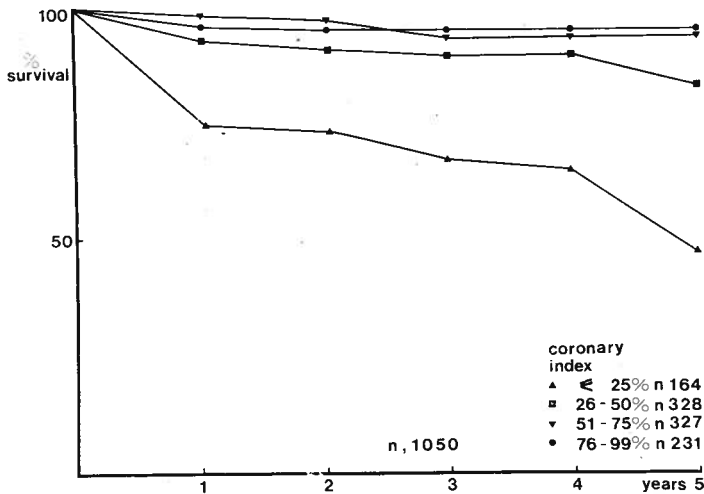


Fig. 4 — Survival curves for 1050 medically treated patients according to their coronary index quartile.

Fig. 5 shows survival curves for all patients according to their left ventricular angiographic findings regardless of the coronary index. These data are from 1607 patients. The difference between the curves is significant ( $P < 0.05$ ) for all curves except between those for patients with one or two abnormal segments.

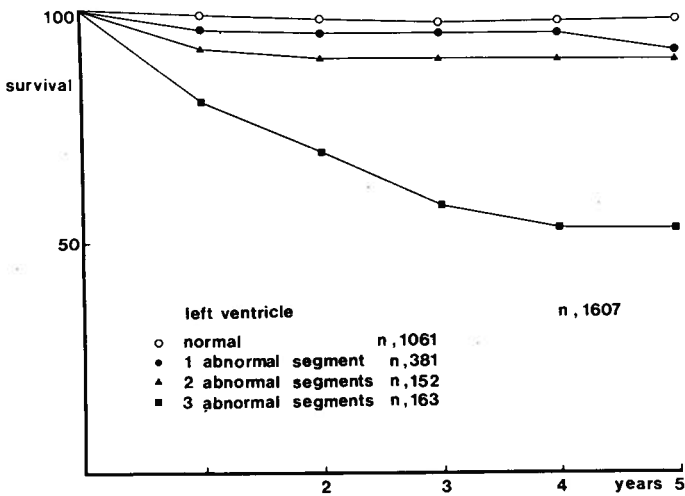


Fig. 5 — Survival curves for all patients according to left ventricular angiographic findings.

Figs. 6 and 7 show survival curves for patients in the first 2 coronary index quartiles according to the left ventricular angiographic findings. (there were insufficient patients with left ventricular abnormalities and indices above 50% to allow separate curves to be drawn).

The difference in survival was only significant with the coronary index subdivisions if there were three abnormal segments.

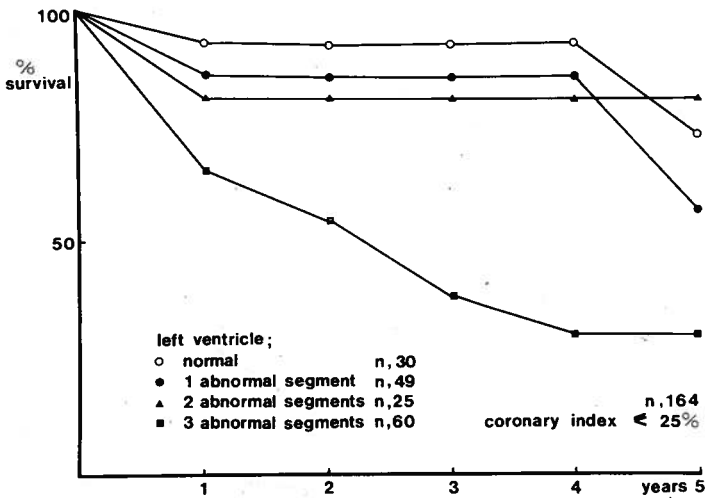


Fig. 6 — Survival curves for patients in coronary index group 26-50% according to left ventricular angiographic findings.

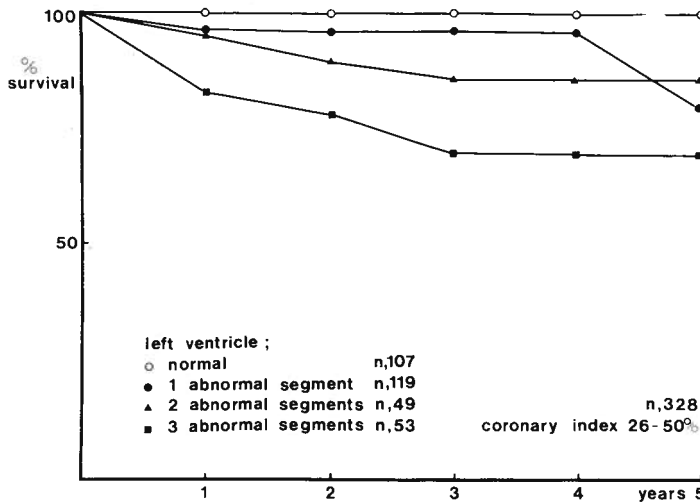


Fig. 7 — Survival curves for coronary index group less than 25% according to left ventricular angiographic findings.

## DISCUSSION

The patients described here were all U.K. residents and attended one hospital for cardiological care. In addition to the usual methods of hospital outpatient visits, communication with attending physicians, and patients and their families, they were indexed with the Registrar General. In this way, information concerning all deaths that occurred in the United Kingdom was available and follow-up was as close to 100% as possible. This addition in fact was the only method that disclosed approximately 30% of the deaths.

Caution is therefore needed when judging all reported survival series especially when the patient population is drawn from a very large area and particularly when they come from a number of different countries, because of the difficulties in ensuring complete follow-up.

An early study (Zakel et al. 1969) suggested annual mortality rates for patients with coronary artery disease of between 3 and 5% depending upon whether they presented with angina pectoris or myocardial infarction. These patients did not undergo coronary arteriography so that the diagnosis was not confirmed nor its severity assessed.

Later angiographically controlled studies demonstrated that mortality rates depended on both coronary and left ventricular abnormalities (Oberman et al 1972; Brusckhe et al 1973; Reeves et al 1974) and were approximately 6% per annum overall and ranged from approximately 2% for one vessel disease to 15-20% for three vessel disease. The situation was worse for left main stenosis up to 50% per annum and generally worse if there was an abnormal left ventricular angiogram. One report suggests a worse prognosis in the first year of the follow-up (Brusckhe et al 1973).

The data presented here are in general agreement with these findings but the overall mortality rates are lower only 6.1% of the patients dying in the first 5 years of follow-up. The first year mortality of 4.3% was as in the Cleveland Clinic series considerably higher than subsequent years. A similar unexpectedly low overall mortality in the

medically treated patients was also found in two reported prospective studies on the effects of aortocoronary bypass surgery (Varnauskas et al 1979; Murphy et al 1977). This adds to the difficulties related to the simplistic classification of the coronary angiographic findings. These problems may account for the controversy that exists concerning the effect of surgery on prognosis.

The sistem of analysis described removes the difficulty of defining only some of the coronary lesions and patients were re-classified into more appropriate groups. In particular, it defined a group of patients with a similarly poor prognosis to that recognised for left main stem stenosis. It is a group such as this who have most to gain from procedures such as aortocoronary bypass surgery and to whom attention should be directed even when symptoms are not the dominant feature.

## RESUMO

### SIGNIFICADO PROGNÓSTICO DA CORONARIOGRAFIA

A partir dos dados obtidos na coronariografia, desde o grau e número de lesões aos locais onde elas se registam, elabora-se um índice da gravidade de comprometimento coronário. Os dados lidos são computadorizados e o resultado final expresso em valor percentual, representando as baixas percentagens doença coronária grave.

Para testar o valor deste índice, utilizam-se os dados obtidos do follow-up de 1050 doentes coronários tratados medicamente. Durante o período de observação, a mortalidade global foi de 6,3%, com 68% das mortes registadas no primeiro ano e 97% nos primeiros cinco anos.

Analisando o comportamento aos cinco anos e utilizando o índice, verifica-se que a sobrevivência é muito diferente nos quatro quartos do índice coronário; quando este é inferior a 25%, correrponde ao grupo de alto risco. As alterações ventriculares esquerdas agravam ainda mais as percentagens de sobrevivência.

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