CORONARY DISEASE IN YOUNG MEN

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In Australia, an affluent "western" country with a high degree of urbanisation, coronary heart disease is the commonest cause of death. It is no longer rare before the age of 40. We present here the findings in 70 men who experienced clinical coronary disease up to the age of 40 and compare them with those in 281 apparently healthy Busselton men of the same age surveyed by the University of Western Australia group in 1966 (Curnow *et al*, 1969). Comparisons have also been made with other surveys of apparently healthy men, notably those reported in the Stockholm prospective study (Carlson and Lindstedt, 1968).

The coronary patients were an unselected group who had survived myocardial infarction or had angina pectoris and had been enrolled in a diet heart study of secondary prevention begun in 1966. They came from the routine admissions of three teaching hospitals of the University of New South Wales.

Fifty eight men had experienced myocardial infarction and twelve had angina pectoris without previous infarction. The mean age at onset of symptoms was 36·0, range 28-40 years. The majority of the patients were seen 8 to 10 weeks after their most recent coronary episode. They had become ambulatory and for the most part had returned to their work. Unfortunately, for our purposes, some of them had already changed their diet and had lost weight, so that they were no longer completely representative of their pre-infarct state. It is likely that the differences between the coronary and control subjects were in fact greater than emerged from our study.

Height of both coronary and Busselton men was normally distributed. Coronary men were shorter by an average of 3·5 cm.

There was no significant difference between the weight of the coronary men at their first visit and the Busselton men. At infarction, the coronary men had been slightly heavier than the Busselton men and in 30% of the coronary men relative body weight at infarction was greater than 120 according to the Davenport standards (Keys *et al*, 1966). The reported weight of the coronary men at age 20 was compared with the observed weight of the Busselton men aged 20-29. There was no significant difference. The relative body weight at infarction was plotted against the relative body weight at age 20. From age 20 to infarction at 36, a significant number of the coronary men had increased their relative body weight by the Davenport standards. However, Busselton men behaved in a similar way and there is reason to believe that both groups contained a considerable proportion of undesirably obese men. From our evidence, it is difficult to conclude that obesity per se was an important risk factor, if we define a risk factor as a characteristic related to the disease present to a greater extent in those with than in those without the disease. However, we were studying survivors and it is possible that those who died may have been fatter. Our data do not negate other well documented evidence that obesity makes a significant contribution to coronary heart disease.

Figure 1 shows the serum cholesterol of the coronary and control subjects. The distributions are clearly different. The mean for coronary men was 308 mg./100 ml. and for Busselton men 244 mg./100 ml. Forty nine per cent of the coronary men had serum cholesterol in excess of 300 as compared with 9% of the Busselton men.

Fasting serum triglycerides of coronary men were compared with fasting serum triglycerides in non-obese Stockholm men of similar age, as triglycerides were not measured in the 1966 Busselton survey. As is usual, the distribution was non linear, with marked skewness towards the higher values. When plotted logarithmically the distribution was linear. Triglycerides were significantly higher in the coronary men, the mean being 235. When four subjects with gross type 4 disease were eliminated, the mean fell to 177 which was significantly higher than the mean of 128 in Stockholm. Sixty two per cent of coronary males exceeded 160 mg./100 ml. as opposed to 23% of healthy men in Stockholm.

Table I shows the notional lipoprotein types, using 180 mg./100 ml. as the upper limit of normal for beta lipoprotein cholesterol and 160 mg./100 ml. for triglyceride. Sixty four per cent of coronary men were type 2, 20% were type 4, and 16% were normal. Half the apparently normal men had lost more than 5 kg. in weight since infarction.

TABLE I

NOTIONAL CLASSIFICATION OF CASES BY LIPOPROTEIN TYPES. IN 5 SUBJECTS CLASSIFICATION WAS MADE SOME TIME AFTER THE INITIAL VISIT

Type	Number	Per cent
Type 2a	15	64
Type 2b	30	
Type 4	13	20
Mixed type 2 and 4	1	
Normal	11	16
TOTAL	70	100

The findings confirm that both hypercholesterolaemia and hyperglyceridaemia are unduly prevalent amongst young men with coronary heart disease. The high prevalence of the type 2 lesion is compatible with the high saturated fat intake which averaged 22% of calories in this group. The high prevalence of hyperglyceridaemia is perhaps a function of overweight and a high carbohydrate and alcohol intake with which it showed significant association.

Figure 2 shows the serum urate for coronary and Busselton men. The mean for Busselton was 5·4 and for coronary men 6·8 mg./100 ml. Seven per cent of Busselton men and 40% of coronary men exceeded 7 mg./100 ml. and could be regarded as abnormal. Four coronary men had gout, a 6% incidence which must be many fold higher than the age specific incidence for men. Hyperuricaemia was also noted by Gertler, Garn and Levine (1951) in young men with coronary disease. In our series, it correlated with hyperglyceridaemia, alcohol intake and with body weight. It did not correlate with hypercholesterolaemia.

Oral glucose tolerance tests with 50 g. glucose were carried out in 64 of the 70 men. Four men had unequivocal diabetes, which had not previously been diagnosed. Using the criteria of Joplin and Wright (1968) only one of the remaining 60 men had a blood sugar at any time during the test which could be regarded as abnormal and indicative of borderline diabetes (Table II).

The systolic blood pressure of coronary men was significantly lower than that of Busselton men by 7 mm. of mercury but the conditions of measurement were different. The distributions of both systolic and diastolic pressure in coronary men were almost identical with those reported for normal men in the Stockholm study (Carlson and Lindstedt, 1968). Thirteen men had diastolic pressures of 100 or more while five below 100 were on diuretics or hypotensive drugs. Thus, possibly as many as 18 or 26% of the coronary men were hypertensive.

Table III shows the percentage distribution of cigarette smoking by classes in coronary men as compared with normal controls. (Todd, 1969). The coronary men showed a clear preponderance of heavy smokers, that is, more than 20 cigarettes a day. Fifty three per cent were in this category. This included 23% who smoked more than 40 cigarettes a day.

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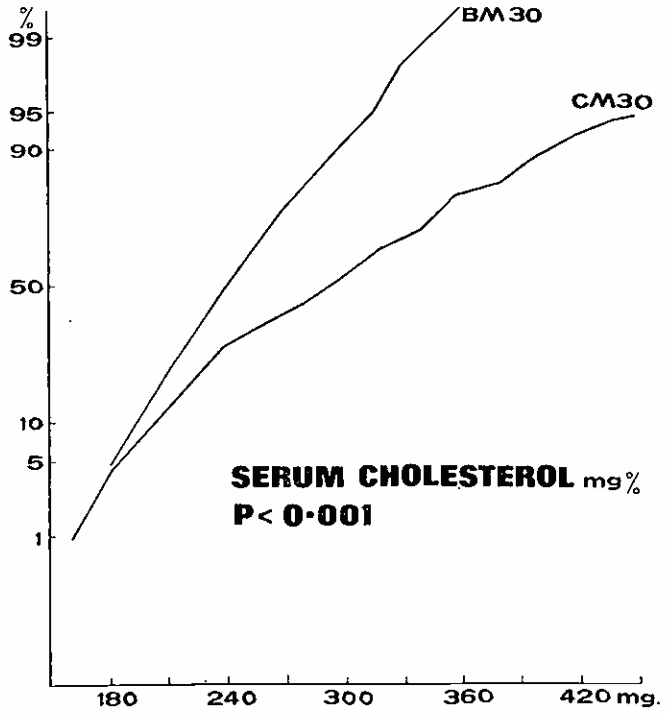

Fig. 1. Serum cholesterol in coronary men aged 28-40 years (CM30) and apparently healthy Busselton men aged 30-39 (BM30). The distributions are plotted as a cumulative frequency on arithmetic probability paper.

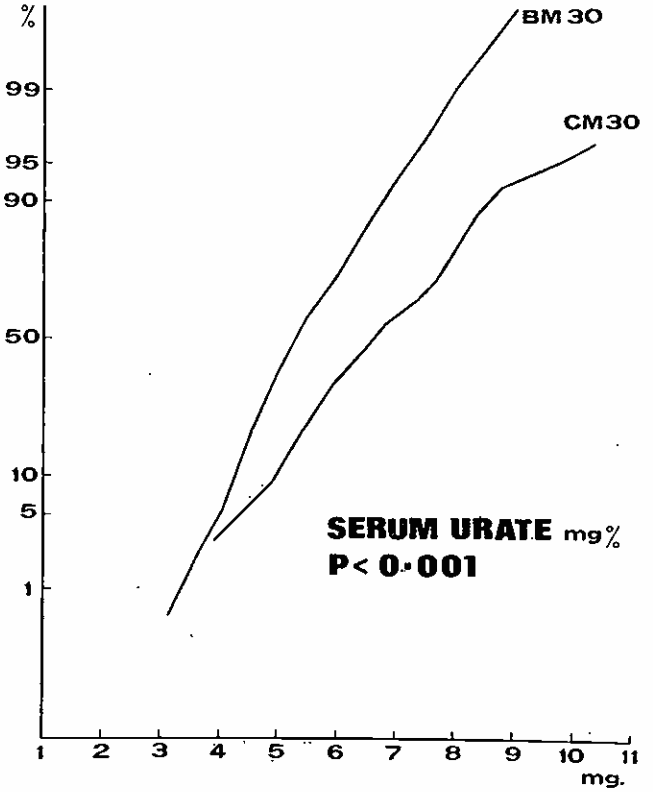

Fig. 2. Serum urate in CM30 and BM30.

TABLE II

GLUCOSE TOLERANCE TEST RESULT IN 64 SUBJECTS WITH CORONARY HEART DISEASE

Group	Time (Minutes) and Blood Sugar (Mg/100 Ml.) ± S.D.				
	0	30	60	90	120
DIABETICS N = 4	97·5 ±8·6	157·5 ±47·3	192·5 ±24·6	192·5 ±6·5	163·7 ±17·5
REMAINDER N = 60	78·8 ±9·3	133·1 ±17·0	118·5 ±20·7	96·9 ±21·6	76·3 ±18·5
UPPER LIMITS OF "NORMAL"	100	170	160	140	120

TABLE III

CIGARETTE SMOKING IN CORONARY MEN AND CONTROLS. THE DIFFERENCES ARE SIGNIFICANT. (P<0·001)

Daily usage	0	<10	<20	<30	30+
Per cent Coronary men	24	6	17	26	27
Per cent controls	33	11	22	22	11

TABLE IV

RISK FACTORS. FIGURES IN BRACKETS INCLUDE SUBJECTS WHO HAD LOST WEIGHT BEFORE INFARCTION

	Number	Per Cent
HYPERLIPIDAEMIA	57	81
HEAVY CIGARETTE SMOKING	37	53
OBESITY	21 (30)	30 (43)
HIGH BLOOD PRESSURE	18	26
DIABETES MELLITUS	4	6
HYPERURICAEMIA (?)	28	40

Standards used:

Cholesterol $\geqslant$ 260 and/or triglycerides $\geqslant$ 160
Cigarettes >20/day
Relative body weight $\geqslant$ 120
Blood pressure $\geqslant$ 160/100
Two hour blood sugar >120
Uric acid >7·0

Table IV summarises the frequency of the recognised risk factors in this group. Hyperlipidaemia was by far the most frequent, being present in 81% of the subjects when we first examined them. We estimate that it was present in at 90% prior to infarction. Heavy cigarette smoking was present in 53%.

Although the prevalence of obesity and high blood pressure was similar in the coronary and control groups, it is probable that these, too, made a significant contribution to the coronary profile. Diabetes mellitus appeared to make a relatively small contribution at this age.

Hyperuricaemia appeared to be an important discriminator as it has been in Busselton in men over 40 years of age (Welborn *et al*, 1969). However, this has not been the experience at Framingham (Hall, 1965) or Tecumseh (Myers *et al*, 1968). In men under 40, Gertler, Garn and Levine (1951) reported the same experience as our own. Whether hyperuricaemia is an independent risk factor is not clear at the present time.

Table V shows that risk factors were usually multiple; 80% had two or more risk factors.

TABLE V

CLUSTERING OF RISK FACTORS

Number Present	Number of Subjects	Percentage of Total
0	5	7
1	11	16
2	33	48
3	19	27
4	2	3
5	0	0

Factors Considered:

Hyperlipidaemia
Heavy cigarette smoking
Obesity
High blood pressure
Diabetes mellitus

The high frequency of hyperlipidaemia, heavy cigarette smoking and obesity present the greatest challenge for primary prevention of early coronary disease. Hyperlipidaemia and obesity in our community are due to a high fat, high calorie diet. Our experience in the treatment of these patients has made it clear that in the great majority of subjects, these disorders are reversible by reduction to ideal weight and modification of the fat content of the diet. If the association between hyperlipidaemia and coronary disease should prove to be causal, as is very likely, it would appear important to adopt preventive measures early in life. This is in line with the recommendations of the Inter-Society Commission (1970).

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