

ANGIOGRAPHIC FINDINGS IN YOUNG PATIENTS WITH CARDIAC INFARCTION AND THEIR RELATIONSHIP TO RISK FACTORS

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INTRODUCTION

Coronary angiography has opened new vistas in our understanding of ischaemic heart disease. (1,2,3.) This study was designed to investigate the appearance of coronary arteries in young patients with cardiac infarction and to test the hypothesis that the appearance of the arteries was related to specific risk factors. This report is confined to patients with definite cardiac infarction and avoids the problem associated with the subjective diagnosis of angina pectoris.

MATERIAL AND METHODS

Forty young patients with documented cardiac infarction were studied at the Royal Melbourne Hospital in the last two and a half years (Table I). All were under forty years of age and most were investigated two to four months after acute cardiac infarction. There were thirty five men and five women. Their average age was thirty four years. The diagnosis of cardiac infarction was established by the presence of a characteristic history, and either conclusive E.C.G. changes or non-specific E.C.G. abnormalities with transient elevation of the relevant enzymes. At the time of investigations twenty five patients had E.C.G. changes of transmural infarction with non-specific changes present in fifteen.

Elevation of blood cholesterol and triglycerides, high blood pressure, cigarette smoking and impairment of glucose tolerance were the four risk factors studied in our patients. Fasting blood lipid estimations were performed at least two months after the acute attack. A concentration of cholesterol of over 280 mg.% or of triglycerides of over 150mg.% was arbitrarily defined as abnormal. Gross elevation was defined as levels above 350gm.% and 250mg.% respectively. Hypertension was defined by a diastolic pressure of over 100mm.Hg. The glucose tolerance test was assessed by conventional criteria.

ANGIOGRAPHIC ASSESSMENT

Selective coronary cine angiography using the percutaneous transfemoral Judkins technique⁴ and a six inch intensifier was performed in all patients. The contractility of the left ventricle as a whole was assessed in the right anterior oblique position.

Each artery was visualised in at least two projections and in most cases left ventriculography was performed prior to selective coronary angiography. Coronary lesions as seen by angiography were graded in severity from 0 to 5 according to the degree of luminal stenosis. A score of zero indicated no lesions and a score of 5 complete occlusion. (Table II). The total score was obtained by adding the grades from the three main coronary arteries. This system is approximate because it does not indicate the site of the lesion, multiple lesions in single vessel, collateral circulation or lesions in smaller branches. It is however a convenient numerical way of describing angiographic findings, a score of 0 implying no lesions and one of 15 total occlusion of all three main vessels.

The longitudinal extent of coronary lesions was assessed by an additional classification of the three main arteries. A smooth normal outline with or without a single discreet lesion was noted by the letter A. More than one lesion, however trivial but of less than 2 cm. in extent was described as B. diffuse lesions were called C. The right coronary artery, left anterior descending artery and left circumflex artery were studied and described in that order. A "CCC" pattern

for example reflected a diffuse lesion of all three vessels. All angiograms were interpreted by one of the authors (W.S.C.H.) without knowledge of the patient's name or possible risk factors. In order to avoid bias the observer viewed the coronary angiograms and left ventriculograms on separate occasions.

RESULTS

a. Risk Factors

Twelve patients (30%) had elevated cholesterol levels and in 24 (60%) the triglycerides were above normal levels. In 26 (66%) one of the other of these variables was abnormal, although in only two patients was the cholesterol elevated in the presence of normal triglycerides. Conversely high triglyceride concentrations were found in seventeen patients with normal cholesterol levels. We found seventeen patients with triglyceride levels above 250Mg.%, but none with cholesterol levels above 350mg.%. (gross elevations). Hypertension was found in six patients (15%) and thirty patients (75%) were smokers. Abnormal glucose tolerance was found in thirteen patients (33%) (Table III). Thirty seven patients had at least one risk factor (Table IV). Three out of five women were taking the contraceptive Pill.

b. Angiographic Findings

The right coronary artery and left anterior descending artery were involved with approximately equal frequency. Complete occlusion was frequent in the right coronary and left anterior descending arteries, uncommon in the left circumflex and never seen in the left main coronary artery. The right coronary artery was diseased in twenty seven out of thirty five patients, being occluded in sixteen. The left anterior descending artery was diseased in twenty eight and occluded in ten patients. The corresponding figures for the left circumflex artery was eighteen and three and for the left main coronary artery was one and zero. (Table V) The left anterior descending artery was usually diseased proximally and right coronary artery 4cm.—5cm. beyond its origin. There was a close relationship between the site of major coronary lesions and areas of myocardial damage as shown by abnormal movement of the left ventricular wall on angiography and E.C.G. changes of transmural infarction.

c. The Relationship Between Triglyceride Levels and Angiographic Findings

The angiographic features of the seventeen patients with gross elevation of triglyceride levels were compared with thirteen patients in whom both cholesterol and triglyceride levels were entirely normal. A different pattern of coronary lesion was seen, all of the former, but only five of the latter suffering involvement of more than one vessel (Table VI). The average angiographic score was 9.3 in the high triglyceride group and 4.2 in the group with normal lipids. More significantly the coronary arteries had a different appearance; hypertriglyceridaemic patients displayed more diffuse lesions. An AAA pattern was seen in only one of the seventeen patients with gross elevation of triglyceride levels compared with ten out of thirteen patients with normal lipids. Both an abnormal glucose tolerance and an impaired left ventricular contractility were more frequently present in the high triglyceride level group. The average age, cigarette consumption, family history, hypertension and left ventricular end diastolic pressures were comparable in the two groups. (Table VII). A comparison between patients with discreet lesions but otherwise normal vessels (AAA pattern) with those displaying diffuse coronary involvement (BBB pattern or worse) was made. There were fourteen patients in each group. (Table VIII). It was again

TABLE I

ACUTE MYOCARDIAL INFARCTION IN YOUNG PATIENTS
(40 patients)

Sex:	Men:	35	= 40
	Women:	5	
Electrocardiographic Appearances:	Infarction:	25	= 40
	Non Specific Abnormalities:	15	
Age:	Range:	21 - 40 years.	
	Average:	34 years.	

TABLE II

ANGIOGRAPHIC GRADING

Grade	Appearances
1	Mildly irregular.
2	50% reduction in lumen.
3	Diffuse irregularities over 1 cm. or 75% reduction.
4	90% reduction in lumen.
5	Total occlusion.

TABLE III

RISK FACTORS IN YOUNG PATIENTS WITH MYOCARDIAL INFARCTION

(40 patients)

Risk Factors	Abnormal Percentage Abnormal	
Elevated cholesterol	12	30
Elevated triglycerides	24	60
Elevated cholesterol or triglycerides	26	66
High blood pressure	6	15
Smoking	30	75
Abnormal glucose tolerance	13	33

High cholesterol with normal triglycerides—2 patients.

High triglycerides with normal cholesterol—13 patients.

TABLE IV

DISTRIBUTION OF RISK FACTORS

Number of Risk Factors	Patients
0	3
1	13
2	11
3	11
4	2
TOTAL	40

TABLE V

DISTRIBUTION OF CORONARY ARTERY INVOLVEMENT

(40 patients)

Vessel	Number Involved	Occlusion
Right coronary artery	27	16
Left anterior descending artery	28	10
Left circumflex artery	18	3
Left main coronary artery	1	0

TABLE VI

COMPARISON OF PATIENTS WITH GROSS ELEVATION OF TRIGLYCERIDE LEVELS AND THOSE WITH NORMAL LIPIDS

Angiographic Features	Triglycerides Over 250mg. % (17 Patients)	Cholesterol and Triglycerides Normal (13 Patients)
ANGIOGRAPHIC SCORE (Average)	9.3	4.2
2 or 3 VESSEL DISEASE	17	5
AVERAGE END DIASTOLIC PRESSURE (mm. Hg)	8.5	8.3
"AAA" PATTERN	1	10

TABLE VII

COMPARISON OF PATIENTS WITH GROSS ELEVATION OF TRIGLYCERIDE LEVELS AND THOSE WITH NORMAL LIPIDS

Clinical Features	Triglycerides over 250mg. % (17 Patients)	Cholesterol and Triglycerides Normal (13 Patients)
AVERAGE AGE	36	33
FEMALE/MALE RATIO	1/16	4/9
ABNORMAL GTT	7	3

TABLE VIII

COMPARISON OF PATIENTS WITH DISCREET AND DIFFUSE LESIONS

Clinical Features	"AAA" Pattern (14 Patients)	"BBB" Pattern or Worse (14 Patients)
AVERAGE AGE	32	37
FEMALE/MALE RATIO	4/10	1/13
ELEVATED CHOLESTEROL (gross)	1 (0)	6 (0)
ELEVATED TRIGLYCERIDES (gross)	4 (1)	12 (8)

found that the two patterns were related to blood lipid levels. Four patients with an AAA pattern had elevation of cholesterol or triglyceride levels compared with twelve patients with a BBB pattern or worse. Gross elevation of triglyceride levels was seen only once in the former group, but eight times in the latter. In none of these patients was the cholesterol level raised without an increase in triglyceride concentration. Patients with the AAA pattern had a lower average age and higher female male ratio than patients with diffuse disease i.e. BBB pattern or worse. The incidence of hypertension, abnormal glucose tolerance, smoking habits and family history were comparable. Not surprisingly the angiographic score was much higher in patients with diffuse disease; although left ventricular end diastolic pressures were similar, left ventricular contractility was more impaired in patients with diffuse disease. (Table IX).

TABLE IX

COMPARISON OF PATIENTS WITH DISCREET AND DIFFUSE LESIONS

Angiographic Features	"AAA" Pattern (14 Patients)	"BBB" Pattern or Worse (14 Patients)
Average angiographic score	2.6	9.4
Average end diastolic Pressure (mm. Hg)	7.6	7.4

DISCUSSION

The high incidence of elevated cholesterol and triglycerides in patients with ischaemic heart disease has long been noted. Heinle *et al*,⁵ have shown an 80% incidence in patients under the age of fifty. The interpretation of lipid levels after acute cardiac infarction is fraught with difficulty. The effects of a changed diet, possible loss of weight, different exercise pattern and drugs all have to be considered.

Myocardial infarction in itself is known to be associated with alteration in lipid levels which may persist for weeks or even months after the acute episode. Tiblin and Cramer⁶ reported an initial fall of cholesterol concentration after infarction with return to original levels in about three weeks. Dodds and Mills⁷ reported similar results. The magnitude of the fall seems to be related to the severity of infarction⁸ and is a non-specific effect which also occurs after surgery⁹.

There is controversy about changes in triglyceride concentration after acute cardiac infarction. Smith in 1957¹⁰ reported a rise in the triglyceride rich pre Beta fraction reaching a maximum in three to five weeks after cardiac infarction. The study by Dodds and Mills⁷ confirmed these findings and showed that a return to original levels occurred at some stage after the 8th week. Tiblin and Cramer⁶ also confirm a rise of triglyceride concentration and suggest that these return to pre-infarction levels between three and twelve months. Fyfe *et al*,¹¹ on the other hand demonstrated a fall in both cholesterol and triglyceride concentrations after acute cardiac infarction with return of both to original levels in three months.

The most significant result of the present study is the association of elevation of triglyceride levels with the more severe and more diffuse type of occlusive process. Cramer *et al*,¹² have already shown that the frequency and severity

of occlusive process as disclosed by angiography was related to elevated triglyceride rather than cholesterol levels. Most of their patients did not however sustain cardiac infarction nor did they confine themselves to a young population. Moreover they employed non-selective angiography with aortic root injection.

The association between triglyceride levels and the type of occlusive process has not been previously emphasized. However one must be cautious in postulating a cause and effect relationship. We have noted that patients with increased triglyceride levels and diffuse coronary lesions had a slightly diminished left ventricular contractility compared with patients with normal lipids. Increased sympathetic drive and catecholamine production could conceivably be responsible for elevated triglyceride levels in patients with diffuse lesions and thus more extensive myocardial damage. The presence of normal left ventricular diastolic pressures and the slight difference in the left ventricular contractility in the two groups, the magnitude of triglyceride changes and the interval of at least two months between infarction and study would make this explanation unlikely.

CONCLUSION

The present study indicates that the severity and type of coronary occlusive processes are related to the presence of various risk factors. In particular elevated triglyceride levels are associated with more severe and more diffuse types of lesion.

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