Acute coronary insufficiency

Review of 46 patients

L. J. DAY, G. E. THIBAUT,¹ AND E. SOWTON

From the Cardiac Department, Guy's Hospital, London

Forty-six patients admitted with acute coronary insufficiency are reviewed. All were investigated by coronary angiography; 4 had normal coronary arteries and are included in this study; the remainder had a distribution of coronary artery disease similar to other angina patients. The clinical and angiographic findings, management, and subsequent course of the other 42 patients are presented. Fourteen patients (33%) in whom rest pain persisted after 48 hours underwent emergency coronary angiography, with 3 deaths; of the surviving 11 who had acute saphenous vein bypass grafting, 2 died at operation and 3 had perioperative myocardial infarctions. Seventeen patients (41%) who initially improved required surgery within 6 months because of symptoms. Eleven patients (26%) were not operated on. It is concluded that acute coronary insufficiency is best managed initially by intensive medical therapy but a high proportion will require surgery later because of disabling angina. Early investigation and surgery are associated with a high mortality and incidence of myocardial infarction. Survivors of surgery are symptomatically improved and there is a low incidence of late infarction and death.

Patients with angina marked by a rapidly progressive course are recognised as having a high incidence of myocardial infarction and death in the immediate future as compared with those with a stable pattern of angina. Because of this, attention has been focused on this group with acute coronary insufficiency especially since the advent of saphenous vein bypass grafting of the coronary arteries.

The optimal method of management in these patients remains uncertain and few long-term studies in which patients have been treated either medically or surgically are available for guidance.

This retrospective report reviews the findings at admission and the subsequent course of 42 patients with acute coronary insufficiency seen at Guy's Hospital from 1 May 1971 to 31 March 1975. During that period it was the policy to perform coronary arteriography on all patients admitted with acute coronary insufficiency after 48 hours of medical treatment if rest pain had not subsided, or before discharge in those who had lost rest pain within 48 hours. The surviving patients have been followed for a mean period of 25.5 months.

Definitions

A patient was considered to have acute coronary insufficiency if the following criteria were fulfilled:

- (a) Typical anginal attacks progressively prolonged and severe and occurring with diminishing provocation in a patient either with a previously fixed pattern of angina or with no angina; and/or
- (b) One or more prolonged episodes of anginal pain at rest not relieved by trinitrin.
- (c) Absence of infarction, enzyme, or electrocardiographic evidence of infarction.

All patients were continuously monitored during at least the initial 48 hours and electrocardiographic abnormalities observed. The changes associated with this condition are T wave inversion or ST segment displacement exceeding 1 mm, without the development of Q waves. Apart from changes observed during monitoring, we were able to record these abnormalities in at least two leads in slightly over half our patients. Patients with cardiogenic shock, valvular heart disease, cardiomyopathy, or normal coronary arteries (see later) were excluded.

The usual definitions of angina and electrocardiographic criteria for myocardial infarction were adopted (Logue and Hurst, 1970). Cardiomegaly was defined as a cardiothoracic ratio of greater than

¹Present address: Department of Cardiology, Massachusetts General Hospital, Boston, Mass. 02114, U.S.A.

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0.50 on a posteroanterior chest film. A left ventricular end-diastolic pressure greater than 12 mmHg was considered abnormal. Coronary arterial narrowing of greater than 70 per cent reduction in diameter was regarded as significant. One vessel disease was defined as a significant stenosis affecting one of the following arteries: the left anterior descending or its diagonal branch, the circumflex or its obtuse marginal branch, the right coronary artery or its posterior descending branch. A reduction of 50 per cent or greater in the left main stem coronary artery was regarded as significant.

Left ventricular function was assessed from angiocardigrams taken in the 30° right anterior oblique position and classified as follows: class 0: normal function; class 1: minor general reduction of function; class 2: hypokinetic, akinetic, or aneurysmal area; class 3: moderate general reduction of function with or without class 2; and class 4: grossly reduced function with or without class 2.

Functional classification was according to the N.Y.H.A. criteria.

Patients and methods

Forty-six patients fulfilling the above criteria for acute coronary insufficiency were seen during the relevant period, but the 4 shown on angiography to have normal coronary arteries have been excluded from the following analysis.

All patients were placed on total bed rest and monitored. Beta-adrenergic blocking agents in full doses and sublingual nitrates as required were administered in addition to analgesics. Anticoagulants were not routinely used in the absence of venous thrombosis or embolism.

Thirty-six patients underwent coronary arteriography and left ventriculography on the same admission at a mean time of 6 days later (range 2 to 33 days). Three patients were readmitted for angiography 40 to 70 days after discharge. The remaining 3 had undergone uncomplicated angiography recently, before their angina became unstable. Coronary angiography was originally performed by the Judkins technique (Judkins, 1967) (25 patients) but the Sones method was used more often latterly (Sones and Shirey, 1962) (17 patients).

The patients have been divided into 4 groups based on their clinical course and in particular their response to medical therapy in the first 48 hours.

GROUP 1

Patients who continued to have rest pain after 48 hours despite full medical treatment. There were

14 in this group. Angiography was carried out and the patients operated upon at a mean time of 3 days after admission.

GROUP 2

Patients whose symptoms disappeared with rest and medical treatment but who immediately experienced increasing angina again on mobilisation. There were 10 patients in this group. All were operated upon at a mean time of 29 days after admission.

GROUP 3

Patients whose symptoms disappeared with rest and medical treatment and who were discharged from hospital without significant angina but whose symptoms subsequently returned as they attempted to resume normal activities. There were 7 patients in this group and all were operated upon. The mean time from the first admission was 5.5 months.

GROUP 4

Patients who were not operated upon. There were 8 patients whose pain settled (6 with medical therapy and 2 after infarction) and 3 whose left ventricular function was too poor for operation to be performed.

All except 1 of the surviving patients have been followed at the outpatient clinic, attending every 6 months. For the 1 exception, follow-up data have been obtained from her physician. Of the 32 survivors, 28 have been seen within 1 month before preparation of this report and a full history, examination, electrocardiogram, chest x-ray film, and bicycle exercise test were performed. The latest follow-up of the other 4 was by communication with the patient's physician.

Exercise tolerance testing was performed on the Monark exercise bicycle; continuous electrocardiographic monitoring was carried out from an electrode placed in the V5 position. The end-point was taken as fatigue or dyspnoea of such severity that the patient could not continue, or chest pain of a degree that would under usual circumstances cause the patient either to rest or to take glyceryl trinitrate. Results have been expressed as total work performed. ST segment displacement was measured 0.04 s after the J point (1 mm ST depression being regarded as significant).

Statistical analysis was carried out using the χ^2 test, and Student's paired and unpaired t test.

Results

Of the 42 patients, 38 were men and 4 were women. Mean age was 52.6 years (range 30 to 71 years).

Table 1 Details of patients

	Group 1	Group 2	Group 3	Group 4 Settled	Inoperable
Number of patients	14	10	7	8	3
Age—mean and range (y)	50.9 30–71	51.7 43–62	52.3 40–57	59.3 44–67	49.0 46–51
Angina—mean and range (m)	24 5–72	61.9 3–144	24.8 2–72	61.1 1–60	48 36–72
Duration of unstable angina—mean and range (d)	19.6 1–35	16.9 1–30	18.5 4–40	28.7 2–35	9 4–14
Previous myocardial infarction	5	5	2	2	2
Radiographic cardiomegaly	—	1	1	—	2
Left ventricular end diastolic pressure mean and range (mmHg)	12 5–17	14 4–20	11 5–25	13 5–24	16 8–22
Left ventriculogram—Class 0	2	4	1	1	—
Class 1	6	3	4	6	—
Class 2	2	—	—	—	—
Class 3	4	3	2	1	1
Class 4	—	—	—	—	2
Average number of vessels involved per patient	2.5	2.6	2.5	2.2	2.6
Left main stem lesion	—	2	—	1	2

GROUP 1 (Table 1)

The 14 patients in this group continued to have angina at rest 48 hours after admission despite beta-sympathetic blockade and sublingual nitrates. All except 1 had a previous history of chronic angina, and the mean duration of unstable angina was 19.6 days (range 1 to 35 days). Five patients had suffered previous myocardial infarctions (range 1 to 14 years).

One patient who had coronary angiography 5 weeks previously to investigate chronic angina was not reinvestigated but all the others underwent coronary angiography at a mean time of 49 hours after admission (range 24 to 90 hours). Four patients had angiography within 24 hours after they had been transferred from other hospitals where the diagnosis of unstable angina had been made earlier.

At angiography the mean left ventricular end-diastolic pressure was 12 mmHg (range 5 to 17

mmHg). The left ventricles were classified as normal in 2, class 1 in 6, and either class 2 or class 3 in the remaining 6.

There was an average of 2.5 coronary vessels involved per patient; none in this group had a left main stem lesion. There were 3 deaths related to investigation. Two patients died during angiography, 1 could not be resuscitated after developing ventricular fibrillation; the other patient had intractable pain and was hypotensive before the study. At necropsy both patients had undetected myocardial infarctions approximately 2 weeks old and extensive coronary artery disease. The third death occurred 18 hours after the investigation and followed a short period of chest pain. Necropsy showed a fresh thrombus in the left anterior descending artery. All had been studied by the Judkins technique.

The surviving 11 patients (Table 2) were operated on at a mean time of 3 days after admission. Ten patients had 2 saphenous vein grafts and 1 patient a single graft. Two patients died at operation (18.2%) and an additional 3 (27%) had perioperative myocardial infarcts.

The 9 surviving patients have been followed for a mean time of 31.4 months (range 9 to 49). There have been no late deaths or myocardial infarcts. Five of the 9 survivors are free of pain and on no medication, 3 are N.Y.H.A. class 2 and 1 patient is N.Y.H.A. functional class 4.

Postoperative angiography in 3 patients showed that all the 6 grafts were patent. Two of these patients are pain free; the other showed progression of the disease, and is the patient in class 4.

Seven patients have recently been exercised at a mean time of 31.4 months after operation (Table 3). Preoperative exercise tests were naturally not avail-

Table 2 Follow-up of surgically treated patients groups 1 to 3

	Group 1	Group 2	Group 3
No. of patients	11	10	7
Operative mortality	2	0	1
Perioperative myocardial infarction	3	2	3
Follow-up of survivors—range	31.4 mth 9–49 mth	19 mth 3–33 mth	25.6 mth 17–29 mth
Late myocardial infarcts	0	0	0
Late cardiac deaths	0	0	0
Non-cardiac deaths	0	1	1
Late survivors	9	9	5
N.Y.H.A. Class 1	5	5	1
Class 2	3	3	3
Class 3	0	1	1
Class 4	1	0	0
Number of patients with angina	3	3	2

Table 3 Exercise tests

	Group 1 Preop	Postop	Group 2 Preop	Postop	Group 3 Preop	Postop	Group 4 (settled) Initial	Recent
Time of test		31.4		19		25.6		18
—mean and range (mth)		9-49		3-33		17-29		3-30
Number of patients	0	7	5	5	5	5	6	6
Mean total kpm	—	3447	1770	4166	1666	2416	1890	2613
—standard deviation ±	—	1056	693	3156	1327	1192	1301	879
More than 1 mm ST depression with exercise	—	1	5	1	1	0	3	2
Angina during exercise	—	1	5	0	4	0	4	2

able for comparison. The average work performed was 3447 kpm; 3 patients were stopped by dyspnoea and 4 by fatigue. One of the patients experienced angina with ST depression.

Of the 9 operative survivors 6 are working full-time, 2 are retired but active; and the remaining patient is in functional class 4.

GROUP 2 (Table 1)

The 10 patients in this group improved on medical treatment but relapsed on resuming activities and were operated on during the same hospital admission. All patients had a history of previous angina with a recent unstable period of mean 16.9 days (range 1 to 30 days). Five patients had suffered a previous myocardial infarct (range 2 to 11 years).

Angiocardiology was performed on these patients at a mean time of 6.6 days from admission (range 2 to 18 days), and there were no deaths. The mean left ventricular end-diastolic pressure was 14 mmHg (range 4 to 20 mmHg). Four patients had normal left ventricular angiograms, 3 had class 1, and 3 had class 3.

There was an average of 2.6 vessels involved per patient; 2 patients had significant main stem disease as well as major lesions elsewhere.

The 10 patients (Table 2) were operated on at an average time of 29 days after admission (range 12 to 45 days). Two patients had 3 grafts, 7 had 2 grafts, and 1 had an internal mammary artery implanted. Operative mortality was nil and the perioperative infarction rate was 2 (20%). Follow-up has averaged 19 months (range 3 to 33 months). One late death has occurred from malignancy; there have been no late myocardial infarcts.

Five of the 9 survivors are free of symptoms and take no drugs (Table 2). Three are class 2, 2 with mild angina and 1 with dyspnoea. One is class 3 with angina and breathlessness.

One patient has been recatheterised and has 1 of the 2 patent grafts (functional class 2). Five patients had a preoperative exercise test (Table 3), the mean work performed was 1770 kpm, with 1 mm ST depression or greater in all 5. Exercise was stopped

in every patient by angina. Recently they have been re-exercised (mean time 19 months after operation); the mean work performed was 4166 kpm but the improvement was not statistically significant. All patients were stopped by fatigue; none experienced angina though 1 showed ST displacement of 2 mm. Seven of the 9 surviving patients in the group have resumed work.

GROUP 3 (Table 1)

The 7 patients in this group improved sufficiently to be discharged from hospital on medical treatment for angina but remained incapacitated and coronary bypass surgery was performed later. All patients had a history of chronic angina; the mean period of unstable angina was 18.5 days (range 4 to 40 days). Two patients had suffered previous myocardial infarction (range 2 to 8 years). Two patients were in left ventricular failure.

Angiocardiology was performed at a mean time of 17.2 days (range 2 to 40 days). The mean left ventricular end-diastolic pressure was 11 mmHg (range 5 to 25 mmHg), 1 patient had a normal ventricle, 4 had class 1 ventricles, and 2 had class 3 ventricles.

There was an average of 2.5 vessels involved per patient. A left main stem stenosis was not found.

Surgery was performed at a mean time of 5.5 months (range 3 to 12 months) in the 7 patients (Table 2). Six patients had 2 grafts, and 1 patient a single graft and plication of a left ventricular aneurysm. Three patients had myocardial infarcts in the perioperative period (42.8%), 1 of whom died, giving an operative mortality of 14.2 per cent.

The surviving patients have been followed for a mean time of 25.6 months (range 17 to 29 months). There has been 1 late death after the patient was brought to hospital with the clinical features of venous thrombosis in the left leg and pulmonary embolism. The electrocardiogram did not show myocardial infarction. We have classified this patient as 'non-cardiac death'. Of the remaining 5 patients, 1 is symptom-free, 3 are N.Y.H.A. class 2 (1 with angina, 2 with dyspnoea). One is class 3 with angina and dyspnoea.

The 5 surviving patients were exercised pre-operatively and achieved a mean total work of 1666 kpm (Table 3). Four had chest pain and 1 had ST depression greater than 1 mm. These patients have been re-exercised after an average of 25.6 months. The mean total work was 2416 kpm; the improvement is not statistically significant; no patient had ST segment changes or chest pain. Four of the 5 patients have returned to work.

GROUP 4 (Table 1)

This group consisted of 11 patients who were not operated on. Eight settled during medical treatment. The remaining 3 did not become free of pain but were not considered surgical candidates because of poor left ventricular function. Of the 8 patients who settled during medical treatment all except 1 were men, and the average age was 59.3 years. Only 2 had angina of recent onset and the mean duration of unstable angina was 28.7 days. Two had suffered previous myocardial infarcts 4 years previously and a further 2 had myocardial infarcts after admission at 48 hours and 7 days.

Angiocardiology was performed on all patients at a mean time of 16.2 days after admission (Table 1). The mean left ventricular end-diastolic pressure was 13 mmHg. One patient had a normal left ventriculogram, 6 a class 1 ventricle, and 1 a class 3 ventricle.

There was an average of 2.2 vessels involved per patient and an additional left main stem stenosis was found in 1 patient. Single vessel involvement was found on one occasion.

During the follow-up period (Table 4) of mean 18 months (range 3 to 30 months) there has been 1 late myocardial infarction and 1 cardiac death. One patient is N.Y.H.A. functional class 1 and 5 are class 2. All have angina. The remaining patient is class 3. All patients are taking beta-sympathetic blockers.

Six patients were recently exercised, mean work

performed was 2613 kpm, 2 patients showed ST depression, and 2 were stopped by angina (Table 3). In the initial exercise test mean work performed was 1890 kpm, 3 showed ST depression, and 4 were stopped by angina. All patients were improved in comparison to their initial exercise test but this result was not statistically significant.

Three patients continued to have pain after admission but were not operated on because of poor left ventricular function (Table 1). Their mean age was 49 years, they had a history of angina of an average of 48 months, and an unstable pattern of mean 9 days. Two had suffered previous myocardial infarcts (range 3 to 10 years). At angiocardiology (Table 1) the mean left ventricular end-diastolic pressure was 16 mmHg; 1 had a grade 3 ventricle and 2 had grade 4 ventricles. There was an average of 2.6 vessels involved per patient. A significant left main stem lesion was found in 2 patients.

One patient has died 12 months after presentation after a myocardial infarct, the other 2 have been followed for 8 months. Both are N.Y.H.A. class 3 (Table 4).

STATISTICAL ANALYSIS

The 4 subgroups were analysed statistically for significant differences in age, duration of angina, duration of unstable pattern, previous infarction rate, end-diastolic pressure, left ventricular pressure and function, number and distribution of vessels involved including left main stem stenoses. No statistical differences were found except that group 2 had a significantly longer duration of angina than groups 1 and 4 ($P < 0.05$).

CORONARY INSUFFICIENCY WITH NORMAL CORONARY ARTERIOGRAPHY

Although patients with the clinical picture of unstable angina who were subsequently shown to have normal coronary arteries have not been included in the above analysis, 4 such cases were admitted during the period covered. There were 3 women and 1 man. All settled within 48 hours and none infarcted. At recent follow-up all continued to have angina but 2 reported an improvement. Thus 8.7 per cent of our 46 patients admitted with a clinical and electrocardiographic diagnosis of acute coronary insufficiency were shown to have normal coronary arteries.

Discussion

The aspect of the natural history of coronary artery disease presented in this paper has been discussed in medical papers for many years under a variety of names, including impending coronary occlusion

Table 4 Follow-up of medically treated patients—group 4

	Settled	Inoperable
No. of patients	8	3
Follow-up—mean and range (mth)	18 3–30	8 6–10
Myocardial infarction—early	2	0
—late	1	1
Cardiac deaths—early	0	0
—late	1	1
N.Y.H.A. Class 1	1	0
Class 2	5	0
Class 3	1	2
Class 4	0	0
Number of patients with angina	7	2

(Sampson and Eliaser, 1937), coronary failure (Freedberg *et al.*, 1948), intermediate coronary syndrome (Graybiel, 1955), acute coronary insufficiency (Master *et al.*, 1956), status anginosus (Papp and Smith, 1960), preinfarction angina (Fowler, 1971), and unstable angina (Conti *et al.*, 1973). The absence of a uniform definition and long-term follow-up and, until lately, angiographic correlation has given no sound basis on which to compare the 2 forms of treatment, medical and surgical. The problem of definition has recently been discussed by Chahine (1975). He suggested that the term unstable angina be adopted for these patients, and because of their differing presentation and prognosis they should be subgrouped, thus allowing proper comparison of different methods of treatment.

Some early series of medically treated patients reported a high infarct rate and a mortality of up to 36 per cent (Levy, 1956; Nichol *et al.*, 1959; Beamish and Storrie, 1960; Wood, 1961; Vakil, 1964). Contemporary series, however, of medically treated patients have reported lower infarct and mortality rates. Krauss *et al.* (1972) have reported a 6 per cent incidence of myocardial infarction with a one-year mortality of 15 per cent, and Gazes *et al.* (1973) a 21 per cent incidence of infarction at 8 months and an 18 per cent mortality at 1 year, with a 5.2 per cent yearly mortality over 10 years. Fulton *et al.* (1972) in a series of 167 patients found a 14 per cent incidence of myocardial infarction and a 2 per cent mortality at 3 months. All of these series suffer from the disadvantage that coronary angiography was not performed.

In recently reported series in which coronary angiography has been performed on all patients, coronary artery disease has usually been confirmed. However, some authors have reported the absence of coronary artery disease in patients with unstable angina (Scanlon *et al.*, 1973), and we found 4 such patients during the period covered by this report. These 4 patients have been excluded from the analysis, and are being reported elsewhere.

Although recent reports of series of patients with unstable angina have been supported by coronary angiography, most patients have gone on to surgery and, therefore, knowledge of the true natural history of this condition remains unknown. Angiographic data have confirmed that most of these patients have severe coronary artery disease but they are not as a group distinguishable anatomically from other patients with symptomatic coronary artery disease. Of 408 patients with angiographically documented coronary artery disease and unstable angina reported in 8 series (Lambert *et al.*, 1971; Cheanvechai *et al.*, 1973; Conti *et al.*, 1973; Fischl

et al., 1973; Scanlon *et al.*, 1973; Segal *et al.*, 1973; Bonchek *et al.*, 1974; Berndt *et al.*, 1975), 25 per cent had significant obstruction of 1 vessel, 34 per cent of 2, and 41 per cent of 3, this distribution being similar to that reported for groups of patients with stable angina who have suffered myocardial infarction (Bruschke *et al.*, 1973).

The high mortality and infarct rate in patients with unstable angina (Levy, 1956; Nichol *et al.*, 1959; Beamish and Storrie, 1960; Wood, 1961; Vakil, 1964) has led to initial enthusiasm for saphenous vein bypass grafting, but as yet surgery has not been shown to be superior to medical treatment. The operative mortality in 361 cases reported in recent series (Lambert *et al.*, 1971; Cheanvechai *et al.*, 1973; Conti *et al.*, 1973; Fischl *et al.*, 1973; Scanlon *et al.*, 1973; Segal *et al.*, 1973; Bonchek *et al.*, 1974; Berndt *et al.*, 1975) was 9.4 per cent and the perioperative infarct rate 13 per cent. Of the 180 patients who survived surgery and who have been followed for more than 1 year (Conti *et al.*, 1973; Fischl *et al.*, 1973; Segal *et al.*, 1973; Bonchek *et al.*, 1974; Berndt *et al.*, 1975), there has been a late mortality of only 1 per cent per year during a follow-up period of 16 months.

The patients described here are not significantly different from those reported in recent series. They are middle-aged, mainly men, and most have a long history of angina. The incidence of an average of 2.5 diseased vessels per patient is similar to other series but the incidence of 1-vessel disease is lower.

The angiographic mortality of 7 per cent occurred in patients who were being investigated during the acute phase because of continuing pain and we regard the investigation of these patients as hazardous because it may be impossible to exclude patients who have actually infarcted very recently. This is clearly an additional risk whenever investigation with a view to surgery is considered. Several authors, however, have reported no deaths from angiography (Scanlon *et al.*, 1973; Bonchek *et al.*, 1974). We recognise that our subgroups contain small numbers, but in all, operations were performed on 28 patients who either continued to have rest pain (group 1) or were incapacitated by angina despite medical treatment when they resumed activities (groups 2 and 3). The operative mortality of 10.7 per cent is comparable with the surgical series referred to but the perioperative incidence of myocardial infarction is higher. This may be because of differing criteria.

Group 1 patients in this series are comparable with Gazes *et al.*'s (1973) medically treated high risk subgroup in that they continued to have pain 48 hours after admittance to hospital. At 3 months these authors found a mortality of 22.5 per cent,

with a 35 per cent incidence of myocardial infarction. The probability of surviving 1 year was 57 per cent and 3 years 37 per cent. Our surgically managed group 1 patients had an operative mortality of 18.1 per cent and a perioperative myocardial infarction incidence of 27 per cent, so if we assume our patients are similar to those of Gazes, the surgical aim of preventing early myocardial infarction and reducing mortality in these high risk patients has not been achieved. During the 31-month follow-up period, however, there have been no further myocardial infarctions or deaths. In a recent progress report of a prospective randomised trial on surgical versus medical treatment in unstable angina, Bertolasi *et al.* (1975) have noted a significantly lower early occurrence of myocardial infarction and death in surgically managed patients. Preliminary results from a further randomised trial (Conti *et al.*, 1975) have shown no difference in mortality rate between medically and surgically treated groups and though the surgical group was symptomatically better they had a higher incidence of myocardial infarction.

There was no surgical mortality among the patients operated on subacutely (group 2) though the myocardial infarction incidence (20%) remained high. They had responded initially to medical therapy but relapsed when mobilisation was attempted. Beta blockade and bed rest were continued, allowing these patients to stabilise before operation was undertaken electively. Fischl *et al.* (1973) have found a similarly low operative mortality in patients with unstable angina managed in this way. Because of the variability of response to beta blockade it is important to adjust dosage individually and in this way many patients with unstable angina may be carried through the acute phase allowing surgery to be performed, if required, electively.

Seventeen (40.5%) of our patients who did not require surgery acutely by our criteria came to operation because of symptoms within 6 months. Similar experience has not been commented upon by other authors. When compared with patients who had settled with medical therapy and did not later require surgery no features were found which would allow the early identification of these patients.

The surgically treated patients in this series followed for a mean time exceeding 2 years have had a low incidence of late myocardial infarction and death. Reports of other surgical series (Conti *et al.*, 1973; Fischl *et al.*, 1973; Segal *et al.*, 1973; Bonchek *et al.*, 1974; Berndt *et al.*, 1975) have also found similar results. It is general experience that among surgical survivors there is a high incidence of asymptomatic patients. The figure is 47 per cent in this series and 57 per cent in those previously referred to (Lambert *et al.*, 1971; Cheanvechai *et al.*, 1973;

Conti *et al.*, 1973; Fischl *et al.*, 1973; Scanlon *et al.*, 1973; Segal *et al.*, 1973; Bonchek *et al.*, 1974; Berndt *et al.*, 1975). The improvement has been supported by objective evidence from exercise testing in the individual patients, and is in contrast to the 11 per cent asymptomatic patients in our medically treated group 4.

CONCLUSIONS

- (1) Patients with acute coronary insufficiency have similar distribution of coronary artery disease to other angina patients. Almost 9 per cent of our cases had normal coronary arteries but the remainder had an average of 2.5 vessels severely stenosed.
- (2) The acute stage can often be managed with bed rest and medical therapy: 60 per cent of our 42 cases improved initially; however 40 per cent required early surgery because of severe pain when they returned to activity. Because of this it is now our policy for all patients with acute coronary insufficiency to have coronary arteriography before leaving hospital.
- (3) Patients who survived surgery were largely symptom-free, without drugs, whether the operation had been performed acutely or after a short delay. Exercise testing confirmed the absence of angina, but though the work performed had increased this did not reach statistical significance.
- (4) There is a low incidence of late infarction and death among surgically treated patients.
- (5) Emergency investigation and saphenous vein bypass grafting carries a high risk. We recommend these procedures are delayed in all patients whose pain is settling on medical treatment.

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Requests for reprints to Dr. E. Sowton, Cardiac Department, Guy's Hospital, London SE1 9RT.