Papers and Originals

Three Hundred Cases of Diffuse Ulcerative Colitis Treated by Total Colectomy and Ileo-Rectal Anastomosis

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In 1953 a preliminary report on the surgical treatment of diffuse ulcerative colitis by total colectomy and ileo-rectal anastomosis was published by the author in this journal. Since that time many interim reviews have been recorded (Aylett, 1960, 1963, 1964), but it would seem appropriate now that well over 300 cases have been subjected to this type of procedure that the experience gained and the lessons learned during the treatment of the first 300 patients in this series, operated upon between March 1952 and March 1965, should be detailed.

Before our first attempts to retain the rectum and to re-establish intestinal continuity it had become apparent that the ulcerative changes present in this disease were by no means irreversible. Repeated sigmoidoscopic examinations carried out on patients who had responded to medical treatment showed conclusively that the previously existing ulcers could become covered with new-formed epithelium, and biopsy material confirmed microscopically this macroscopic observation. It was also noted that these changes followed and did not precede the alleviation of the patient's toxaemia and ill-health. It appeared that if the toxaemia associated with the disease could be overcome—and in the chronic as well as the acute and fulminating cases it is severe—the regenerative processes inherent in the intestinal mucosa were adequate to recover areas of ulceration and permit the intestine once again to fulfil its normal physiological function.

In those cases which failed to respond to medical treatment it was possible that, if excision of the vast bulk of the source of this toxaemia—that is, the excision of the whole of the colon and the uppermost part of the rectum—was undertaken, then the consequent relief of the toxaemia would be such that the ulcerative processes in the rectum remaining would heal as the patient recovered health. Thus a permanent ileostomy would be avoided and a normal route of intestinal evacuation established. This theoretical basis of the operation of total colectomy and ileo-rectal anastomosis has been amply established in practice, and, except in a very small minority of patients to be discussed later, experience has shown that pan-proctocolectomy with the formation of a permanent ileostomy is an unnecessary disability to inflict upon a patient requiring surgery for the cure of ulcerative colitis.

Operative Technique

Since my original contribution changes of technique have become, with experience, inevitable, and that originally described has been abandoned owing to difficulty in effecting closure of the proctostomy. Our present methods have been detailed elsewhere (Aylett, 1960, 1963, 1964), though further modifications are included in this paper. In brief, one of two routine methods is normally employed. In the reasonably fit patient and in the patient in whom the rectum is neither so thinned by ulceration nor swollen with inflammation that the safe insertion of sutures into its wall is impossible—a not uncommon finding—the colectomy is followed by immediate end-to-end anastomosis of the ileum to the rectum. During the colectomy the pedicle of the inferior mesenteric artery with its accompanying veins and sympathetic nerves is deliberately divided, and the reduction of an excessive blood supply to the rectum or the division of the nerves may play some part in subsequent healing.

The anastomosis is always protected by an ileostomy made in continuity and brought out usually through the right iliac fossa. As the anastomosis is effected to a diseased rectum there is less chance of a primary union occurring than in an anastomosis between normal tissues. It is essential, therefore, to divert the intestinal content from the anastomotic line until a barium enema, carried out as a routine about three weeks after the colectomy, has proved that union of the two ends of intestine is complete. In about 12% of patients the *x*-ray examination reveals a leak; if such is the case the patient is sent home for a further three-week period, following which the *x*-ray examination is repeated, and by this time, except in the very rare case which may require longer to heal, union is then complete and the ileostomy can be closed with safety.

Failure to protect the anastomotic line by a defunctioning "safety valve" ileostomy may well, if the suture line should leak, give rise to pelvic peritonitis and abscess formation. At best the operation of ileo-rectal anastomosis is likely to prove a failure and a permanent ileostomy will be required, and, at the worst, death may ensue.

The second method is employed in the very ill patient, usually the fulminating type, in which the extent of the operation should be limited in order to cut down the operating time to a minimum. It is also used in those cases mentioned above in which safe suturing of the open end of the rectum to the ileum is impossible. In this type of operation the colon and upper third of the rectum are mobilized in routine fashion and the pedicle of the superior haemorrhoidal artery is ligated. The whole of the large intestine is lifted on to the surface of the abdomen and before any section of the bowel is undertaken the abdomen is closed, the terminal ileum and the upper part of the rectum or lowermost portion of the pelvic colon emerging through separate openings in the lower end of the paramedian incision. These openings are separated by 4 or 5 cm. of skin so that a bag can be applied to the ileostomy which is subsequently formed. Where the bowel ends emerge through the abdominal wall the peritoneum is sutured to the sero-muscular of the ileum and to the rectal wall. At the completion of this stage of the procedure the operation has the appearance of an extended Paul-Mikulicz type of exteriorization. The wound

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is then sealed, and only then are the ileum and pelvi-rectal region transected, the latter almost flush with the surface of the abdomen and the former just short of the caecum, so that an efficient ileostomy can be established. The free margins of the rectum are sutured to the skin edges to prevent its retraction.

The advantages of this method in the very ill patient are several-fold. First, it reduces the operating time and the period during which the abdomen is opened to a minimum, a factor of great importance in the reduction of mortality. Secondly, provided the colon is not ruptured during mobilization, no peritoneal soiling is possible, and as the desperately ill patient may have received no local antibiotic treatment in the short pre-operative period of therapy this is of great import in minimizing post-operative intraperitoneal infection and abscess formation. Thirdly, as has been mentioned, the subsequent anastomosis between ileum and rectum, usually carried out about a month later, can be achieved with the confidence that the sutures will not cut out of the rectal wall, which in this period of time will have regained to a large extent its normal texture.

It is indeed true that the subsequent ileo-rectal anastomosis is not a minor procedure, as is the closure of a temporary defunctioning ileostomy, for the dissection of the two ends is difficult. Moreover, if any of the pelvic colon has been left behind this must be excised and a true ileo-rectal anastomosis undertaken, and on occasions we have thought it even wise to protect this union by an ileostomy until a barium enema has made it certain that the anastomosis is secure. However, by the time this stage is carried out the patient is well able to withstand a further operative procedure, and no case has been lost following such an ileo-rectal anastomosis.

This two-stage type of procedure we have undertaken until recently in all fulminating cases, including those in which the severity of the ulcerative process has been such that the wall of the colon has been reduced in parts to little more than peritoneum and inflammatory tissue. It is in such cases that as a result of the destruction of its muscular layers the colon becomes enormously distended, finally rupturing at one or more points. These ruptures may become temporarily sealed off, or, alternatively, general peritonitis may rapidly ensue.

In this series of 300 patients there were 53 fulminating cases, of which 9 were fatal, a mortality rate of 17%. Although such a rate is comparable with that found by other workers—for example, Cattan (1960); Goligher (1962)—it is a formidable one.

A year ago we were presented with a patient, a young girl aged 22, who arrived from another hospital late at night. She was nearly moribund, gravely toxic, with early peritonitis and with a grossly distended abdomen, the result of colonic distension. Regions of tenderness and rigidity made it apparent that early perforation had occurred, though this was, as yet, sealed off. After a few hours of preliminary resuscitation she was operated upon, the intention being to carry out a colectomy. So grave was her condition, so distended her colon, and so bound down at the regions through which perforation had occurred, that it was soon apparent, when her abdomen had been opened, that she would not stand any extensive procedure such as had been envisaged. I therefore closed the abdomen, exteriorizing a loop of transverse colon and incising this at the completion of the brief operation. My idea at the time was that the relief of pressure would eliminate the possibility of further perforation of the bowel wall, and the immediate danger to life would be thus excluded. The distension was, in practice, at once relieved, and she returned to the ward with a soft abdomen. Within a few hours her condition improved. The pulse and temperature fell and the colostomy soon started to work. Her improvement was so rapid that within a month I was able to carry out a total colectomy and ileo-rectal anastomosis with complete safety. Two other cases have also been treated with success along these lines, and when presented again with similar patients I shall certainly employ this method of treatment. I believe that, had I used it in other of our fulminating cases with gross colonic distension, our mortality for this type of patient would have been considerably less.

In another rare type of fulminating case not only is the colon distended but the ileum as well. Here it would seem logical, in addition to carrying out a transverse colostomy, to perform an ileostomy as well. I have recently had one such patient treated in accordance with this principle who, following subsequent colectomy and ileo-rectal anastomosis, has returned to normal health. I believe that he would not have survived had a colectomy been undertaken as an initial procedure.

It is of interest that Dr. Rupert Turnbull, of the Cleveland Clinic in America, has, quite independently, come to the same conclusion as myself concerning this type of patient.

Indication for Operation

Except in the fulminating case the initial treatment of ulcerative colitis should be a medical one, and to this something like two-thirds of patients will respond, at least to the extent that they recover from their present attack. If, however, the patient fails to improve with all the adjuvants of modern therapy, such as steroids, salazopyrine, penicillin V and sulphonamides, blood transfusion and electrolyte replacements, the treatment must give place to surgical intervention. It is very easy to continue medical treatment too long, so that when surgery is finally decided upon the patient may have become so toxic and so emaciated that the hazards of operation are unnecessarily increased (Fig. 1). Thus the care, certainly of the severely ill patient, must be a combined medical and surgical responsibility, so that, should operation be required, the optimum time for this to be undertaken may be selected. Our indications for operation in the acute case are shown in Table I. With regard to the fulminating case, I consider that the chances of survival are better if surgery is undertaken, and the brief preliminary pre-operative care is probably best carried out by the surgeon.

If, in spite of the resolution of a preliminary attack with medical care, the patient continues over the years with recurrences of his or her illness, or is in a state of health constantly below normal, total colectomy and ileo-rectal anastomosis

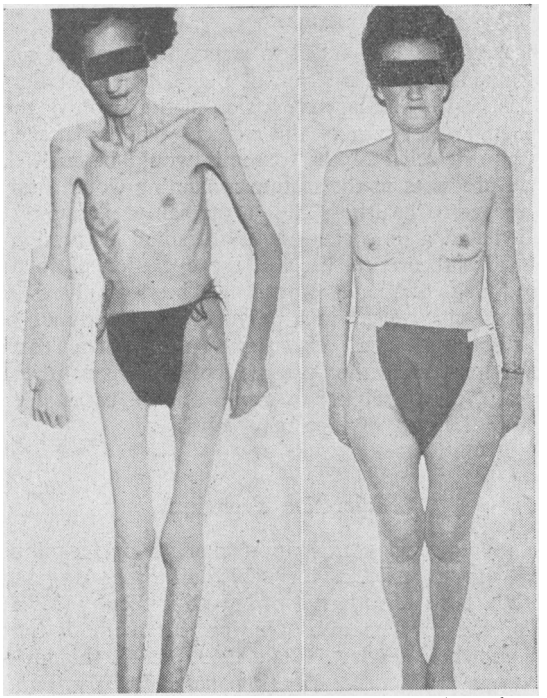

FIG. 1.—Preliminary medical treatment of this patient was continued too long. Patient shown before and after operation.

should be advised. During medical surveillance of such patients it is essential to carry out a barium enema, a sigmoidoscopy, and liver-function tests at least every nine months. There is the danger of the development of cancer in the long-standing case, and usually this complication supervenes in areas of stricture in the bowel wall. Thus the identification of such a lesion by either of the first two examinations mentioned is an urgent indication that surgery must be undertaken.

TABLE I.—*Indications for Surgery in the Acute Case*

1. Failure to improve after 7–10 days intensive medical therapy.
2. A continued high fever and pulse rate.
3. A rise in pulse rate before the ten-day period has elapsed.
4. Tenderness on abdominal palpation.
5. Early abdominal distension.
6. Continued anaemia in spite of transfusion.
7. Persistent clinical toxaemia.
8. A white cell count of 10,000 or above.
9. Generalized manifestations of the disease—e.g., pyodermia.

In the period under review 17 patients with widely disseminated carcinoma, all of whom have died, have been referred to our clinic. These patients, most of whom were young, had been under medical care for many years with long-standing ulcerative colitis, but the essential periodic barium enemas and sigmoidoscopy examinations had been neglected, and the developing carcinoma had thus been overlooked.

Cirrhosis of the liver is a known complication of ulcerative colitis of long duration, and any suggestion of its development as revealed by impaired liver-function tests is an indication for excision of the colon. Apart from minor degrees of the condition, six severe cases were seen in the series under review. Two at the time of operation had considerable ascites, but following colectomy this completely disappeared and the liver-function tests returned to normal. A further patient who at operation was observed to have a cirrhosed liver subsequently developed porto-caval hypertension with massive haemorrhage. A porto-caval shunt was carried out, and he is fit and well three years after this operation and seven years after the colectomy. Of the remaining three one developed fatal hepatic failure immediately after the colectomy, a further one died in hepatic coma five years after operation, and the sixth patient is also likely to die of this condition.

Other indications for operation include the development of arthritis, which is frequently arrested and improved following excision of the diseased colon, local complications such as severe haemorrhage or pericolic abscess formation, or those generalized such as pyodermia or iritis.

In children a special problem presents, and that is the retardation of growth, which can so often be the result of chronic disease. This, associated with an increased risk of the development of cancer in those who develop the disease at such an early age, makes it imperative that a medical régime should not be persisted with if good results are not quickly achieved.

Analysis of Results

Table II represents the age groups of those subjected to total colectomy and ileo-rectal anastomosis. From this it is seen that many in the older decades may require surgery for the cure of their disease, and the results of operation in this group are no different from those in others. Age, therefore, is no direct contraindication to advising surgery.

TABLE II.—*Number of Patients in Each Age Group Subjected to Total Colectomy and Ileo-rectal Anastomosis* (131 *Males*, 169 *Females*)

Age Range:	10–	15–	20–	25–	30–	35–	40–	45–	50–	55–	60–	65–	70+
No. of cases ..	16	32	34	47	30	32	19	36	31	13	5	4	1

Table III illustrates the number operated upon each year. Initially the number of cases referred by our physician colleagues was small, but the increasing confidence in the results of the method is represented by the larger numbers referred in later years.

TABLE III.—*Number of Patients Operated Upon Each Year from* 1952 *to March* 1965

Year of Operation	1952–3	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
No. of cases	8	10	13	19	28	29	34	36	36	22	26	31	8

Table IV represents the operative mortality, most of which has occurred in the fulminating cases. Many of these patients were desperately ill, and though there were deaths many recovered. In the whole period under review no patient has been refused operation because of operative risk.

TABLE IV.—*Operative Mortality*

	No. of Cases	Operative Deaths	Mortality Rate (%)
Fulminating cases	53	9	17
Acute cases	134	5	3·7
Chronic ,, ...	113	3	2·7

Overall operative mortality rate, 5·7%.

Table V records the non-operative deaths, of which there were 10. With one exception (D. M.) all the patients had returned to normal health before death occurred. Two died as the result of obstruction. One of these patients was operated upon elsewhere. The second was finally sent back to our hospital after a 10-day illness. At laparotomy a gangrenous loop of small intestine had to be excised. She recovered well until the day she was due for discharge, when she died suddenly from a massive pulmonary embolus.

TABLE V.—*Non-operative Deaths*

Patient	Age at Death (Years)	Time between Operation and Death	Cause of Death
G.M.	23	4 years	Cancer of rectum
R.B.	56	7 ,,	Broncho-pneumonia
M.P.	24	18 months	Obstruction
D.J.	58	6 years 2 months	,, (pulmonary embolus)
F.P.	73	6 ,,	Squamous cell. Cancer of lung
B.R.	69	2 ,, 11 ,,	Coronary thrombosis
C.D.	61	2 ,, 7 ,,	Dissecting aortic aneurysm
D.M.	52	13 months	Carcinomatosis. Carcinoma present at operation
J.C.	69	5 years	Cirrhosis of liver
J.G.	55	5 ,, 6 months	Coronary thrombosis

Table VI lists those patients in whom a conversion to an ileostomy had been required, and they constitute the failures in this series. Three were converted because of the development of cancer in the rectal stump, but some detail of these patients is required to evaluate the risk of such a complication. One patient had a strictured rectum, and because of this and the known danger of the development of carcinoma was advised to undergo pan-proctocolectomy. This she refused, and an ileo-rectal anastomosis was therefore carried out in association with a colectomy. Six years later the expected cancer developed, and she submitted to an abdomino-perineal excision. A year later she died of broncho-pneumonia with, at the time, no evidence of metastasis. Her death is included in Table V.

TABLE VI.—*Patients Converted to Permanent Ileostomy*

Reason for Conversion	No. of Cases
Carcinoma of rectum	3
Rectal stricture (benign)	2
Perirectal suppuration	3
Incontinence	3
Rupture of rectal wall	1
Mesenteric thrombosis	1
Obstruction	1
Total	14 (5% of operative survivors)

The second case occurred in a young man aged 19 who had had the disease for 17 years. Soon after his discharge from hospital a rectal biopsy of the unhealed rectum revealed a carcinoma. Abdomino-perineal excision was undertaken, but he died of the disease. He was one of our early cases, and

the degree of stricturing in his rectum and the long history in a young person would exclude an ileo-rectal anastomosis according to our present indications of suitability for this procedure. In retrospect it seems likely that the carcinoma was present at the time of operation, and undoubtedly an error of judgement was made in not initially carrying out a pan-proctocolectomy.

At routine follow-up the third patient was observed to have developed a nodule in her rectum seven years after operation, and biopsy confirmed carcinoma. Abdomino-perineal excision of the rectum was carried out, and she is alive and well, free of any recurrence of the disease four years later. It is fair to state that, though this patient was considered to be a case of ulcerative colitis on clinical and operative grounds, a pathological report on the excised specimen stated that the appearances resembled those of Crohn's disease and not colitis. It would thus seem that the risk of the development of cancer is a very slight one following the type of operation under review, and certainly much less than that associated with medical treatment. Nevertheless, follow-up of these cases is essential, particularly should the inflammatory changes in the rectum fail to resolve. This occurred in two cases, both of whom underwent abdomino-perineal excision, but in both the strictured areas proved benign.

At this juncture it is of interest to note that five patients in the series had established, but resectable, carcinoma at the time of the colectomy, one in multiple areas. This patient was the only one who died (see Table V). One of the remaining four with a stage C carcinoma is alive and well twelve years after operation, and the other three, with a minimum follow-up of three years, are also recurrence-free. It would not appear from these observations that a cancer developing in ulcerative colitis has any added virulence, but its danger lies in the fact that the symptoms to which it gives rise may easily pass unrecognized and be regarded as due to a flare up of those of the colitis.

Three cases were converted because of incontinence. Two of these were females in whom the sphincter had been damaged at childbirth, and such an injury we now regard as a contra-indication for attempting to preserve the rectum. The third case occurred in a male, in whom there was no obvious cause for the incontinence. Persistent rectal infection with associated fistula formation accounted for a further three failures.

Table VII enumerates the successes of this type of operation. On 1 April 1965 there were 259 patients alive and well, of whom 250 had no restraints whatsoever to a normal social, domestic, and economic life. They follow all walks of life—from doctoring to engine driving, from acting to being mothers. They travel at home or abroad where duty or fancy takes them. They have borne and sired children, and there are no cases of impotence in the male such as are likely to be associated with pan-proctocolectomy. Some have bowel actions only once or twice in the 24 hours, though the average is four, but this increase in number worries them not an iota. They have put on weight often to a degree that necessitates dieting, and they regard themselves as normal, their illness being a thing of the past. Fig. 2 and Fig. 3 show the typical appearances of a patient, before and after operation, who suffered from a fulminating episode of the disease. Many take no drugs at all, while others are helped by small doses of codeine phosphate and isogel. In the immediate post-operative period penicillin V and sulphonamide tablets are often of great help in reducing the number of bowel actions.

TABLE VII.—*Number of Surviving Patients with Ileo-rectal Anastomosis at April 1965*

With minor fistulae	3
„ excessive bowel actions	1
„ clinical cirrhosis of the liver	1
„ minor limitations of normal living	4
In normal health	250
Total	259

It must be stated that before these good results are achieved the immediate post-operative progress of some patients has often been extremely difficult and all forms of surgical complications have been met with. Their solution has taxed the patience and ingenuity of all who have cared for them, particularly the nursing staff, to whom many patients owe their lives.

Episodes of obstruction, initially the result of adherence to small intraperitoneal abscesses and later due to band formation, have proved the most frequent complication. We have learned that, unless these rapidly respond to conservative therapy, re-operation must be undertaken. However, apart from the cases reported, no other patient has died from this complication.

Our experiences have shown conclusively that ulcerative colitis can be cured in the vast majority of cases by total colectomy and ileo-rectal anastomosis without subjecting the patient to a permanent ileostomy. However, these results are best achieved if the patient can be treated in a special centre. Ulcerative colitis is undoubtedly on the increase, not only in this country but throughout the world. Only by setting up more specialized units for its treatment will its high morbidity and mortality be lessened, and only thereby will the causation of this killing disease be ascertained and eliminated.

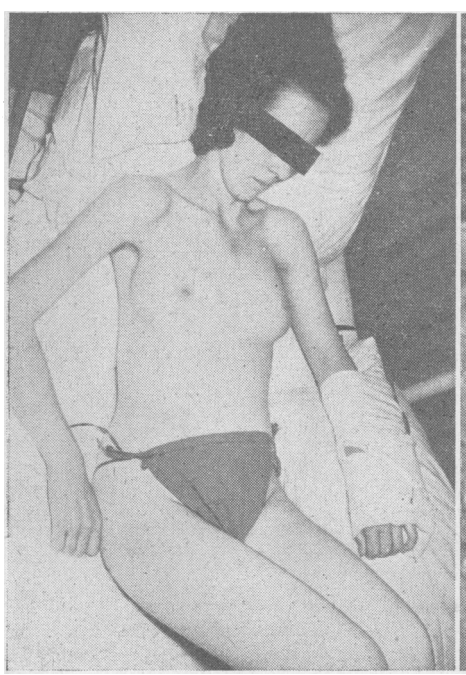

FIG. 2.—Fulminating ulcerative colitis with peritonitis.

FIG. 3.—The same patient six years later.

Summary

Ulcerative colitis can be cured in the vast majority of cases without subjecting the patient to permanent ileostomy by the use of the operation of total colectomy and ileo-rectal anastomosis.

Surgical excision of the whole colon and upper rectum produces an alleviation of toxaemia and ill-health, which promotes the growth of the new epithelium over the ulcerated areas of the rectum.

Analysis of 300 cases of ulcerative colitis treated in this manner over the past 14 years

reveals an overall mortality rate of 5.7%. Two hundred and fifty patients are in normal health leading active lives. Conversion to total ileostomy has been necessary in 14 cases (5% of operative survivors), because of the development of carcinoma of the rectum, stricture, incontinence, or other complications.

The indications for this type of operation in acute and chronic diseases are discussed. It is suggested that the best results in the surgical management of patients with ulcerative colitis can be achieved only in special centres.

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Mortality Reduction in a Coronary Care Unit

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The concept of special care units for patients with acute myocardial infarction arises from the recognition that 60% of the deaths in these patients occur in the first week (Honey and Truelove, 1957; Wahlberg, 1963). Sudden deaths from cardiac arrest are common during this period. The development of external cardiac massage (Kouwenhoven *et al.*, 1960), external electrical defibrillation (Zoll *et al.*, 1956; Lown *et al.*, 1962), and external electrical pacing (Zoll, 1952) have led to continuous electrocardiographic monitoring with a view to the immediate detection and correction of ventricular fibrillation and asystole (Brown *et al.*, 1963; Day, 1963; Robinson *et al.*, 1964; Julian *et al.*, 1964a). Monitoring has led to the recognition that abnormalities of conduction and excitation occur in 90 to 95% of patients with myocardial infarction (Julian *et al.*, 1964b).

A specially staffed and equipped coronary care unit should result in a reduction of mortality through immediate effective resuscitation of some patients following cardiac arrest, through the rapid correction of those arrhythmias which may be life-threatening, possibly through earlier control of hypotension, cardiac failure, and cardiogenic shock, and perhaps through the prevention of some of these complications. The coronary care unit in the Royal Melbourne Hospital was established in an attempt to define the potential of such units in achieving these aims. This paper presents the results in the first 150 patients.

Materials

Patients with acute myocardial infarction were admitted to the two-bed unit as beds became available, but preference was given to men. There were 144 men and 6 women. Ages ranged from 36 to 87, with a mean of 57 years. The diagnosis of acute myocardial infarction was based upon a history of ischaemic cardiac pain lasting more than 30 minutes, occurring within the previous 24 hours, and with electrocardiographic confirmation, this consisting of abnormal Q waves, ST segment elevation, and established or developing T-wave inversion.

Patients remained in the unit for a period of three days after the last pain or following cardiac arrest. They were divided into three groups—"mild," "severe," and "cardiogenic shock"—classification being made after pain had been relieved and oxygen administered for at least 30 minutes.

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Mild cases were those in which there was no hypotension or evidence of cardiac failure, apart from a transient rise in jugular venous pressure. There were 67 mild cases.

Severe cases were those in which there was evidence of circulatory embarrassment, indicated by hypotension (systolic arterial pressure below 100 mm. Hg) or cardiac failure with persisting moist sounds at the lung bases (Freis *et al.*, 1952). There were 70 severe cases.

Cardiogenic shock was considered present when the systolic arterial pressure remained below 80 mm. Hg, associated with pallor, cyanosis, sweating, cold skin, and oliguria (Binder *et al.*, 1955). There were 13 cases in this group.

Methods

The staffing and details of equipment and methods used have been reported elsewhere (Robinson *et al.*, 1964, 1965). A trained nursing sister was on duty at all times and a roster of medical staff was on call.

On hand were a self-expanding bag respirator and R-M resuscitator connected to a face-mask, to deliver oxygen from a piped wall supply, and a defibrillator and external-internal pacemaker. Automatic-demand external pacing was not used. All drugs likely to be required for cardiac emergencies were kept in the unit. Facilities for tracheal intubation and tracheostomy were readily available.

Bed heads were removed for easy access to the patient; a large single-bed board was fixed under the mattress to facilitate external cardiac massage. Each patient was connected by chest electrodes to an electrocardiograph recorder, cathode-ray oscilloscope, heart-rate meter, and rate-activated alarm. An automatic recorder was activated when a predetermined variation in the heart rate persisted for more than eight seconds. Additional records were made at hourly intervals or if changes were observed in the oscilloscope tracings. Arterial pressure was obtained by cuff at hourly intervals.

The patients were allowed to adopt a position of comfort in bed and received a light diet with no added salt. In the absence of shock a bedside commode was used, and if there was difficulty with micturition patients sat on the side of the bed. Unless there was a specific contraindication, all patients received phenindione as an anticoagulant. Analgesia was obtained with papaveratum. Sodium amylobarbitone or promethazine hydrochloride was given to produce sedation. Wakeful or apprehensive patients received sodium pheno-