

# THE TREATMENT OF CHRONIC ADHESIVE OBSTRUCTION BY THE NOBLE PROCEDURE

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The subject of peritoneal adhesions is a well-worn one, with a voluminous literature. It is a concern to many patients and to many surgeons. The reason for this article is the presentation of a group of cases of recurring threatened obstruction due to adhesion formation. These patients were dealt with by the surgical staff of the writer's unit at the Johannesburg General Hospital, and in private practice.

## PATHOLOGY

In response to irritation of various kinds the mesothelium of the peritoneum reacts by proliferation, and the subjacent tissues by an inflammatory response, which is usually proportional to the amount of irritation or violence to which the area is subjected. This is well illustrated by the ability of the omentum to wall off infection or foreign bodies. The great majority of such adhesions, having possibly served a useful purpose, cause no harm and are often resorbed by natural processes of repair. The minority, however, may lead to much suffering and grave and recurrent surgical problems. It has long been recognized that some people

are adhesion formers or have a 'diathesis' in this respect. It is quite unknown why this should be so. It is, however, indisputable that the majority of cases of adhesion are the outcome of surgical trauma. Boys<sup>1</sup> in reviewing the matter, points out that peritoneal adhesions have been recognized as an entity for over a century and a half. The etiology and pathology have been understood since the beginning of the century. Duff, in a personal communication to Boys, tabulated during several years the incidence of all adhesions, significant or not, which he found during routine autopsy. He found adhesions in 90% of persons who had had abdominal operations performed and in 30% of those who had not. Inthorn<sup>2</sup> quotes Naegeli, who carried out pneumoperitoneum on 148 cases who had had previous laparotomy. Between 80 and 90% of these cases gave radiological evidence of intra-abdominal adhesions. When operated on subsequently adhesions were found in substantially the same percentage of cases. Payr is quoted by Inthorn to the effect that 3.5% of all major laparotomies are for intestinal obstruction and 30 to 40% of these are caused by adhesions.

Wangensteen<sup>3</sup> found appendectomy the most frequent cause of adhesive obstruction following operation. About half of these cases had required drainage at the time of the removal of the appendix. Operations on the female pelvic organs were the next commonest cause of adhesion formation. Becker,<sup>4</sup> however, in reviewing 412 cases of acute adhesive intestinal obstruction covering a 10-year period found that gynaecological operations were responsible for 34.3% of the cases and operations on the appendix for 28.3%.

In reviewing the prophylaxis of adhesion formation Boys concluded that the only factor emerging is the importance of trauma and infection.

The matter stands thus: In the voluminous literature on the subject of adhesions it had been insufficiently stressed that the ability of the outer covering of the bowel and of the omenta and mesenteries to form adhesions is primarily a protective one and has made abdominal surgery possible. Thus the danger zones in abdominal operations are the uncovered *retro-peritoneal* areas, such as the posterior surfaces of the duodenum, vertical colons and rectum. Oesophageal suture is more hazardous to the patient than suture of intestine because the former is devoid of a peritoneal coat. In 24 hours the serosa to serosa suture of a gastro-enterostomy is watertight because of the reaction of the serosal covering to the trauma of the suture. For that reason also the surgeon uses a fine catgut for bowel suture because an animal protein suture material acts as an irritant and encourages the peritoneal mesothelial covering of the viscera to bury the offending material.

Wangensteen<sup>3</sup> stresses the fact that the formation of adhesions is a reparative process in response to trauma to a serous surface and therefore the surgeon's aim should be limitation and not prevention of the process.

The insult to the peritoneum may be (a) infective or (b) traumatic, which in turn may be chemical or due to violence. Infection has, since the introduction of antibiotics, come under such excellent control that deaths from acute appendicitis for instance have become rare.

The commonest cause of violence as applied to the abdominal contents is surgery, and there can be no question but that the chief causes of peritoneal adhesions arise from this cause. The theme that a diathesis exists in regard to the formation of adhesions is supported by all surgeons of experience and must be accepted, though no adequate explanation is forthcoming. The mere fact of working in the peritoneal cavity, however gently, will cause adhesions to form, but the degree and extent of the ensuing reaction are directly the responsibility of the operator.

Minimal handling of tissues, great gentleness in manipulations, avoidance of forcible retraction, the use of wet instead of dry swabs, and thorough washing of the gloved hands to remove powder, are mandatory if the surgeon's job is to be efficiently performed. Mass ligatures and the use of unsuitable suture material are a prolific cause of adhesion formation. The experienced surgeon is surprised, not because adhesions form, but because—infection apart—so little trouble ensues from

adhesion formation in the extensive abdominal surgery which is practised today.

#### CHRONIC ADHESIVE OBSTRUCTION

Whether due to infection or to 'diathesis' or to surgical trauma there exists a group of cases where adhesions cause obstruction. Often the story is that of a young woman, not infrequently a nurse, who has had abdominal pain. Some of these sufferers are viscerototics and the pain is a lateral one due to caecal drag. An unwise appendectomy in such cases may set the process going. Pain recurs—and an operation is done for 'adhesions'. These are freed and before long the condition is worse, the pain more severe. Many cases have had a whole series of operations. The patient suffers from chronic adhesive obstruction and becomes a regular and dreaded visitor to the ward and only too often a drug addict. The handling of such cases has presented a considerable problem. Each recurrent bout of obstruction leads to the formation of a fresh crop of adhesions. It is here that Noble's work has been so valuable.

#### THE CONTROL OF ADHESION FORMATION

In 1937 Noble<sup>5</sup> introduced his method of controlling the formation of adhesions. Should an area of bowel be denuded of its surface mesothelium and adhesion between it and adjacent tissue be inevitable, the damaged area is covered by attaching two lengths of bowel together by bending one on the other, much as a jointed rule is bent when folded. With fine catgut the parts of the mesenteries concerned are sutured together, beginning at the root of the mesentery. When this suture is complete, the two limbs of bowel now lying in contact are sutured together at their anti-mesenteric borders. In this manner the injured area of bowel is covered by uninjured intestine and adhesion takes place in such a manner that no subsequent harm from mechanical cause can ensue. Furthermore, Noble has shown by observation in his cases that there is no resultant interference with normal bowel motility. The method has been used by him in several degrees:

1. As it effects a single area of bowel injury where a local plication only is necessary.
2. As it effects several separated injuries where several plications may be required.
3. In cases where plication of the entire jejunum and ileum is necessary.

Noble<sup>6</sup> draws attention to the dangers following bursting of the low or pelvic appendix. In such cases peritonitis and sepsis result in multiple areas of constricted bowel, distension and obstruction. In such cases he carries out appendectomy with pelvic drainage. Where after 2-4 weeks distension, tenderness and perhaps fever continue, a second operation is done. Abscesses are evacuated, all adherent portions of bowel are liberated and the small bowel is plicated where its surface has been damaged. This may mean the entire length of the small intestine.

Ripstein, McDougall and Thompson<sup>7</sup> in experiments in dogs confirmed Noble's findings that adhesion formation was less after plication. Lord<sup>8</sup> analysed his results in 11 operations of plication for recurrent

adhesive obstruction. The results were excellent in 6, 2 were improved, 3 failed.

We have not had occasion to put Noble's work into practice in the more acute cases. With increasing knowledge of the blood chemistry and fluid and nitrogen balance, together with the use of antibiotics, adhesion formation causes difficulty in but a small minority of cases. Where we are indebted to Noble is for his appreciation of the principle of taking control of adhesions so that they do not take control of the patient. The latter is precisely what happens in cases of chronic adhesive obstruction and in such cases the Noble principle is applied. Noble<sup>9</sup> furthermore stresses the importance of removing erroneous concepts regarding obstruction; the ileus that follows peritonitis from appendicitis is mechanical and he denies the probability of adynamic or paralytic ileus where there is or has been peritonitis.

#### *The Noble Plication Operation*

The case of chronic obstruction due to adhesions which does not respond to Wangenstein suction despite the establishment of fluid and electrolyte balance is a candidate for the operation. So too is the patient who suffers from repeated attacks of threatened obstruction. The procedure is as follows: The patient is prepared for surgery by attention to blood and fluid needs. The bowel may well be opened during the operation. It is prepared by giving sulphathalidine for 4 days prior to surgery. The dosage is  $\frac{1}{4}$  g. per kg. body-weight per day. A quarter of this dose is given by mouth each 6 hours. To secure proper concentration in the gut the first dose given is half the total for the first day. Doctors have often been surprised at the magnitude of the dose. It is perfectly safe and no trouble has resulted from its use in hundreds of cases of operations on the intestines.

The abdomen is opened by a long vertical incision. All adhesions are freed. They involve mainly small bowel in part or most of its extent. This is a time-taking procedure which must be meticulously carried out, until the gut is free from duodeno-jejunal flexure to caecum. Plication is then commenced from above. The first 6 inches of jejunum is placed parallel with the next 6 inches. The mesentery is then approximated by interrupted sutures placed  $\frac{1}{2}$  inch apart and using 000 catgut on an atraumatic needle. When this is completed, the two lengths of bowel now lie side by side. They are approximated at their mesenteric borders in the same way. Care is necessary to avoid pricking of vessels which would cause haematoma formation. The adjacent 6 inches of bowel is then applied to the length above in the same way and this process is continued until the entire small bowel is plicated in concertina fashion (Fig. 1). It is important that the folded leaves of mesentery be sewn together; we have seen the procedure fail from neglect of this precaution.

The peritoneum is closed with No. 1 catgut on atraumatic needles. At each inch of the continuous suture a reinforcing stitch is put in. The rectus sheath is sutured with continuous 32 alloy steel wire. The skin is closed with linen. Suction and parenteral feeding

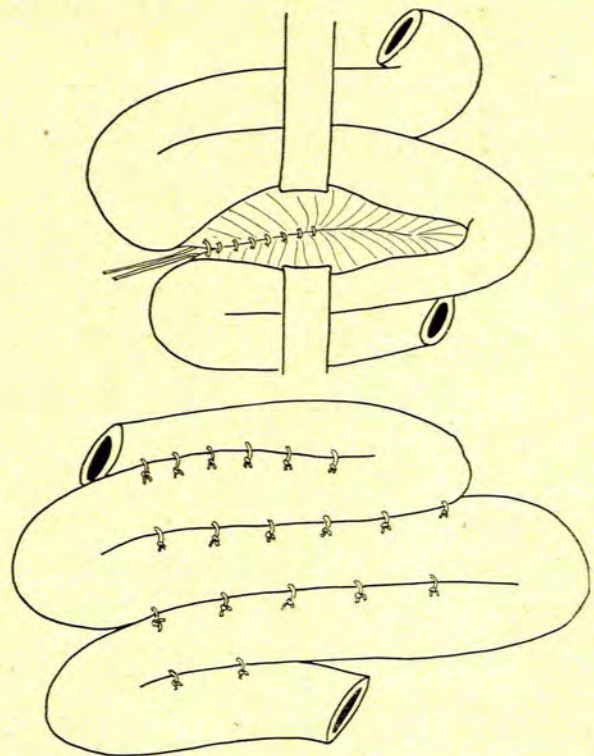


Fig. 1. Showing the detail of suturing in intestinal plication.

are established. The suction is discontinued when flatus is passed.

Convalescence may be trying to the patient. Stay in hospital may be two to three weeks.

#### AUTHOR'S CASES OF RECURRING ADHESIVE OBSTRUCTION

Cases of recurring adhesive obstruction are dreadful surgical problems and are fortunately not common. This analysis is based on 6 cases, 4 of which came under my direction in my service at the Johannesburg General Hospital, the other 2 in private practice.

##### Case 1

Mrs. M.M.L. was seen in hospital in 1951. She was 28. She had been operated on for appendicitis in 1945. Subsequently she suffered intermittently from abdominal colic. In 1949 an operation for intestinal obstruction was carried out elsewhere and an ileo-transversostomy performed. Since then she had suffered greatly from crampy abdominal pain and was admitted to hospital on several occasions for threatened obstruction, being temporarily relieved by conservative treatment.

In 1951 she was admitted to the Johannesburg General Hospital under my care. She was suffering from subacute obstruction of the small gut. She was a thin young woman who had lost weight from long-continued abdominal pain. She was vomiting on admission. Examination showed several abdominal scars and wide-spread tenderness round the central areas of the abdomen. Examination was not otherwise noteworthy. She improved on conservative measures. Radiographic studies of the alimentary canal showed stagnation of barium in the caecum. The diagnosis was post-operative adhesions complicated by recurrent attacks of threatened obstruction.

Operation was carried out on 15 June 1951. The procedure was prolonged, taking  $3\frac{1}{2}$  hours. The small bowel was widely and extensively adherent to itself and to the abdominal wall and

pelvic viscera. It was opened in the process of freeing adhesions. The ileo-transverse colostomy was undone. Because of the density of adhesions involving the terminal ileum, this part of the bowel was cut through, the distal end closed and the proximal limb anastomosed end-to-side to the ascending colon after large barium scybala had been evacuated. The entire length of the small bowel was then plicated.

Convalescence was stormy. Ultimate recovery was complete and she was discharged on 3 July 1951. She reported back on 23 October 1951 feeling very well and having gained 15 lb. in weight.

*Comment.* This young woman having undergone an appendix operation in 1945 suffered severely from threatened or actual adhesive obstruction of the small bowel. Total plication was performed in 1951.

#### Case 2

Mr. A.P.K. was 48 years old when admitted to the Johannesburg General Hospital in 1949. He was in sheltered employment. There was a long surgical history, summarized as follows:

1. 33 years ago operation for appendicectomy.
2. 20 years ago a colostomy was done for prolapse of the rectum, which was closed a year later.
3. 1947: Emergency operation for intestinal obstruction.
4. 1948: Emergency operation for intestinal obstruction; caecostomy done. This was closed 2 months later.
5. September 1948: Re-admitted for threatened intestinal obstruction.
6. March 1949: Re-admitted for threatened intestinal obstruction.

In May 1949 he returned to hospital and was admitted to my service. He stated that abdominal pain had been almost continuous since his previous admission. At this time he was eating poorly and was constipated. There was nocturia.

There were many scars on the abdominal wall and an area of paper-thin skin over a left-sided incisional hernia. Further investigations were not relevant. The diagnosis was extensive abdominal adhesions. It was decided to carry out the plication procedure.

Operation was carried out on 23 May 1949. The approach was through an extensive right paramedian incision. There were extensive adhesions matting together abdominal wall, small bowel and surrounding structures. These were liberated until the small bowel was quite free of adhesions. Total small bowel plication was performed. Moderate shock followed operation. There was some sloughing of skin overlying the suture line owing to the poor condition of the integuments. In two months the wound was healed. During his stay in hospital he suffered occasional abdominal cramps, which were thought to be colonic in origin.

In January 1950 the patient was readmitted with abdominal pain and vomiting. There was neither distension nor rigidity. The condition responded rapidly to conservative measures.

In March 1950 he was again in hospital because of an attack of pain which lasted a few hours. This cleared up after an enema. His bowels were functioning normally and he was otherwise well.

On 25 September 1951 he was readmitted complaining of abdominal pain, which was often preceded by vomiting. The pain was of epigastric origin, radiating to the hypochondria. Bowel habits were regular. He had lost some weight owing to poor appetite. He suffered a good deal from headache. Urinary frequency had increased.

On examination at that time the abdomen was generally distended, though soft. He was thought to be suffering from subacute adhesive obstruction. He responded in 2 days to conservative measures.

As the patient suffered a great deal of pain it was decided to remove afferent pain impulses by sympathetic denervation.

On 29 October 1951 left-sided splanchnicectomy, together with removal of ganglia thoracic 9 to lumbar 2 inclusive, was performed. Recovery was uneventful. The patient refused the second-stage procedure and signed himself out of hospital on 15 November 1951.

On 18 November 1953 he was readmitted under a physician, suffering from myocardial infarction. It is of interest that he stated he had been yellow on 3 occasions and had twice felt pain in the right hypochondrium. There was no abdominal tenderness or guarding. He had been eating well until 3 months ago and bowel function was normal.

*Comment.* This case conforms to the general pattern, where an abdominal operation is followed by widespread adhesions leading to attacks of actual or threatened obstruction for which a number of adhesion-freeing operations have been done. The plication procedure carried out in 1949 may not have completely succeeded. This is open to question since the patient had symptoms suggestive of biliary-tract disease and a left-sided incisional hernia, which may have caused the pain. The sympathetic denervation of the left side of the abdomen finally removed all pain except for the attacks in the upper right abdomen associated with jaundice. This is of considerable interest because it would seem to have functioned by soft-peddalling sympathetic activity, removing incoordination or peristalsis, and thus relieving spasm. It cannot have acted by cutting off all centripetal pain-impulses from the small gut, for this structure is bilaterally innervated. Here an observation of Wangenstein<sup>10</sup> is of interest. He emphasizes the well-known fact that many cases of adhesive obstruction are morphine addicts. This drug causes constipation, and intestinal spasm and not obstruction may be the cause of the abdominal pain. The success of suction with an in-dwelling tube in many cases may be due to relief of spasm by reduction of tension in the gut.

#### Case 3

Mr. F. V. du T. was 21 when, in December, 1947 he sustained a bullet wound of the abdomen. At operation several bowel perforations were sutured and a colostomy performed. This was closed in January 1948. In August 1949 an operation for small-bowel obstruction was performed in Rhodesia. He complained of colic on occasions and was readmitted in November 1949 with symptoms of small-gut obstruction, which responded to conservative measures. He refused the plication procedure. His symptoms continued and in February 1950 plication of the small bowel was carried out. There were two admissions for colicky pain soon after the operation. In May 1950 he was again admitted with sudden severe pain associated with vomiting. This did not respond to treatment. Operation on 2 June 1950 disclosed gangrene of a foot of small bowel, the mesentery at its base being constricted by a fibrous band which had cut off the blood supply. The small gut could not be delivered because of the previous plication procedure. The convalescence was stormy. The wound broke down and several bowel fistulae formed. He was discharged at the beginning of September 1950.

On 4 February 1953 he was readmitted with signs of large bowel obstruction. Laparotomy disclosed no obstruction, but blood in the bowel for which no explanation was forthcoming. He was discharged a fortnight later.

There have been no further admissions. The patient has been seen on several occasions and is well.

#### Case 4

Mrs. M.E.P. had undergone a Caesarean section in November 1949. When admitted in January 1950 she suffered from uretero-vaginal fistula, which was cured by a right nephrectomy.

She was admitted to my wards in August 1950 with the history that she had undergone an operation for ectopic pregnancy and retroversion of the uterus in 1935. She vomited so persistently after this operation that the abdomen was reopened a week later and a foot of small bowel was resected. She was fairly well for 5 years. Then abdominal pain began again and in 1940 operation was carried out elsewhere. Numerous adhesions were freed and uterine fixation was again performed. After this abdominal pain rarely left her and she spent two months in hospital in Durban in 1947, during which time a further segment of bowel was resected. In April 1950 she was in the Princess nursing home in Johannesburg for a week suffering from abdominal pain. When, in August 1950, being then aged 42, she came into my wards, abdominal pain was again the cause. The diagnosis was threatened obstruction due to adhesions. X-rays were not helpful.

On 27 August 1950 the heavily-scarred abdomen was explored. A solitary small adhesion was found. No plication was done. A hole in the left broad ligament was repaired and another opening, leading through the great omentum into the lesser sac, was also sutured. She was well after this operation. She was readmitted to another unit on 6 March 1951 complaining of pain in the nephrectomy wound. A mass was felt in the right loin. Exploration of the abdomen disclosed the mass to be the right lobe of a ptosed liver. No cause for the pain was found.

*Comment.* This case illustrates the fact that though the abdomen had been subjected to so much surgical violence, it was quite capable of putting its own affairs in order and resolving adhesions. Another point is that abdominal pain in the presence of numerous laparotomy scars does not necessarily mean that adhesive obstruction is the cause. Recurrent self-reducing internal herniation was the cause in this case.

#### Case 5

Mrs. J.G. was referred by Dr. H. Javen of Koppies. When first seen in July 1953 she was aged 47. In 1944 ureteric dilatation had been done. She had undergone cholecystectomy in 1946. For 2 years before my seeing her she had suffered recurrent attacks of 'terrible' colic associated with vomiting and constipation. She suffered lesser attacks between the main ones, though the intervals between the latter were diminishing. She had had 8 children, of which 6 were alive.

On examination no gross abnormality was found. The diagnosis made was threatened obstruction due to adhesions. Radiography of the alimentary tract and an intravenous pyelogram were not informative. She was put on conservative treatment and sent home. She returned a month later because the symptoms were continuing.

On 11 August 1953 an old scar was excised through a long paramedian incision. The small bowel was so densely adherent to the scar that it was lacerated in several places. An area of 18 inches of small bowel was resected and an end-to-end anastomosis was performed. No adhesions were present. There was no bile-duct pathology. Nothing further was done.

She was well for 6 months, after which abdominal pain began again and was becoming worse, though she was eating well and putting on weight. There was a hernia present in relation to an old mid-line scar. Symptoms were ascribed to adhesions.

On 13 May 1955 laparotomy was done. The entire length of the small gut was involved in adhesions. Their liberation was difficult. The small gut was ultimately completely freed of adhesions and plicated throughout its length. Convalescence was smooth. She has remained well since.

*Comment.* The main feature of interest in this case lies in the fact that at the first operation the cause of the symptoms was removed, leaving a peritoneal cavity free of adhesions. Within a few months the entire small gut was plastered with them.

#### Case 6

Miss M.A.B.Z. was referred by Dr. C. Gotlieb of Johannesburg in October 1955. She was 48 years of age, and held an important secretarial position. In 1935 she had a 'chronic' appendix removed for biliousness and vomiting. She was well until 1946, when hysterectomy for fibroids was carried out. Within 9 months a laparotomy was performed for adhesive obstruction. A year later she was again operated on for a similar reason. Two years after this a third operation for adhesive obstruction was done. Soon attacks of pain and vomiting recurred. Two operations were carried out for the same reason, including an ileostomy, which took months to heal. Symptoms recurred quite soon and were getting worse. She complained of a constant burning abdominal pain and on frequent occasions of colic. She vomited most days. The pain required pethidine for its relief. She was very constipated. She had lost much working time.

She was a stout woman in good general condition. Many abdominal scars were present. The abdomen was generally tender with much noise on auscultation. There were no other relevant findings. Porphinuria was excluded. The diagnosis was extensive intra-abdominal adhesions involving the parietal peritoneum.

Operation on 4 November 1955 disclosed dense adhesions involving abdominal wall, bowel, mesenteries and adnexa. These were liberated, those to the upper jejunal coils causing much difficulty. Total plication of the small gut was then carried out. The procedure was a severe one and convalescence was difficult. Suction and parenteral feeding were necessary for 10 days. A walled-off intraperitoneal abscess presented in the upper part of the wound. It was opened and soon healed. She was home in 3 weeks.

When last seen in February 1956 she was recovering from a severe attack of influenza. The abdominal condition was satisfactory. Her bowel function she described as 'wonderful'.

Her present condition: The patient states that she is very well,

enjoys her food and has no abdominal symptoms, and that the bowel habits are normal.

*Comment.* The case illustrates the protracted suffering and surgical vicissitudes of sufferers from adhesive obstruction. It also teaches the surgical difficulties implied in the condition and the need for 'taking control' of the adhesions earlier.

#### DISCUSSION

The analysis of the foregoing cases indicates the gravity of the problems with which the surgeon is faced in dealing with post-operative adhesions. There is first the matter of diagnosis. This was wrong in cases 3 and 4. Having diagnosed adhesions as the causative factor in threatened obstruction, how long should conservative measures be continued with? In the absence of any signs of shock or blood loss Wangensteen drainage with parenteral feeding will often produce remission. The danger of continuing too long with such methods is appreciated and in 2 cases in the writer's service (not due to adhesions) conservative measures were continued for over 24 hours in the presence of unsuspected gangrene of a loop of bowel. Nice judgment, repeated careful examination, and close observance of the pulse rate, supply the best indications if and when to operate.

When laparotomy has been decided on and the diagnosis of adhesions as the cause of the trouble has been confirmed, what should be the extent of the operation? If the adhesions are very limited in extent, then there is place for local plication. If, however, they are considerable and involve several feet of small gut, then total plication should be carried out. It is also clear that should obstructive symptoms recur after one operation for the relief of adhesions then total plication should be done if the laparotomy shows adhesions to be the cause of the patient's symptoms.

In regard to operation itself Noble advised that the walls of the peritoneal pockets between the lengths of plicated bowel should be sutured together. Failure to adhere to this injunction was the cause of further obstruction in case 3. Finally, with the knowledge that there is no substance of proved value in preventing the formation of adhesions, it remains for the surgeon to exercise all possible means to inflict minimal trauma on his incursions into the abdomen.

My thanks are due to Messrs J. Wolfowitz, the late Mr. J. Pencharz, Mr. L. Mace David, Mr. H. W. Gordon, Mr. A. J. Leonsins, and Mr. B. Shaff, members of my unit in Ward 19, of the Johannesburg General Hospital, for their care and skill in dealing with some of the cases mentioned. I am grateful to Dr. E. A. Thomas of Springs for the illustration.

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