at that level has any positive disadvantage. The doubt only remains that denervation of the cardiac plexuses can be so complete that it is effective.

The following case report suggests that it can be.

A man aged 41 had repeated Stokes-Adams attacks for five years. Several of these lasted intermittently for up to seven hours at a time. The electrocardiogram showed complete heart-block, and during attacks there was ventricular arrest. The attacks could not be prevented or treated by ephedrine, atropine, adrenaline, or intravenous lactate. He was operated on by Professor Kimmonth, and the left antero-lateral side of the arch of the aorta was cleared of connective tissue and nerve fibres from before backwards. Further pieces of nervous tissue were removed behind the aorta and the pulmonary artery. The impression was gained that the superficial, deep, and para-aortic plexuses had been removed. Before the operation the heart rate was 34 a minute; at the conclusion he was in normal rhythm at 90 a minute. Eleven months later he had had only one attack of giddiness, but his doctor reported that his pulse rate had never been below 60 a minute. He was then back at work.

Summary

The autonomic nervous supply of the heart pursues a diffuse and complicated course in both its afferent and its efferent components. Its role is often in doubt, but slowly it is becoming clarified.

The nature of cardiac pain is discussed and the metabolic changes consequent upon myocardial infarction are stressed. Coronary "spasm" has no factual evidence to support its occurrence.

A case is described in which the patient suffered a variety of autonomic disturbances when he developed cardiac pain; they are best explained by central radiation within the spinal cord.

The "shoulder-arm" syndrome and excessive flatulence, sometimes associated with coronary artery disease, are probably concomitant autonomic phenomena.

The association between cardiac pain, gall-bladder disease, and hiatus hernia may be more than reduction of pain threshold, and either condition may cause reduction in coronary arterial blood flow.

The evidence is that most operations designed to re-vascularize ischaemic hearts diminish pain by destroying sympathetic afferent pain fibres.

Upper dorsal sympathectomy and direct denervation of the heart may well have a place in uncontrollable auricular fibrillation and sometimes in repeated Stokes-Adams attacks.

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TREATMENT OF COMPLETE PROLAPSE OF THE RECTUM

BY

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The conflicting reports on the results of treatment of complete prolapse of the rectum have caused confusion, and this is reflected in the large number of operations which have been advocated for the condition. Dickson Wright (1949) was able to find 51 procedures described in the literature up to 1949, and more have appeared since. In this report we describe the two types of operation we have performed since 1951 and record the progress results; we have endeavoured to correlate this experience with published reports.

In complete prolapse of the rectum there is a peritoneal sac extending distally between the vagina (or prostate) anteriorly and rectum posteriorly. As such a peritoneal sac may be present without rectal prolapse it is probable that the latter appears only when the pelvic fascia and the muscles surrounding the pelvic aperture are defective.

Present Series

Since 1951 we have operated on 30 patients suffering from complete prolapse of the rectum. In each case the rectum prolapsed at least 3 in. (7.5 cm.) and in some cases as much as 9 in. (23 cm.). There were 28 females whose ages ranged from 27 to 87 years (average 54), and 2 males aged 36 and 40 years. One patient was very obese and another very thin from malnutrition; one patient had long-standing cardiopasm with secondary nutritional changes; a fourth patient had severe rheumatoid arthritis with almost complete fixation of the hip-joints; a fifth had had an amputation of an arm and a leg in the past for an obscure vascular disease.

The series has been divided into two groups according to the type of operation. In group 1 are 17 patients who were operated on between July, 1951, and November, 1955, and in group 2 are 13 patients who were operated on since January, 1956.

Treatment of Patients in Group 1

Each of the 17 patients in group 1 was subjected to a synchronous combined operation. The patient was placed on the Lloyd-Davies lithotomy-Trendelenburg leg-pieces. Through a lower midline incision the abdomen was opened and the small intestine displaced from the pelvis into the upper abdomen. The fundus of the peritoneal sac, having been freed by the perineal surgeon, was grasped from above, invaginated into the peritoneal cavity, and amputated. The pelvic peritoneal cavity was obliterated as completely as possible with multiple encircling purse-string sutures and the abdomen closed.

The perineal surgeon exposed the fundus of the sac through an incision placed between the vagina (prostate) and rectum. After pushing it through to the abdominal surgeon a perineorrhaphy was performed by suturing the puborectalis and pubo-coccygeus muscles and related fascia together with chromic catgut size 2, anterior to the rectum. In 14 of these patients additional reconstruction was carried out behind the anal canal. A longitudinal incision behind the anus was deepened through the coccygeal attachments of the external sphincter and levator ani muscles and the fascia of Waldeyer to enter the presacral space. The rectum and

anal canal were displaced forward and held in this position by interrupted sutures of chromic catgut passed from one side to the other.

Results.—There were no deaths and no serious complications. The longest follow-up after the operation was 5½ years and the shortest 15 months. There have been three recurrences. In one, a married woman aged 72 who suffered from advanced rheumatoid arthritis, the prolapse reappeared within six months of the operation; the perineal wounds were severely infected and it was thought that this was responsible for the failure. She declined further treatment. In a man aged 36 the operation was effective for 15 months before the prolapse recurred, and a second repair was performed in the way described for group 2 cases. At the second operation the peritoneal pouch was found re-formed and in every way similar to that noted at the first operation, despite the fact that encircling silk sutures were used to obliterate the pouch. A married woman aged 75 was satisfactory for two years before the prolapse recurred. In the remaining 14 cases the results continue to be satisfactory. Four patients have remained well for 4 years or more, three for 3½, 3, and 3 years respectively, five for 2 years or more, one for 18 months, and one for 15 months. Each of these 14 patients has enjoyed adequate continence, although imperfect sometimes if the motions become loose. On straining, mucous membrane may appear at the anal verge (two cases). The tonus of the anal sphincter muscle improved, but did not always recover completely, despite the absence of prolapse.

FIG. 1.—Appearance at laparotomy for repair of complete prolapse of rectum.

FIG. 2

FIG. 3

FIG. 4

FIG. 2.—Peritoneal sac is inverted and excised. FIG. 3.—Sutures approximating the levator ani muscle and inserted by the perineal surgeon can be seen. Pelvic fascia is sutured with a series of "purse-string" silk sutures passed through the fascia on the four walls of the space opened up between rectum and vagina. FIG. 4.—Upper parts of the lateral ligaments are approximated anterior to rectum; utero-sacral ligaments are sutured together above the fascial repair.

Treatment of Patients in Group 2

The 13 patients in this group had the same perineal operation, but the abdominal procedure was changed. After exposing the pelvic peritoneal cavity the peritoneum was incised on either side of the rectum, and these incisions were continued distally to meet anteriorly to the rectum (Figs. 1-4). The fundus of the peritoneal sac was excised to expose the fascia on the posterior wall of the vagina (prostate and seminal vesicles), on the anterior wall of the rectum, and on either side of these structures. A series of silk sutures (size 4) were placed in this extraperitoneal space between the rectum and vagina (prostate and seminal vesicles). Each suture encircled the space, passing through the fascia on each wall. The first of these sutures was placed immediately above the levator ani muscle, which represented the upper limit of the perineal repair. The subsequent sutures were placed at short intervals above the first, ending at the level of the cervix (upper end of seminal vesicles). The peritoneal floor was closed by uniting the lateral peritoneal flaps with a continuous suture anterior to the rectum. In nine of the cases the posterior reconstruction was performed in the way described for group 1 patients.

Results.—Treatment was conducted without mortality despite the frailty of a number of the patients. There were no complications except wound infection in the perineum. The longest follow-up is only 13 months and the shortest 3 months. There have been no recurrences, and continence has been satisfactory, although imperfect if the motions lose their solid consistency. In one patient straining caused the anus to evert, exposing the mucous membrane of the anal canal, but there was no prolapse. The sphincter muscle appeared capable of recovering normal tonus.

Discussion

The obvious procedure, amputation of the prolapse, was popularized by Mikulicz (1888), by Miles (1933), and later by Gabriel (1948). As might be expected, this operation, known as rectosigmoidectomy, gave good immediate results, but the later recurrence rate has proved high, which is not surprising, because the operation does little to remove the cause of the prolapse (Thompson, 1949; Pemberton *et al.*, 1953).

The Moschowitz Approach

The first to advocate a procedure designed to correct the cause of the prolapse was Moschowitz in 1912. He pointed out that normally there was a fascial weakness where the rectum left the abdominal cavity and that this weakness might be greater than usual and allow a peritoneal sac to indent the anterior wall of the rectum and finally force it through the anal orifice. Moschowitz favoured an abdominal operation; the hernial sac was obliterated with purse-string sutures placed around it and including the pelvic fascia. This operation also proved unsatisfactory: Brintnall (1952) reported that of 11 patients so treated the condition recurred in 8; Pemberton *et al.* (1953) found that 29 of 46 cases treated at the Mayo Clinic by the Moschowitz operation and followed for two years or more had recurred, while Swinton and Mathiesen (1955) infer that the results at the Lahey Clinic were also poor. In the one case in our series, the patient was subjected to operation following an unsuccessful Moschowitz type of repair; the peritoneal sac had re-formed without leaving trace of the original encircling sutures.

Roscoe Graham (1942) also called attention to the Moschowitz conception of the pathology and treatment of complete prolapse of the rectum, and, like him, advocated an abdominal repair, but one which was more complete. The levator ani muscle was exposed and the two halves were joined together anterior to the rectum with interrupted sutures; the pelvic fascia was sutured and the pelvic peritoneal pouch obliterated in the way suggested by Moschowitz. Snellman (1954) reported 12 cases treated in this way with good results, but the follow-up was too short to permit firm conclusion; one patient was traced four years after operation, another three years, and three for two years, but the remainder had had their operations less than two years prior to the report. Brintnall's one case recurred. Lloyd-Davies (1949) described a modification of this procedure; six loosely tied slings of floss silk, attached firmly at the sides of the rectum by deep insertion into the sacrospinous ligaments, were placed between the rectum and vagina. No results were given. Hayes and Burr (1948) report two cases in which the lateral ligaments of the rectum were sutured together anterior to the rectum. They claimed cures, but no follow-up times are given.

These attempts by Moschowitz, Graham, Snellman, Lloyd-Davies, and Hayes and Burr were made through an abdominal approach, although undoubtedly the levator ani muscle and lower pelvic fascia are more accessible through a perineal incision. This was recognized by Moschowitz (1912) because in half of his cases some type of perineal operation was combined with the closure of the pouch of Douglas, although performed at a separate operation. McCann (1928) described a perineal operation in which the levator ani muscle and fascia of the rectum were sutured anterior to the rectum, but three patients so treated at St. Mark's Hospital all developed recurrences. Orgias (1954) reported a similar operation, performed on two patients, but was careful to remove as much of the peritoneal sac as possible; however, the longest follow-up was only four months, so that no conclusion can be reached concerning the efficacy of the method. When the perineal herniotomy has been performed by excising a portion of the rectum and sigmoid colon as in rectosigmoidectomy the reported results have been fairly good provided the levator ani muscle and fascia are sutured anterior to the rectum. Altmeier *et al.* (1955) reported 13 cases treated in this way with only one recurrence; the longest follow-up in their series was 4½ years. However, Dunphy (1948) and Dunphy *et al.* (1953) were less satisfied; two of their three cases developed prolapse of the rectal mucosa within three months of the operation.

Dunphy's Operation

If the abdomen is open during these procedures performed entirely through the perineum it is apparent that a deep pelvic peritoneal sac persists even after a carefully done

operation. The logical procedure would appear to be a combined abdomino-perineal operation, and Dunphy (1948) was one of the first to realize the advantages of such an operation. His operation was done in two stages. Through a perineal approach the prolapsed segment of the rectum was excised, the hernial sac removed, and the levator ani muscle sutured anterior to the rectum. Some days later the abdomen was opened, the rectum mobilized, the transversalis fascia sutured, the hernial sac and pouch of Douglas closed by circular sutures, and the pelvic colon fixed to the lateral wall of the pelvis. All 12 cases so treated (Dunphy *et al.*, 1953) remained satisfactory, although one patient had a mucosal prolapse and was incontinent after the operation. Butler (1954) advocated a combined abdomino-perineal procedure performed in one stage, and he reported five cases without recurrence, but the longest follow-up was only two years. The Butler operation accomplishes the same results as that described by Dunphy. The patient is placed in a lithotomy-Trendelenburg position; the colon and rectum are mobilized and excised from above and an end-to-end anastomosis is completed from below. The levator ani muscle is repaired from below and the hernial sac obliterated from above.

Method in the Present Series

In our series a combined abdomino-perineal operation was performed by two surgeons working simultaneously; the perineal part of the operation was conducted by a surgeon with gynaecological training and experience, whilst the abdominal part was performed by a surgeon accustomed to pelvic dissections. The operation in group 1 cases consisted of complete abdominal excision of the peritoneal sac combined with perineal perineorrhaphy. The results of the operation in this group were imperfect, and accordingly in group 2 cases the abdominal part of the operation was changed. In addition to the two manoeuvres described the pelvic fascia above the levator ani muscle was repaired with a series of interrupted silk sutures. Brintnall (1952), Dunphy *et al.* (1953), and Newell (1954) have all described a similar operation; in the present series the perineal and abdominal phases were performed synchronously, whilst in the cases described by Brintnall, Dunphy *et al.*, and Newell they were done consecutively.

The procedure appears formidable, but there have been no deaths and no serious complications have endangered life. In the first group of 17 cases there have so far been three recurrences; of the 14 cases which have remained satisfactory, four have been followed for four years or more. In the second group of 13 cases there have been no recurrences, but the first of the group was subjected to operation only 13 months ago, so that it is too early yet to decide if the results in this group are better. Brintnall (1952), reporting two recurrences in six patients so treated, noted that in one the recurrence appeared 16 months after operation and in the other it had developed after only three months; the four successful cases had been traced for periods ranging from 20 to 36 months. Dunphy *et al.* (1953) were satisfied with the two cases treated by them, although they commented upon the tendency of the mucous membrane to slide through the anal orifice after operation, and this was also noted in our series. The result of the operation in Newell's (1954) case was good 10 months after operation. In our series, 23 cases had a posterior reconstruction of the levator ani muscle; whether or not this is a useful procedure has not been decided, but in each of the three recurrences this additional part of the operation was done.

In our series no bowel has been excised, although a number of authorities believe removal of redundant bowel to be an essential step. Mikulicz (1888), Miles (1933), Gabriel (1948), and others have removed a considerable part of the rectum and sigmoid colon through the perineum, whilst Butler (1954), Muir (1955), Swinton and Mathiesen (1955), and others have excised the bowel through the abdomen. It is certain that recurrence occurs after resection of this bowel unless it is combined with a repair of the pelvic musculo-fascial floor. In this series an attempt has been

made to perform this repair without removal of the rectum and sigmoid colon, and subsequent experience and comparison with other follow-up studies will decide whether it has been successful.

Other Procedures

Some operations devised are based on the principle of fixation of the rectum and sigmoid colon to rigid neighbouring structures. For example, Pemberton and Stalker (1939) and Pemberton *et al.* (1953) have been impressed with the results of an abdominal suspension-fixation operation; the rectum and sigmoid colon are freed to the upper surface of the levator ani muscle, pulled taut, and sutured to a higher level. The authors felt that adherence of the rectum to the anterior surface of the sacrum prevented recurrence, and recommended that in a large prolapse a pack be left in the hollow of the sacrum for about a week to promote this adherence. Orr (1947) performed a similar operation, but inserted fascial strips to aid the suspension, while Stabins (1951), Mills and Lawler (1956), and Tendler (1956) have reported the same type of suspension operation, but in addition have resected redundant bowel. Muir (1955) advocated an anterior resection of rectum and sigmoid colon with end-to-end anastomosis, and without any special attempt to repair the pelvic floor or to "suspend" the bowel. He believed that firm adhesion of the anastomosis to the sacrum prevented recurrence. It is to be hoped that these authors will report the long-term results of these suspension-fixation procedures. Lockhart-Mummery (1910) gave an extensive trial to posterior fixation of the rectum to the sacrum, but it proved a complete failure (Hughes, 1949). Furthermore, nine cases of sigmoidopexy (two with obliteration of the pouch of Douglas) performed at St. Mark's Hospital all proved unsuccessful (Hughes, 1949). Brintnall (1952) reported a recurrence after anterior resection and anastomosis of the bowel and at the Lahey Clinic procedures based on fixation have fallen into disuse (Swinton and Mathiesen, 1955).

Conclusions

In this series of cases of complete prolapse of the rectum treated by operation, a procedure has been used which entails abdomino-perineal removal of the hernial sac and abdomino-perineal repair of the defect. Both abdominal and perineal phases have been performed simultaneously. No bowel has been resected and no attempt has been made to achieve success by "fixation" or "suspension" of the bowel. The operation performed in group 2 is a technical improvement on that used in group 1 and continues to be used as our method of choice.

Summary

A series of 30 patients suffering from complete prolapse of the rectum have been subjected to operation. They have been divided into two groups according to the operation performed.

In group 1, comprising 17 patients, a synchronous combined abdomino-perineal repair was performed. A perineal perineorrhaphy was carried out after complete excision of the peritoneal sac from above. The pelvic cavity was then obliterated with encircling sutures of silk. In this group three patients have suffered a recurrence, but the remainder have remained satisfactory for periods up to 5½ years.

In group 2, in which there are 13 patients, a synchronous combined abdomino-perineal repair was performed. Perineorrhaphy was carried out after complete excision of the sac. The pelvic fascia between the rectum and vagina (prostate) was sutured with a series of interrupted silk sutures, after which the remaining pelvic peritoneum was obliterated as in group 1. No recurrences have yet occurred, but the longest follow-up is only 13 months.

The results of procedures utilizing solely the abdominal or the perineal route do not appear to have been uniformly satisfactory.

A combined abdomino-perineal operation has become widely used in the past decade, but it is difficult to assess results.

Many operations which have been designed for complete prolapse of the rectum have entailed excision of rectum and sigmoid colon. The procedures used by us have consisted of removal of the hernial sac and repair of the defect without removal of the bowel.

The repair has been designed to correct an anatomical defect and does not rely on "fixation" of the bowel to or "suspension" from neighbouring rigid structures.

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SUBCUTANEOUS HEPARIN WITH AND WITHOUT HYALURONIDASE

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It is usual to commence anticoagulant therapy with heparin given intravenously every four to six hours. Such a regime is time-consuming for the doctor, and a number of attempts have been made to overcome the necessity of giving heparin by the intravenous route.

Intramuscular heparin was used by Abrahams (1950), who included procaine in the injection to prevent local pain. He found that the clotting-time was satisfactorily prolonged with twice-daily injections and noted haematomata in only 10% of cases. Gubbay and Pash (1953) also found that the intramuscular route was satisfactory and free of complications. However, Bauer *et al.* (1950) and Wynn and Goodwin (1952) noted that intramuscular haematomata occurred quite often with such treatment, and in the latter series forced cessation of therapy in 25% of cases. Marks *et al.* (1954) gave intramuscular heparin mixed with hyaluronidase four-hourly for four doses, and state that the hyaluronidase overcomes the disadvantages of pain, local bruising, and variable absorption found with intramuscular heparin alone.