a collodion dressing and the last cervical and first dorsal laminae removed. This was done piecemeal, as the laminae were represented by an indefinite mass of old and new bone, and it was very difficult to determine when the spinal canal was reached. This was, however, eventually well opened up, the fatty sheath separated, and the theca well exposed and lifted gently to free it. Pulsation good. Wound closed without drainage. Three days afterwards the patient volunteered that he could "feel his feet." Lower limbs immobile, very spastic, and involuntary movements as troublesome as ever. Within ten days the patient could, however, control the "spinal convulsions," and considerable muscular power was evident. By the end of June he could walk without support, and on August 25th was invalided, walking quite normally. Reflexes active, no clonus, anaesthesia about upper part of thorax.

CASE II.

Pte. G., aged 18, was wounded on March 20th, 1916, by a fragment of shell, which entered on the left side of the spine in the interscapular region; on the right side of the same region a counter opening had been made. Missile not removed. Admitted March 25th; x rays showed a piece of metal between the angles of the fourth and fifth ribs (right side) and damage to the right side of the fifth dorsal vertebra and neck of the fifth rib. No chest symptoms. Both wounds healed without removal of the missile and patient was sent to an auxiliary hospital on May 3rd. On May 28th the patient, who had been walking about quite actively for some weeks, was suddenly seized with weakness of both legs, especially the left, which gave way under him, and he fell to the ground. He was at once returned to this hospital. On readmission there was paralysis of the whole left leg, except for some fruitless twitchings of the front of the thigh. Superficial and deep reflexes grossly exaggerated; no Babinski. Right leg definitely weak, but all movements could be executed. No sphincter trouble. Partial anaesthesia in both limbs, with tracts of complete anaesthesia on outer side of the left leg and thigh. Wounds soundly healed. Operation June 3rd; the fifth and sixth dorsal laminae removed. When the theca was well exposed a nodule of soft vascular bone was seen projecting against the right side of the dura. The projection was continuous with a mass on the right side about the pedicles of the vertebrae, was easily lifted out, and showed a central core of soft granulation tissue, continuous with septic granulation tissue in the new bone close by. Theca gently freed and observed to pulsate well. Wound drained. Convalescence interrupted by pneumonia on second day; patient had to be placed in a sitting position with shoulders strapped to the bed-rest for two days; after that nursed on each side alternately. Temperature normal in six days. Recovery of paralysis by the end of June was nearly complete. Invalided out, walking quite normally, in August.

CASE III.

Pte. M., aged 20, was wounded on September 20th, 1916, by a shrapnel ball which entered between the vertebral border of the left scapula and the spine, and was localized as lying "behind or in the body of the third dorsal vertebra." He had been operated upon in France for removal of the missile, but his condition forbade completion of the operation. Notes from France indicated that a left motor and right sensory paralysis had existed from the nipple lines downwards.

On admission to this hospital on November 3rd, 1916, there was a discharging sinus in the centre of a wide vertical scar about two inches from the middle line. Movements of the right limbs were not affected. The left was paralysed below the knee and its reflexes were very active. Sensation was impaired on the same side, especially in the foot, and in the right limb, though not acute, was better than in the left. Condition slowly improved until hip and thigh movements were quite strong, but not more than a flicker of movement was possible below the knee. The sinus discharged as freely as ever, hence it was decided to attempt to remove the missile. This was done on January 7th, 1917, and as any attempt to explore the sinus would be dangerous unless its exact relation to the theca were known, the latter was deliberately exposed by the removal of the greater part of the third and fourth dorsal laminae. A probe was then passed forwards by the side of the left edge of the theca into the body of the third dorsal vertebra. The theca being protected by a small spatula, the ball was easily removed, together with a quantity of septic granulation tissue. The laminectomy incision was closed entirely and lateral drainage with gauze carried out along the course of the original sinus. Suppuration was free for two or three weeks, then rapidly improved, as did the paralysis. At the end of March the patient was walking with the aid of a walking-stick, and by the end of May walked quite normally.

Summary.

In Case I the paralysis, slight at first, increased to complete immobility of the lower limbs. In Case III the paralysis also existed from the time of wounding, but recovered to a considerable degree before operation. In Case II the paralysis occurred quite suddenly about nine weeks after the injury in a patient who was well and active. In no case was the Brown-Séquard syndrome (paralysis and hyperaesthesia of one side and anaesthesia of the other) seen, although Cases II and III were mainly unilateral lesions as far as motor paralysis was concerned.

Case II showed a patchy anaesthesia most marked on the outer side of the paralysed thigh, but the other limb was dull to pinprick; the fact being that when sensation is involved on both sides differences of degree are hard to detect, and, unfortunately, no attempt was made to discriminate between painful, thermal, and tactile impressions.

In each case (a) the paralysis was incomplete in the sense that sphincter trouble was absent; (b) the injury was indirect, and due to damage to the spinal column and not to the cord itself, and (c) recovery was complete.

The immediate effects of the operation in restoring or improving the circulation in the cord were not determined in any case. Decompression in laminectomy is a gradual procedure, and probably pressure is relieved long before the theca is exposed. The dura was not opened in any one of the three cases.

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FIVE INTESTINAL OPERATIONS ON THE SAME PATIENT.

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THE following case is interesting, not only because the patient had to be submitted to five intestinal operations in four years, but on account of its course and the difficult clinical problems it presented. The patient was a man born in 1894.

I.

Appendectomy, for acute appendicitis, at the North Staffs Infirmary in July, 1913; no drainage. Afterwards he had frequent attacks of sharp colicky pain in the right iliac fossa, but was not confined to bed.

II.

Exploratory laparotomy, at Hull Naval Hospital, in December, 1915, for severe pain in the right iliac fossa, with vomiting. The abdomen was opened near the appendectomy scar and closed without drainage.

III.

Ileostomy, for acute intestinal obstruction. He was admitted to the Stoke-on-Trent War Hospital late at night on January 14th, 1916. No satisfactory history could be obtained. The abdomen was opened by a median subumbilical incision. The small intestine was greatly distended; the large intestine loaded with hard scybalous masses. In the right iliac fossa was a mass of large and small bowel, inextricably matted together by very numerous and tough adhesions. There was great abdominal distension and profuse stercoraceous vomiting. He appeared to be moribund. A piece of ileum, as near the caecum as possible, was brought into the wound, stitched there, and opened at once. The stomach was washed out. The artificial anus acted well, but the skin around it became very foul and sore, and the man begged for a further operation.

IV. *Intestinal anastomosis*, with bilateral exclusion of intestine, leaving mucous fistula. On February 11th, 1916, the artificial anus was plugged, and the soiled skin excluded, as far as was possible, by a sheet of sterilized batiste fastened down with I.R. strapping. A large flap of skin (Fig. 1) was marked out on the left side above the umbilicus, and turned over to the right. The abdomen was then opened just to the left of the middle line. The intestine was doubly clamped in two places—the ileum as near the artificial anus as was feasible, and the transverse colon in its distal third. Later, anastomosis was made between the ileum and the transverse colon (Fig. 2). Then the ileum was divided distal to the anastomosis and the transverse colon proximal to the anastomosis. Both ends of

FIG. 1.

the ileum were closed, as was the distal end of the colon. The proximal end of the colon was ligatured where crushed, and the end brought to the surface at X (Fig. 1), being fastened in position by several sutures. The flap was replaced without drainage.

FIG. 2.—The bilaterally excluded bowel is shaded, and is the portion removed at Operation V.

weight and strength. The only disabilities remaining were the moisture from the fistula, and the fact that the bowels were always opened at least three times daily.

On August 6th, 1916, he was suddenly seized at breakfast-time with severe colic; no vomiting; no rigidity; great tenderness over caecum; temperature and pulse only slightly raised; great increase of fluid—now very malodorous—in spurts, from the fistula, where the exposed mucosa had lost its peristalsis.

On August 9th he was better and peristalsis was again seen at the fistula. On August 12th the skin at X (Fig. 1) showed signs of acute inflammation and soon discharge occurred with rapid relief of symptoms.

V.

Colectomy (July 18th, 1917).—A sponge was packed into the fistula. The incision was made through the entire length of the right linea semilunaris (Fig. 1), in its lower part invading the incisions of the first two operations. The abdomen was difficult to enter because of great vascularity, adhesions, and scar tissue. The adhesions in the right iliac fossa (see Operation III) had almost entirely disappeared. Thorough exploration was made, adherent coils separated, and all bleeding points tied. One adherent coil required inversion by a purse-string suture at the area of separation. Colectomy was started by mobilizing the caecum and ascending colon—this was easy and the mesenteric vessels were tied off very tightly with strong silk near the bowel, or in places where fat was very abundant, in the groove left by crushing forceps. Clamps were placed on the bowel side of the ligatures. More trouble was met with at and beyond the hepatic flexure because the empty part of the transverse colon was much atrophied—smaller than the ileum—and was shrunken up under the ribs owing to shortening of its mesentery. The mucous fistula was excised, and it was strange to find that six feet of ileum required removal before the blind end near the anastomosis was reached. The removal of the excluded portion of transverse colon was troublesome because of the poor access, adhesions near the anastomosis, and atrophy and friability of this gut. The blind end was embedded in scar-tissue at X (Fig. 1), and a fresh incision had to be made encircling this pocket. Some oozing took place here, and as it was known to be previously infected tissue a split tube was left at X for two days.

He did well, and writing on October 4th, 1917, said, "I feel better now than for the last two years." Up to the present (March, 1918) he remains quite well; weighs 10 st. 10 lb., and plays football.

The following points in the case appear worthy of remark:

1. The adhesions found on January 14th, 1916 (Operation III), could not be separated by fingers and gauze. Their origin is obscure, and their almost total disappearance noteworthy.

2. The constant tendency to diarrhoea since 1913 is, perhaps, partly due to his very healthy and unrestrained appetite.

3. When he was operated upon for obstruction his moribund condition and the absence of history made the case difficult.

4. An ileostomy is a hateful proceeding, but it is the only life-saving measure to be considered in such a case. The bowel should be opened at once and the stomach washed out. Primary anastomosis should not be attempted.

5. The technique of intestinal anastomosis and bilateral exclusion of intestine presents few difficulties nowadays, but in the presence of an artificial anus special care is required to avoid infection.

6. Owing to an error of technique an adequate safety-valve was not procured for the excluded portion of colon. For a time the outlet at the ileal end was sufficient, but the instructive and interesting happenings in August, 1916, have been described to illustrate the dangers of relying upon the ileo-caecal valve to become incompetent—as finally occurred. A safety valve at both ends of bilaterally excluded intestine should always be provided.

7. It was astonishing that no less than six feet of ileum had to be removed at Operation V, in spite of the deliberate choice, at Operation III, for the ileostomy of what was thought to be a coil quite close to the caecum.

NOTES ON SURGICAL WORK IN A GENERAL HOSPITAL.

WITH SPECIAL REFERENCE TO THE CARREL-DAKIN METHOD OF TREATMENT.

BY

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The following is written from notes made by me during the period of seven and a half months when I acted as officer in command of a surgical division of a general hospital at a port of embarkation. The situation of the hospital made it necessary that a certain number of beds should be left in reserve for cases from ambulance trains and ambulance transports when from any cause cross-channel traffic was held up.

Cases admitted had been treated by various of the methods advocated.

1. *Flavine*.—A number admitted from casualty clearing stations had been treated by flavine and Z paste, and had been kept by the casualty clearing station for a period of from six to ten days. The results were exceptionally satisfactory. The wounds in nearly all were closed; in some the sutures had been removed, in others the sutures were removed in this hospital. Only two showed signs of inflammation; one of these was a case of very severe multiple wounds, which would account for the incomplete operation performed. Where the patient can be kept under observation and an early and complete operation performed, this seems an ideal method of treatment.

2. *Bipp* cases did not arrive in the same satisfactory condition; most of them were thoroughly septic. In my practice, with two exceptions, Bipp was used only as a sequel to the Carrel-Dakin method when the wound surface had become flat or too small for the application of Carrel's tubes. In the latter part of the period it was replaced by chloramine 4 per cent. in vaseline.

3. *Salt pack* cases arrived bathed in foul-smelling discharge; gas gangrene cases arrived with this dressing. Salt dressings were continued for a short time by one surgeon. *Bacillus pyocyaneus* was a constant complication, and the haemorrhagic granulations were a constant drain on the patient's vitality.

4. *Carrel-Dakin Method*.—Cases so treated invariably arrived in good condition, and if the complete operation had been performed and the technique strictly carried out, it was often difficult to realize that the patient was suffering from a dangerous wound.

An officer arrived after a very long train journey, sitting up on his stretcher, looking quite fit. Ten days previously he had been hit in the right lumbar region by a piece of shell casing 2 in. x 1 in.; there had been a jagged wound and rupture of the colon. Operation within twelve hours; the foreign body and fragments of clothing were removed, the lacerated muscles and fascia excised, and the rent in the colon closed. Carrel-Dakin dressings. On admission, the temperature was normal; there was one Carrel tube in the superficial wound, the remainder was closed and healed.

The Carrel-Dakin method gave the greatest satisfaction to me and was carried out thoroughly with the following technique:

Technique.

X-ray photographs accompanied the patient to the theatre. Ether soap, followed by methylated spirit and 2 per cent. iodine, were used to disinfect the skin. Free incisions were made exposing all injured structures and opening up dead spaces; the foreign bodies present were removed, and fragments of clothing looked for; all dead tissues, fascia, muscle, and fragments of bone without periosteal attachment to the shaft were excised, and all bleeding and oozing were controlled. Carrel's tubes were then placed in every part of the wound so as to ensure flow of