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

MAJOR J. S. DUNNE, D.S.O., F.R.C.S.I., R.A.M.C.

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

antiseptic towards the surface. Gauze soaked in Dakin's solution was placed lightly on the tubes. The adjacent skin surface was spread with gauze soaked in sterilized vaseline; the dressing was completed by applying a large Carrel dressing held in place by wooden clothes-line pegs. When the general condition of the patient made speed imperative, and the local conditions made complete operation dangerous, the injured part was rapidly explored, and incisions made to allow the Carrel tubes to reach the depth of the wound. This plan was so satisfactory that a second and complete operation could be performed without danger of septic absorption. The surgeon, assisted by a sister, nurse, and orderly—no more than he has for any other method—could carry out the after-dressings. The same preparations and precautions were used as for an aseptic operation as far as sterilization of dressings, instruments, and gloves is implied. The gloved hands were never permitted to touch the dressings. With each of the team doing his or her allotted part, ten large dressings could be accomplished in an hour. Sisters soon became expert, and taking the place of the surgeon, could carry out the dressings with success, the only difference being that the time occupied for each dressing was perhaps a little longer.

Bacteria counts were very efficiently carried out by a V.A.D. nurse trained in the work. The results were charted. Variations in the curve led to scrutiny of the technique, and delay in rapid improvement led one to suspect errors in technique, such as insufficient opening up of tracks, or, in comminuted fractures, necrosis of a doubtful fragment, or tubes badly placed.

Results.

Of 1,917 admissions, with 1,100 operations, there were 40 deaths. Many of these were admitted moribund from trains or hospital ships, and included 3 cases of tetanus, 2 of gas gangrene, 5 fractured femurs, and 2 unoperable neck wounds, 4 knee cases septicæmic on admission, 1 of secondary hæmorrhage which developed gangrene after necessary ligation of the femoral artery, 2 buttock cases—one of these had longitudinal fracture of the neck of the femur with infection of the hip-joint—and many severe head injuries.

The success of the Carrel-Dakin method was obvious from the first. Secondary hæmorrhage practically completely disappeared. There were three hæmorrhages; two were reactionary, the third was a true secondary hæmorrhage from an external saphenous vein, and was easily controlled without anaesthetic. The patients were cheerful and happy; dressings were not dreaded, and the nursing staff were pleased with the rapid convalescence of their charges.

Immobilization of Fractures.

The splints most in favour were Thomas's arm and leg, with or without superstructure; special splints were also obtained. At the end of the period under review, two officers who made a special study of constructing splints for individual cases were attached. I had not an opportunity of seeing splints for femurs, but their arm and lower leg splints were excellent. Compound fractures, both upper and lower arm, were amongst the up-patients very soon after admission; their apparatus, combined with the Carrel-Dakin technique, gave very good results. The large Carrel dressings are supplied to this hospital by the Irish War Hospital Supply Dépôt, Merrion Square, Dublin.

Carrel's method of instilling a potent antiseptic is both a life and a limb saving technique. Cases which arrived with the treatment in progress, even though the tubes might have been displaced in transit and a further operation proved necessary, could be approached without anxiety. In some other cases I would have amputated without hesitation as the only means of saving life but for this method.

Secondary hæmorrhages need never occur if the technique is faithfully carried out. The method goes as nearly to giving complete physiological rest as is possible. Dressings need only be done every forty-eight hours, except in very septic cases, and there is none of that terrible nerve racking which other dressings entail. Patients watch the progressive improvement of their wounds with the greatest interest. In the Carrel-Dakin technique we have physiological rest reinforced by the scientific destruction of the local poison.

General Surgery.

During the period there were 481 major operations of a general surgical nature.

Appendicitis.—Of these operations, 103 were for appendix conditions, with 98 per cent. recovery. The incision recommended by Battle was used in 95 per cent. I modified it slightly by carrying the incision lower than recommended; by this I left the semilunar fold intact. Jackson's parieto-colic membrane

was found in two cases, Lane's bands in three. Two deaths occurred. The first patient was almost moribund from general peritonitis at the time of operation. The second, a Portuguese soldier, with gangrenous appendix involving the caput caeci, died from obstruction due to volvulus caused by a mass of faeces the size of a large orange. A case of appendix abscess was treated by drop irrigation with Dakin's solution, six or eight drops to the minute. The abscess cavity closed with extraordinary rapidity, and cases of faecal fistula yielded in a surprisingly short time.

Enteric Ulcer.—Two cases. One died a month after operation from intercurrent acute general tuberculosis, the other was transferred to England convalescent.

Acute Renal Cases.—Perinephric abscess, two; operation, recovery. Hydro-pyonephrosis, one operation; died.

Acute Cholecystitis.—One case. Operation in two stages: (1) Drainage; (2) excision of gall bladder. A pure culture of paratyphoid bacillus was grown from the contents of the gall bladder, though there was no history of this disease. He was transferred to England convalescent.

Gastric Ulcer.—One case, a Spanish sailor. The ulcer was closed, and gastro-duodenostomy performed. He was transferred convalescent.

In the work of a large hospital the best results are obtained not by the work of the officer in charge alone, but require in addition the zealous and enthusiastic co-operation of all the staff. I wish to express my thanks in particular to Captain Bourne, F.R.C.S., and to the Sisters, whose careful attention to detail largely contributed to the success obtained in the use of the Carrel-Dakin method.

[Owing to want of space we have omitted reports of a number of cases, the course of which illustrated the excellent results described by Major Dunne as generally obtained.]

INFECTED FRACTURES:

TWO CASES TREATED BY LANE'S PLATES AND
CARREL DRESSING.

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In the last ten months I have had over 500 cases of infected gunshot wounds, many with profound bone lesions, under my care at this hospital, and nothing but Carrel's method has been used. The results have been invariably successful; healing has been rapid, and in only two very badly infected cases have I seen secondary hæmorrhage, and that only in the early stages of treatment. The charge that cases break down after apparent healing and evacuation from hospital is one that can be brought against any method of treatment. If the preliminary *débridement* has not been thorough, the surgeon will find cases breaking down; but it is not the method that is here to blame—it is the surgeon. Besides, a superficial breach of the surface of a scar of a wound treated by the Carrel method frequently ensues when massage and thermal baths are used for the stiffened joints and muscles that accompany the wound. This, again, might occur with any method of wound healing. The breaking down in any case is usually only superficial and slight compared with the great gaping wounds so wonderfully built up again by the aid of the Dakin solution.

I need not describe the method here; that is best to be found in Carrel's own book or Child's translation.¹ But it is better learnt from practice than from books. See someone who has mastered its use at work and then work at it yourself. It is not difficult, but a certain facility and sense of perspective can only come from practice, and are not to be got from precept.

One thing is of prime importance—the preparation of the Dakin solution according to Carrel's instructions. Failure usually comes from use of a faultily made solution, or from use of a carefully prepared solution which has been kept over-long and has deteriorated. In fact, the surgeon himself should be familiar with the process by which the estimation of the percentage of hypochlorous acid in the solution is made, and check this percentage for himself. If he does this he will have a proper strength of solution; if not, he may have a proper strength or he may not, and he must take the consequences in risks of failure. Nothing much can go wrong if the surgeon will spend five minutes twice weekly at the titration of his Dakin's solution. We have found that the best chloride of lime and other chemicals necessary for Carrel treatment are