local signs, it struck us in the light of a phenomenon, until the same pressure was employed in an acute case, when the stimulating effects of negative pressure became rather too evident. In this case patient had complained of pain; nevertheless, in a few hours the wound opening, previously pouring pus, was found filled with lymph and blood; there was improvement in general appearance, less swelling and tenderness, and yet temperature was elevated. We then came to look upon this rise of temperature as being of a reactionary nature and consequent upon pouring out of lymph and extravasation of blood, with their content of ferments, into cavity of wound. We have been led, therefore, to consider it of kindred nature to the aseptic fever following operations and accidents.

In very acute cases minus pressure may be greatly reduced or even abolished until the more urgent symptoms subside. To measure its amount with accuracy we use the barrel of an ordinary 3 oz. glass

FIG. 5.

syringe, attached to reservoir stand by sliding collar, and so adjustable to any level. (Fig. 5.) The outflow tube arising from the device is made to empty into glass barrel, whilst length of tubing attached to syringe nozzle leads into waste-pail. The depth of pendant column of fluid upon which negative pressure depends is in this way varied as desired.

In cases with much swelling it may be necessary as this disappears to readjust bandage. Sometimes subsidence of swelling is remarkably rapid, in which event the bandage may become loose and device thereby allowed to rise from skin.

Alternations of Pressure.

The variations between positive and negative pressures are accommodated, as regards duration, to particular features of the case.

At commencement, and until effluent becomes fairly clear, the alternations should be of about 15 minutes each, or 15 minutes positive and 5 to 10 minutes negative. After this, positive pressure is prolonged to half-an-hour or so and duration of negative adapted to type of wound, being long in chronic and short in acute cases. As a general rule the duration of negative pressure should not exceed 20 minutes and never be long enough to produce pain. These alternations may be regulated by patient during waking hours and, for convenience,

the periods of positive pressure may be prolonged during night and duration of negative be just sufficient to freshen solution in wound (about 10 seconds).

A wound with counter-opening should be treated by application of two devices. The device covering main wound should have its outflow tube occluded by short length of glass rod for course of case. The device covering counter-opening should have its inflow occluded in same way. Thus through-and-through circulation of fluid is provided for. It will be convenient to have devices for application to counter-openings made much smaller and furnished with outflow tube only. This application of the method is particularly useful in the drainage of joints.

In employment of device in empyema, positive pressure should be very low and its periods be of short duration. The negative pressure exerted in intervals should equal that of normal pleural cavity—i.e., about a 3-inch column of water. To what extent this may be increased to encourage lung expansion we do not know, but as much as 12 inches has been used without ill-effects. The device should be bandaged to chest during expiration.

After irrigation with hypertonic saline has been in operation 4 to 10 days—according to severity of infection—we are in the habit of removing device for two or three hours. If no pus appears, clear lymph and blood alone occupying mouth of wound, the device is reapplied and irrigation continued with an antiseptic solution for 48 hours, our idea being to effect a final sterilisation. Latterly we have been using a 1 in 5000 solution of flavine in hypertonic saline.

Results.

Certain phenomena have been observed to follow so constantly the employment of this method of irrigation that we are able now to predict their appearance. Though our investigations as yet have been largely confined to stubborn old sinuses, and not to recent wounds, this form of irrigation has on many occasions been instituted at the time of an acute flare-up. We have not, it is true, an imposing array of cases as regards number, but our results have been of a very positive nature. We do not propose to weary our readers with individual instances, but shall wait until our series is compiled for presentation in tabulated form. The results which we have observed may be epitomised as follows:—

1. Rapid softening of indurated tissues and return to normal colour.
2. Disappearance, often within 24 hours, of swelling.
3. Profuse discharge of pus for first 12 hours, and rapid diminution afterwards, the secretion becoming sero-purulent, then lymphoid in character.
4. On an average, in chronic cases, the wound is cleansed of pus in 36 hours—i.e., pus is removed as soon as formed.
5. Granulations become bright in colour and bleed more readily. After four or five days if device be removed an old chronic sinus usually fills up with lymph and blood.

6. The almost instant relief from boring pain which may have worried patient for months.

7. The improvement in general health and morale of patient incident to these local changes is often remarkable.

[A long section¹ on rationale has been omitted owing to lack of space. The use of the device in dressing-stations and ambulance-trains was then advocated, the question being considered chiefly from the view-points of time and expense. The method was here regarded merely as a portable wound-bath which becomes part and parcel of the patient during transportation, and to this end a convenience, but in a place and at a time when such a convenience means much. Both tubes leading from the main chamber might then be tied off and the patient evacuated, the fluid to be drained away and replaced by fresh at the next stop without so much as undoing the bandage. The authors believe that the difference in time required would be slight. "If at the main dressing station supplying some one casualty clearing station in France this method should be tried in that one grave type of wound to which it seems particularly applicable—we refer to compound fracture of the femur—we believe the results would furnish a surprise."]

Summary.

The following advantages, it is believed, are associated with this plan of treatment:—

1. Penetration of fluid to, and tidal evacuation of, distant loculi, resulting in thorough mechanical cleansing of wound cavity.
2. Establishment during negative pressure of outward flow of lymph with, presumably, its quota of bacteria.
3. Avoidance of large mutilating incisions required for evacuation of deep pockets and insertion of fluid-conducting tubes.
4. The concentration of antiseptic or hypertonic fluid remains constant, since, the freedom of its delivery into the wound being unrestricted, the solution can be frequently renewed.
5. The ease with which the beneficial effects of heat in interior of wound may be secured.
6. Elimination to a large extent of personal equation.
7. Ensurance of dry beds and sense of comfort to patient, who is enabled in many instances to be out of bed whilst undergoing treatment.
8. Economy in time, effort, and material.
9. Presumed adaptability of its use to dressing stations and ambulance trains.

This, then, is the substance of our brief for the mechanical cleansing of wounds. Whether the method be looked at from the therapeutic view-point, irrespective of its palpable convenience, or whether it be regarded as a convenience only, yet one which would render the bath treatment of wounds possible near the firing-line and during transportation, the implication surely is that this measure should be tried.

ON BLADDER DRAINAGE AND IRRIGATION.

BY JAMES MACMUNN, M.R.C.S., M.R.C.P.I.

MANY cases of cystitis thought incurable are amenable to constant antiseptic and astringent irrigation and efficient drainage. Cases of prostatectomy are lost on account of the "two-stage" procedure not being adopted, and also through defective after-drainage. When doubt exists about doing prostatectomy, preliminary drainage will likely decide. If the patient survive the minor operation he will likely survive the major; whereas he might have succumbed to the combined operation. Even drainage of itself is at first a load to weak kidneys, as shown by blood, urea, and urine tests. But readjustment, as a rule, soon sets in.

Description of Instruments.

The means taken to prevent urine leaking from bladder wound into cellular tissue I consider most defective, a view emphasised by the loss of one valuable life.

Fig. I. is a trocar, which in use is kept in place by the index finger pressing on A whilst the hand holds the semi-cannula. When the bladder is punctured the trocar is removed, and the notch B catches in edge of wound and holds bladder up, whilst a rubber tube C (Fig. II.), stretched on mandrel D, is introduced. The end of rubber tube is cut V-shape on each side; apices of V are transfixed and tied at E. The mandrel impinges against suture; tube is stretched to about half normal size and then fixed by clamp F. This clamp is unscrewed after insertion of tube and semi-cannula into bladder, and after removal of

¹ This section appears at length in the April number of the official Bulletin of the Canadian Army Medical Corps.

trocár and cannula, the tube resumes its normal size, tightly corking the opening in bladder.

The other instrument (Fig. III.) is used after suprapubic prostatectomy.

It is a large metal tube—made for me by the Holborn Instrument Company—with arms for ingress of flushing fluids and egress of urine. A is a rubber cork, B a removable slide dividing main stem into two channels when required. The wall of bladder wound is bound into a groove by suture. Perfect dryness, perfect drainage, and, when required, perfect irrigation are secured.

In either instrument, a siphon or pump is attached to one arm (a T-piece being inserted into rubber tube of the first) and a valveless Higginson's syringe placed in circuit, so that in any blockage or inactivity pressure on bulb rights it.

I usually make the wound in the bladder correspond to size of tube—best done with a broad knife whose width is less than half the circumference of the tube. U-shaped pieces cut from the ends of drainage-tubes prevent tubes sticking to bladder, should they—which they should not do—come in contact with bladder floor.

An extemporary rubber apparatus like the T-shaped one, or one to act like it, may be made in a few minutes. A large rubber tube is transversely grooved by a red-hot round piece of iron—such as a knife-sharpener. A hole is bored by top of iron $\frac{3}{8}$ inch from tube top, and another a little below on opposite side. Through one hole a smaller tube is tightly inserted and stitched into main tube. Into the other perforation a thick rubber catheter is passed as far as end of main tube; the top of latter is corked. The catheter is fitted to the irrigating supply, the other arm is the egress tube. Everything is watertight.

Perineal drainage is best done by the same means; here, however, the holes are bored more obliquely. Such a means of drainage should have other uses, abdominal drainage, &c.

Other Points.

I usually suture the parietal tissues with silver wire softened in a flame. Silver is inimical to micro-organisms, and allows of closure of wounds without the circular constriction of other sutures. A large hypodermic needle, through which the wire is passed after wound is transfixed by needle, is a good dodge.

Drainage per urethram should be more effective than it is. Here, too, though more difficult to accomplish, a double channel may be used for irrigation and drainage. Any rubber catheter can be made double-channelled by inserting a small gum-elastic catheter through it. A rubber catheter can be made self-retaining by passing a short piece of rubber through two oblique holes at its vesical end and secured by a stitch. This is a substitute for Pezzer's. A patient of mine wore one like this for years, going about his business. It is wonderful how tolerant the tissues sometimes get.

Bladder-irrigating fluids should have a constant temperature—if to check hæmorrhage about 125° F.

Renal suppression is greatly prevented by well-arranged hot irrigation. So are ordinary shock, blood-clotting, and sepsis.

It is futile to try to keep up a steady temperature in the ordinary way. A good way is:—

Two holes are bored in, say, a tin kettle; a metal tube is pushed through and soldered in. One end of tube is connected with rubber supply tube, the other with tube attached to the bladder. A thermometer, spirit-lamp or gas-jet do the rest; or more simply still, the supply-tube is coiled in the heated water.

Men accustomed to large "residual" often, as is known, die when this residual is too suddenly removed. It is not so well borne in mind that for a few days after prostatectomy intravesical tension is also a thing to consider.

Finsbury Pavement, E.C.

FISTULA IN ANO.

WHY IS OPERATIVE INTERFERENCE SO OFTEN INEFFECTUAL?

BY F. SWINFORD EDWARDS, F.R.C.S.,

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PERHAPS I may surprise a good many of my professional brethren by suggesting that operation often fails to cure excepting in the simpler forms of fistula. The experience gained after many years of work at St. Mark's Hospital and in private practice leads me to affirm that such, unfortunately, is indeed the case. Some three years ago I saw three patients within ten days in consultation. The first had suffered from fistula for 20 years and had undergone many operations, the last being eight weeks previously. The second had an unhealed wound, with discharge of pus after the sixth operation, and the third was in the same condition after the second operation carried out two months before. They had all been under hospital surgeons of repute and were all suffering from some variety of what is known as "horseshoe" fistula. I operated myself on the first two with complete success, and in the third case a like result followed after I had pointed out to the surgeon the nature of the lesion and the necessary incisions for a cure.

In hospital practice hardly a week passes that I am not called upon to operate on a case which has undergone operation in another hospital, and this not only in vain but with a cicatrix showing that the sphincter had been divided, rendering any further division liable to result in some amount of incontinence.

Causes of Failure: Varieties of Fistula.

In my opinion the causes of these failures are due to one of three reasons. First and foremost, the topography of the fistula is not thoroughly recognised, and thus a part of the fistula's track escapes division. Secondly, caries of the coccyx, or even of the ischium, is a not infrequent cause of a persisting fistula, and unless this is discovered and dealt with a cure is impossible. Thirdly, tubercle; but although a certain small proportion of fistulæ are tuberculous, it is astonishing how readily healing takes place after operation in the majority. When it does not the operation wound remains open and gaping, but the fistula as such may no longer exist.

I propose to limit my remarks in this communication to the first cause of failure.

Let me take a case of complete fistula—i.e., one having both an external and an internal orifice. An external orifice bears a definite relation to the internal, as was pointed out many years ago by my late colleague, Mr. D. H. Goodsall. He affirmed that if a line is drawn transversely across the centre of the anus, external openings anterior to this plane will usually have their openings in the gut immediately opposite, and such fistulæ are therefore straight and simple; but, on the other hand, where the external opening is behind this transverse plane, the internal opening will usually be found in the mid-line dorsally and between the two sphincters. Hence the fistula runs backwards and not towards the gut at first, but to a point behind the gut, whence it runs straight in from behind forwards. In this way the fistula is more or less curved, sometimes even being bent to an acute angle, depending on the situation of the external orifice. In most cases of fistula, especially when of long standing, there is some amount of induration about the track, which can readily be felt by compressing the part between a finger in the bowel and the thumb outside. In this way the direction of the track can often be ascertained and the diagnosis of a straight or curved fistula verified. I have called this variety the "semi-horseshoe," and it is more frequently met with than the "horseshoe," which is merely a "semi-horseshoe" on both sides.

It is said that there is no rule without an exception, and such is the case here, for one sometimes meets with an external opening in the mid-line posterior to the anus and not far from it, the track of the fistula running straight into the anus but below the sphincter—i.e., superficial to it. It is a subcutaneous track and will be found due to a posterior fissure, and both lesions can be treated by a simple division. Again, as touching those external openings which are situate anterior to the above-mentioned transverse plane, although it is true that they are generally simple and straight