

ANNALS *of* SURGERY

VOL. LXXV

APRIL, 1922

No. 4

DRAINAGE*

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As far as the drainage of wounds of the muscle planes is concerned the practice, as generally carried out, seems to be satisfactory and does not call for much improvement. During the war, the importance of dependent drainage was emphasized by our experience with gunshot injuries, but we also found that drainage was not necessary when there was no dead or necrotic tissue in the wound. It is well to bear this last fact in mind, for it is also true in infections of the body cavities and viscera. I am now speaking of drainage in the sense of employing tubes or other materials to produce it, or rather continue it; for we should make a distinction between an incision used merely to evacuate a cavity of the products of inflammation and perhaps allow these products to escape for a short time, and drainage continued for a longer period by means of drains. I shall use the term evacuation for the former and reserve drainage for the latter procedure. An illustration of the needlessness and, as I shall show later, the actual harm of drainage when there is no necrotic tissue remaining, occurs in the treatment of peritonitis. I called attention to this in 1903-04 † and at that time showed a marked difference in mortality in favor of non-drainage between drained and undrained cases of bad diffuse peritonitis. It is only fair to state that the high mortality followed introduction of drains through multiple incisions and also much handling of the viscera; yet subsequent experience demonstrated that the drains themselves by pressure and foreign body irritation, or presence, or whatever you may call it, kept up a peritonitis which otherwise would have subsided. At that time I made the rule that drains into the peritoneal cavity were unnecessary when, after elimination of the cause of a peritonitis, there was no great difference in the appearance of one part of the peritoneum from another. Thus, in an ordinary diffuse peritonitis no matter how bad the peritonitis, drainage was unnecessary, but in a localized peritonitis, as, for example, an abscess, drains should be used.

The same principle of non-drainage in diffuse infections without local

* Read at a joint meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, November 7, 1921.

† Treatment of the Peritoneum in Diffuse Peritonitis, *ANNALS OF SURGERY*, August, 1903. The Treatment of Diffuse Peritonitis, *New York Medical Journal and Philadelphia Medical Journal*, November, 1904.

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necrosis was found to hold true during the war in the treatment of infections of the joints. Early in the war I found that drains traversing the joints were fatal to the joint, and my results were greatly improved by using short drains which only entered the joint. Later on we all were struck with the remarkable results obtained by Wilms, who did not use drains at all, but after opening them relied on active motions of the joints for the prevention of accumulation.

In the treatment of empyema we have not as yet been able to demonstrate in so forceful a manner that drainage tubes are detrimental, yet I believe, if we could only insure some other method of keeping the wound in the thoracic wall patent, that much better results could be obtained than by the use of tubes. The nearest I have been able to get to this ideal is by the use of very short tubes; tubes just long enough to keep the pleural cavity empty. These tubes may be removed usually in four or five days, namely, as soon as the drainage tract is established; and in most cases the cavity is closed and the condition cured in ten to twelve days. On the other hand, if tubes traverse the cavity and are left in for longer periods, no matter whether they are slender Carrel tubes or tubes as big as one's thumb, they establish the infection which often becomes mixed in character and cause a more or less chronic sinus.

As I say, it would be better to leave tubes out if we could; but, in order to drain efficiently, the opening should be made just at the upper line of the costo-phrenic sinus, and if continued drainage is needed something must be introduced to prevent the diaphragm closing the opening. In some cases of empyema in which resistance to the infection was obviously active and in which there was extensive fibrinous exudate I have cleaned out the latter by hand through a large incision, and dispensed with drains and obtained immediate resolution.

There is no doubt but that evacuation of the products of infection by simple incision will suffice in many cases of empyema. It only remains to be able to select or rather recognize such cases. It is difficult to lay down rules by which such cases may be distinguished, but I believe it is safe to dispense with tubes if after evacuation no visible foreign material such as adherent fibrin remains. In such cases the secretions forming in the pleura will be serous in character and will escape through the incision, which should not be entirely closed by suture. In two or three days there will be no secretion and no drainage unless foreign materials such as drains are left in the chest. In other words, repair in the pleural cavity does not differ essentially from repair in a joint or the peritoneal cavity.

There is another class of drainage cases in which the question again arises as to whether the drainage we customarily employ is not detrimental in a similar way. I refer to drainage of the common bile duct in cases of cholangitis and more particularly when drainage is to be employed temporarily as is the case in the great majority. The usual manner in which drainage is accomplished is by introducing a tube into the duct. The tube may pass upward into the hepatic duct, or it may be a T tube, one limb of the T lying

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in the hepaticus and one in the choledochus. The question is, should we, in view of our knowledge of the harmful effects of drainage tubes in prolonging and establishing infection, introduce tubes into the duct? Would it not be better to simply drain to the opening we have left in the duct? Closing of the opening in the duct thus dispensing with drainage has already been recommended and practiced; but when one has traumatized the duct, particularly if in the region of the papilla, or when pus is flowing from it, one hesitates to close it. An objection to draining only to the opening in the duct is that the bile flows into the peritoneal cavity before entering the drainage tube. This does not seem to matter, for we find it escapes around the tube even when the tube is introduced into the duct. When I have drained to the opening in the duct and not into the duct, it is my impression that the discharge has cleared more quickly with less suppuration and has ceased in a few days instead of often as many weeks.

There is another class of cases in which drainage of the viscus is not practiced frequently enough. I refer more particularly to cases of advanced peritonitis with paralytic ileus. How often the peritoneal cavity has been drained when unnecessary and the patient has died of ileus, often caused, it is true, by the drains in the peritoneum, but more often by toxic paralysis of the muscularis or a combination of paralysis and tubes. Most of us have saved patients by a secondary ileostomy. My plea is that it should more often be a primary operation. Not that it should be done in every case, but that it should be done more often. It is very easy. A soft catheter stitched with catgut to the margins of a small opening in the lower part of the ileum and then the wall inverted with a couple of purse-strings so that the stoma will close when the catheter is withdrawn is all that is necessary. The catheter may be withdrawn with safety after two or more days when the catgut stitch has loosened. There is no need of a Paul's tube or any other such formality. I have brought the catheter out of a buttonhole incision in the linea alba when I wished to close the operation wound completely.

There is still another type of drainage to which I shall apply the term *precautionary*; namely, drainage, which is used to prevent accumulation of wound secretions, or infection in case of visceral leaks. I have little or nothing to say of precautionary drainage of ordinary wounds to prevent accumulation of serum or blood, for I believe that the rules for this are sufficiently definite. Of course every surgeon of experience establishes his own, although the question is often debatable as to whether one should drain or not. As a protection against peritonitis caused by leaks there are two operations in which surgeons differ and in regard to which there is a grand opportunity for discussion. These two operations are cholecystectomy and resections of the colon. I believe a drain does no harm in these cases and will save lives. Gauze should not be used. A slip of rubber dam is sufficient. All that is necessary is a lead along which discharges may escape.

If retroperitoneal spaces are opened, and particularly if large as in retroperitoneal ureterotomy, drainage must be employed.

Before closing I must say a word about the materials used to produce drainage. In the first place, gauze is commonly employed, but never should be for drainage alone. Gauze is extremely useful as a packing in certain classes of wounds but is not a good drain and may be exceedingly injurious. In the first place gauze is an effective filter and consequently while the serous secretions may escape through it, it acts as a dam to the solid necrotic portions which form the food upon which bacteria grow. Gauze has been a woeful cause of death when used in gunshot wounds and in the peritoneal cavity. It has plugged up the secretions in one and acted as an irritant and cause of obstruction in the other. The indications for its use are, first, as a pressure hæmostat, and, second, to prevent the soft parts falling into cavities during the early stages of repair such as are formed in excision of joints or other operations upon bones. Except when used as a hæmostat it should be separated from the wound surfaces by rubber or other non-adhering material.

Rubber tubing is the material most commonly used for drainage, but is more often used than is necessary. The true indication is when large quantities of material, and particularly solid material, are to be evacuated. Thus we use tubing with reason when we drain the urinary bladder, the gall-bladder or ducts, or the intestines, and also when we drain wounds in which there is solid necrotic material which has to be evacuated by irrigating through the tubes. For these latter cases, the tubes should be large, for otherwise they may become blocked. When large it is very important for them to be soft as otherwise they may be dangerous through causing pressure necrosis. I shall never forget the sensational report by one of our members of a case of ligation of both iliac arteries because of hemorrhage produced by the pressure of drainage tubes used after a double ureterotomy for calculi. If solid matter does not have to be evacuated there is much to be said in favor of a number of small tubes such as the Carrel tubes, for they are not so likely to cause disagreeable pressure effects and they permit the use of irrigations. Also as the holes in tubes are usually blocked by the soft tissues, Chaput is probably correct in his belief that drainage takes place alongside of and about rather than through tubes. However, even if we agree with him thus far, we should not necessarily go to the point of believing that a bunch of silkworm gut is better for all conditions than a tube because there is more superficies to the many strands of gut than to the single tube. For precautionary drainage silkworm gut and folded rubber dam are excellent, for they do not produce pressure necrosis, they efficiently drain off fluid secretions and also form a sufficient lead along which larger drains may be inserted if developments demand them.