

ABDOMINAL DRAINAGE.

BY

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DRAINAGE of wounds is a subject that has received careful consideration during many centuries. It may be said to be as old as the hills, for do we not find in the earliest medical writings mention of lead and brass tubes having been used to drain both the pleural and abdominal cavities?

When to drain and when not to drain, how to drain and where to drain, how long to drain, and whether to drain at all, and what is the most desirable drainage material? These are questions which are by no means settled at the present day. The subject of drainage still continues to be in a state of evolution.

We must admit that gravity is the most important aid to drainage and that next in importance is capillary attraction procured by a tube or gauze, or both. The absorptive power of the peritoneum is least in the pelvis and gradually increases upward until it is greatest at the diaphragm. It was at one time advocated that we elevate the foot of the bed to cause the flow of infective material toward the diaphragm, where it would become more rapidly absorbed and eliminated. It was then found that the patient might become overwhelmed with the amount of toxins absorbed. Later, upon Fowler's recommendation, gravity was again called into play and we raised the head of the bed and even placed the patient in a sitting posture.

Most of us remember the glass tube placed through the lower angle of the abdominal wound and into the pelvis, at the close of nearly every abdominal section, and the glass syringe with a rubber tube attached which was used at frequent intervals to remove the fluid which accumulated in the glass drainage tube. After some years it was found that infection of the peritoneum occurred, at times, through the use of the drainage tube and syringe. Also, ventral hernia at the site of the drainage opening was a not infrequent aftermath. Now the glass drainage tube is seldom seen in the surgeons armamentarium, as we soon learned that the peritoneum was capable of taking care of a considerable amount of toxic material.

There is a growing tendency to drain less and less. Recently some surgeons notab'y Dameron, Wallace and Adams have advocated closing the abdomen without drainage, after removing a gangrenous appendix with free pus in the peritoneal cavity. These methods to me seem too extreme.

Infection of the abdominal structures, especially the fat and fascia, is likely to occur and may require drainage. Owing to the adhesions which rapidly form around the drainage tubes, their value is limited in the treatment of peritoneal infection; for since the tissues of the abdominal wall possess a much lower degree of resistance than the peritoneum, drainage of the former may frequently be called for where drainage of the peritoneal cavity is not necessary. The presence and pressure of a drainage tube in the peritoneum adjacent to covering the bowel, may determine the transudation of organisms from the lumen of the gut to the peritoneal cavity.

No one now thinks of draining the pelvis following the removal of the uterus, tubes or ovaries; unless there are unremovable bacteria; capillary hemorrhage, requiring packing with gauze, or injury to the ureter, bladder or rectum. We do not now drain where clean blood is found in the peritoneal cavity following injury or ruptured tubal pregnancy. The peritoneum has shown itself amply able to care for this extravasated blood as well as normal bile or urine which may have entered the abdominal cavity.

The ancient dictum of *ubi pus ubi evacuatio*, still holds good with reference to pus in or about the abdominal viscera.

Our countryman, the celebrated Dr. Peaslee, as early as 1855, drained the pelvic cavity by making an opening through the vagina posterior to the cervix into Douglas' culdesac.

We can aid gravity by the use of a soft rubber drainage tube or a wick of gauze, but intraabdominal pressure also assists the flow of fluids into the vagina. This intraabdominal pressure, I believe, is an important factor in forcing fluids through our drainage wounds.

The materials in use at the present day are soft rubber tubing, gauze wicks, cigarette drains, made of gauze covered with soft sheet rubber tissue, or a rubber tube cut spirally with a gauze strip drawn through its lumen. The number and the type of drains to be used, their location and the length of time they are to remain, vary with one's experience and judgment.

Should it be deemed necessary during an abdominal operation to drain the pelvis through the vagina, the drainage tube, or gauze or both, should be passed from the abdominal cavity through an

opening made from Douglas' pouch into the vagina and never from the vagina into the pelvic cavity. The vagina may be readily entered by lifting the uterus, thus making the uterosacral ligaments prominent and cutting with a knife, or scissors, close to the cervix between the uterosacral ligaments into the vagina.

Boveé suggests, in cases where the uterus has been removed, leaving a cervical stump, passing one blade of a scissors through the cervical canal and cutting the cervical stump posteriorly, thus entering the vagina.

The surgeon should never rely upon an instrument passed from below by an assistant, but make the opening from above as described, where there is no danger of injuring important structures. A case is on record where an assistant while endeavoring to place an instrument in the vagina, as a guide, to assist the surgeon in making an opening in the vagina from above, had passed the instrument, by mistake, into the rectum, and the gauze was drawn from the pelvis out through the rectum with a fatal result. In another instance the instrument was passed through the urethra and bladder, and the bladder was incised instead of the vagina.

The site of the incision made to open the abdominal cavity should be determined not only by the nature of the disease or seat of the tumor, but also with a due regard for a suitable place for drainage

Saline cathartics and the use of large quantities of water per rectum, flush the kidneys and bowels and thus remove toxic material. These are very potent adjuncts to external drainage.

Where shall we make our incision for removal of the appendix? While each case is a study in itself and no hard and fast rules should be laid down, yet we may mention our belief in the value of certain methods of procedure. Take a case of chronic appendicitis, interval operation, where we wish to examine the stomach, pylorus, duodenum, gall-bladder, as well as the uterus, tubes and ovaries, the vertical right rectus incision undoubtedly gives us the most desirable access to these parts.

The cases of acute appendicitis, however, present an entirely different problem. Most of these cases will require drainage whether the appendix is removed or not, hence the incision should be made in a location best adapted for adequate drainage and least likely to be followed by hernia. We know that drainage through a right rectus incision is frequently followed by hernia, hence I wish to emphasize the value of the McBurney or muscle separating incision, not only because by this method adequate drainage can usually

be obtained, but the abdominal wall is left in a more normal condition and hernia at the site of the drainage opening seldom occurs.

I am not in accord with those who say that the McBurney incision should not be selected when we find drainage necessary. I have time and time again proved that excellent drainage may be obtained through the McBurney incision. I firmly believe that the McBurney incision is the most desirable one in cases of acute appendicitis, whether we wish to drain or close the wound without drainage. The opening can be made sufficiently large so that we can remove the appendix, examine the uterus and both tubes and ovaries and allow us, if necessary, to remove the tubes and ovaries.

An examination of the pylorus, duodenum or gall-bladder should not be attempted in acute cases of appendicitis owing to the danger of spreading toxic material to other portions of the abdominal cavity. The low right rectus or median incision may be desirable where we feel that there is need of pelvic surgery as well as surgery of the appendix. These incisions may be closed throughout and drainage carried out by means of a drain inserted through a separate stab wound. Stab wound drainage is of distinct value and should be more often employed. We should remember, however, the fact pointed out by Coffey that a drain is efficacious only in proportion to the area of a transverse section at the point of construction.

Our cigarette drains at times not only do not drain but seriously interfere with drainage by plugging the wound and causing retention of secretions. This condition of affairs may be avoided by the use of the rubber drainage tube which keeps the edges of the wound apart and allows fluids to pass through the lumen of the tube. These tubes were more frequently employed in the past and with great benefit.

Drains are of value not only on account of their capillary action, but because they can be used to wall off and thus protect the uninvolved structures from the field of infection. They are of decided assistance in checking troublesome oozing when not readily accessible or when difficult to stop by ligature. A drain also aids in the formation of a sinus to the site of the infected area.

Formerly many cases of appendicitis were drained by making one opening in the right iliac region near the anterior-superior spine of the ilium and another in the loin and drawing a rubber tube through from one opening to the other, and I believe that this method may be used with advantage to-day in certain cases with large abscesses. Sometimes a yard or more of gauze was used to wall off the appen-

dicial region and even allowed to remain several days, requiring the administration of an anesthetic for its removal on several occasions.

Dr. Morris did yeoman service by ridiculing this procedure. He said these men who stuffed their patients with gauze were not surgeons, they were taxidermists. We all now realize that great injury may be done by using too much gauze. One or two cigarette drains are usually sufficient for adequate drainage following the removal of a gangrenous appendix. One drain should be placed at the site of the appendix, the other in the pelvis. They should be removed in one or two days and replaced by a rubber tissue drain.

A counteropening in the right loin is of value occasionally where large abscesses have formed and vaginal drainage is sometimes desirable where we have large collections of pus in the pelvis the result of appendicitis.

Drainage is carried out in cases of acute pancreatitis by placing drains in contact with the pancreas through openings made in the gastrocolic or gastrohepatic omentum. Certain cases may require incision into the pancreas. The region of the pancreas may also be reached through an incision in the back, in the left costoiliac space. This method of approach has been seldom used on account of the fear of injuring important blood-vessels.

A subdiaphragmatic abscess may be reached by an incision into the abdominal cavity made in the right eleventh costal interspace in the posterior axillary line. Certain cases may be best reached through a high right rectus incision. The transpleural operation, to reach a subdiaphragmatic abscess, is mentioned only to be avoided.

Drainage is the most important thing to be secured in disease of the biliary tract. How, then, is this best brought about? At one time we opened the gall-bladder and stitched the edges of the gall-bladder to the edges of the parietal peritoneum. While this method has been efficacious in some instances, it was found to be followed for some months by a pulling sensation at the site of the scar.

Many surgeons now pass a rubber drainage tube into the gall-bladder and close the opening about the tube with a purse-string suture of chromic gut, one end of this suture is then passed through the tube and tied, this holds the tube in place until the catgut dissolves, which is usually about the tenth day. A cigarette drain passed by the side of the gall-bladder to the cystic duct takes care of any oozing or secretion which may have run down the side of the gall-bladder during the operation. This drain can be removed on the second day and replaced by a rubber tissue drain from day to day as long as drainage is required.

The common duct can be drained by placing a small rubber catheter, the end of which has been removed and an opening made in its side about 1 inch from the end, through the common and hepatic ducts and into one of the branches of the hepatic duct. The opening in the side of the catheter is placed opposite the entrance of the other branch of the hepatic duct, one or two sutures are now used to fix the catheter in the opening in the common duct.

Drainage of the gall-bladder with a drainage tube and a cigarette drain to the common duct may be all that is necessary.

Should we drain our cases of tuberculous peritonitis or is it sufficient to open the abdomen and allow the fluids which have accumulated to escape and close the abdominal wound? I have seen a number of cases relieved and some cured by this latter method.

Drainage is most effective when we call to our assistance the forces of gravity, capillary attraction and siphonage.

CONCLUSIONS.

1. Drain when necessary, but only with suitable material and not for too long a time.
2. Aid elimination and assist drainage by large enemata of water and saline cathartics. The abdominal incision should be made with a due regard for drainage.

DISCUSSION.

DR. CHARLES W. MOOTS, Toledo.—I would disagree with the part of the paper that refers to making an incision with the idea of drainage. I consider it much better to make your incision with reference to removal of the pathology, and a thought of the anatomy of the parts, and consider drainage afterward. I am glad the author refers to the stab-wound drainage. For some time, even in gall-bladder drainage, I have been using a stab-wound away from the line of incision, and we find we get along very nicely. Therefore, I am decidedly in favor of getting drainage away from the line of incision if possible.

DR. ALBERT GOLDSPOHN, Chicago.—We must always bear in mind that the peritoneal surfaces very soon agglutinate together to shut out any foreign body, any tube, any gauze, any drain we may put in. When we introduce a tube they can do that very quickly. You may move the tube and it does not break down this new wall of agglutination that has been formed. If we introduce a gauze rope or something that will slip in easily, we will have the same thing occur. If we introduce gauze, there will be a fibrillary adhesion for the first day or two to the viscera and the serous surfaces, and it will

stick until enough time has elapsed, say some four or five days, until an exudate forms, and that causes the foreign body to become loose from the tissue. Therefore, gauze is superior to any smooth surface as a drain because capillary attraction will be really active, thoroughly active, for about forty-eight hours. Soon after that the fibers become saturated with fibrin or mucin, and it may be in danger of becoming a cork. We can disturb the agglutination between the gauze fibers, and the tissues and renew drainage thereby from day to day. By beginning to move strands of the gauze after forty-eight hours, we reestablish active drainage. Intraabdominal pressure assists capillary drainage to move the liquid uphill. Therefore, I want gauze drainage; but if we leave the incision in the abdomen so wide open that gauze will not be constricted and drainage not interfered with by constriction in the abdominal wall, then we will frequently have a hernia follow. I have overcome that difficulty in my practice with satisfaction by having an oval glass tube constructed that is only long enough to go through the abdominal wall and a little further, and has a lumina of from about $3/4$ to $1\ 1/4$ square inches, with a flange outside, so that it is practicable. I put the gauze or cigarette drain down through that tube. I do not care to have the gauze walled off by anything after it gets inside beyond the parietal peritoneum. The pain in pulling it out comes from contact with the parietal peritoneum, but the visceral peritoneum does not have much feeling, and the former we protect with the glass tube. If the drainage becomes inactive after forty-eight hours, I begin to pull enough to break up agglutination, and start up new drainage. I close the abdominal incision, all the layers of fascia and everything solid up against the tube from both ends of the wound, so that when the tube comes out the small wound collapses, and we practically never see any hernia.

DR. FRANK D. GRAY, Jersey City.—Gauze will drain water. Its fine capillarity is such that it will not drain a thicker fluid like pus; consequently the cases where we need drainage of pus are not to my mind provided for by gauze drainage. Where we need serous drainage, only, gauze is sufficient. In my opinion the most efficient abdominal drain ever devised was proposed by Peple, a surgeon of Richmond, Virginia, about three years ago. This drain is made by splitting a piece of rubber tubing longitudinally; inside of that is placed some folded rubber dam, so that you have from six to ten thicknesses longitudinally or lengthwise, sewing this to the posterior wall of the split tube by two or three interrupted sutures to keep it in place. You have a certain amount of capillarity that an empty tube does not possess, and yet you do not have the plugging quality of gauze. I have used this drain with great satisfaction for the last three years.

The question of when to drain was not touched on. We find cases of early appendicitis where there is apparently a purulent effusion in the peritoneal cavity, but this fluid in most cases is harmless. It is serum filled with leukocytes. It is, in all probability, sterile. These cases can be left without drainage. Late cases of

pus accumulation, like old pus tubes, are generally sterile and can be left without drainage. The mid-way cases are dangerous and we ought to drain them.

DR. EMERY MARVEL, Atlantic City.—With reference to the question of drainage, in cases in which it is desirable to drain, it is very essential to know how best to care for the material draining. Realizing that this discussion is being held in a meeting where diseases of women are mostly considered, I hope I am not presuming too much if I should trespass for a minute on the Association's time to present a little apparatus which has served me well in remedying a very difficult and annoying condition in connection with suprapubic cystotomy. Those of you who have done suprapubic cystotomy and prostatectomy know that there is excoriation of the skin of the scrotum and thighs where the urine comes in contact. This is especially true after the tube has been removed. In addition to that, it is disagreeable to the nursing staff who has to do with the bedding. In attempting to secure a means of overcoming this annoyance, I went to Lentz of Philadelphia and suggested a means whereby sufficient pressure upon the abdominal wall could be secured to prevent leakage, which pressure should be of such a nature that it would not be injurious to the skin of the abdominal wall. It should limit all fluid to its confines, and have a reservoir for collecting. We took the pneumatic collar of an Allison by inhaler which when inflated pressure over the suprapubic aperture can be attained. A metal cap with drainage was provided. The device is very simple and convenient and it can be strapped to the abdomen with suspender straps and can be held taut. The usual reservoir or urinal, is placed upon the leg into which the urine is collected. I want to recommend this device to you as being very useful. Where a patient is greatly distressed by urine trickling down the surface, this contrivance affords relief. In twenty-four hours the skin was dry and all irritation had disappeared in the case where I used it. It can be worn while the patient is in bed, standing or walking.

DR. J. HENRY CARSTENS, Detroit.—If my friend Dr. Goldspohn, of Chicago, had ever had a gauze drain in his abdomen, he probably would treat his cases a little differently than by establishing drainage by means of gauze, because if there is anything that hurts a patient it is to take that gauze out, and gauze absolutely stops drainage inside of twenty-four hours as we have demonstrated. It is not that you have to wait until it is loosened, which does not take place in a few days; it may take ten days sometimes, and still be adherent. Not only do you hurt the patient by pulling out the gauze you put in the abdominal cavity, but you *liberate some of the adhesions* that have been formed in the gauze, and these adhesions open the general peritoneal cavity and some of that virulent pus and toxins may get into the abdominal cavity. Every time you pull out some gauze the patient will have a severe attack of pain until Nature walls off the opening, and the next day you pull out some more gauze and there will be some more pain. There is nothing like a plain rubber tube for drainage, and you can use the smallest kind if you wish.

This brings up the question of the size of tubes to use. The nurse comes along with a tube $1\frac{1}{2}$ in diameter, and I say to her, "I am not a veterinary surgeon; I am not operating on elephants; I am an abdominal surgeon, and I want a small tube." I use a tube $\frac{1}{2}$ to 1 inch in diameter, and if necessary I put in two, but one is generally enough. I do not have it perforated because it so happens that once in a while I wish to wash out the bottom of the cavity, and if the tube goes to the bottom I can wash it out. What I would plead for is a simple, plain rubber tube for drainage purposes. You do not have to use it very often.

Reference was made to opening the vagina from above. I have had constructed a special perforator of the culdesac, and I can do that myself. I need not put my finger into the vagina; I do not like to do it when performing an abdominal operation. I can put that instrument in the vagina, I can feel with the other hand the posterior culdesac, and when it is in there I can perforate. Take hold of the rubber tube, and pull it down the vagina, and the whole thing is done.

Dr. Marvel has described and demonstrated an apparatus which he uses in cases of suprapubic cystotomy. When I do that operation I put in a little rubber tube, sew it up close so that nothing comes outside of the tube. To that tube I attach a small piece of glass tube, and then a longer tube that goes on the side, and as a result I have not a particle of leakage. I can watch the glass tube to see what is going on.

As I have said, I wish to make a plea for simplicity, in very very rare cases only is gauze of value. Let this miserable gauze business alone, as gauze causes a great deal of trouble. The atmospheric and intraabdominal pressure will force out fluids through the tube.

DR. WILLIAM SEAMAN BAINBRIDGE, New York City.—There are a few points in connection with this very interesting paper to which I desire to call attention. It brings me back to the time of Charles McBurney, when, as his house surgeon, I often heard him speak of what he called the grid-iron incision which we now call after him. He frequently explained that by extending upward and outward, or downward and forward, good drainage could be easily obtained in pus cases. Although severely condemned by many for use in septic patients, it is interesting to hear Dr. Keefe strongly advise it. I have seen it employed many times, and have employed it myself in a great many cases, with excellent results.

The rubber drainage tube is highly recommended. In connection with this I would like to bring to your notice the oft-repeated advice of Sir Berkeley Moynihan, given to us at Leeds, never to use a rubber drainage tube at all for the drainage of other than hollow organs unless the tube be split either directly or spirally. A drainage tube is likely to become plugged where there is coagulating matter to pass through it. I always split the tube.

Another point is in connection with the drainage of cases of tuberculous peritonitis. Drainage of these cases, unless they be of the mixed type, is unfortunate for the patient. I think it simply adds

to the adhesion already there. I take it that we are discussing the type that might have fluid to drain, but there are cases of tuberculous peritonitis that do not need drainage. Instead of employing a drain, which means an added number of adhesions, it has been my practice for the last ten years to introduce into the abdomen, after the adhesions have been broken up, and the fluid removed, 95 to 98 per cent. pure oxygen. This is introduced and the individual is blown up to the fullest extent possible, and the wound absolutely closed. The oxygen will remain for from forty-eight hours to a week, depending upon the amount used. Oxygen has a definite effect in inhibiting the growth of organisms, helps prevent adhesions, acts as a tonic, and diminishes the likelihood of the fluid reaccumulating. I would not like to return to the old method of draining these cases.

DR. ROBERT T. MORRIS, New York City.—The question of whether capillarity or gravitation exerts a greater force is one that relates to the character of the fluid to be drained. With a thin fluid to be drained, capillarity has the greater force. With a thick viscid fluid to be drained gravitation exercises a greater force. With the question of abdominal pressure comes the whole question of atmospheric pressure. Atmospheric pressure causes abdominal pressure. When I squeeze a grape I will get the inside of the grape out. That is the question of abdominal pressure in relation to free fluid within.

As to gauze drainage, I have not a great deal to say. In the days when we packed patients with gauze and iodoform gauze at that, I spoke of committing taxidermy upon these patients. The idea of gauze drainage is fallacious unless you use a Mikulicz apron, a covering of gutta percha tissue or rubber dam. The small capillary drain surrounded by gutta percha tissue would drain well enough in most cases.

In regard to closure without drainage, Dr. John G. Clark and I in 1895, published papers and took the first stand upon the subject, and the profession fired at us with murderous 13-inch guns and everything you could imagine. Then the question was forgotten altogether for seven or eight years. Now, the profession is taking it up again. There are very many cases of septic peritonitis that can be closed without any drainage whatever, depending upon the leukocytosis which has been established by the patient for disposing of infection. In regard to tuberculosis of the peritoneum, it makes no difference whether you blow the patient up with hydrogen dioxid, or inject iodine through a trocar, or whether you open and put in a wick drain, or whether you do not drain at all, so long as whatever you do excites a great degree of local hyperleukocytosis. That is the idea. It is the hyperleukocytosis which wipes out the tubercle bacillus. I thought it was the saprophytes at one time, and I took the fluid that entered by way of the drain, extracted the globulins, and used them against test-tube cultures of tubercle bacillus, and came to the conclusion that it was the saprophyte toxins which destroyed the tubercle bacillus and brought about a cure in these cases. But I know better now. Anything that will excite a great degree of

hyperleukocytosis within the peritoneal cavity will have a tendency to wipe out the tubercle bacillus.

DR. DAVID HADDEN, Oakland, California.—In this connection I would like to speak of the work of May. His work emphasizes the importance of protecting as much as possible the omentum, and not removing the least portion of it if we can help it. He took sterile beads and placed them in the abdomen and found after varying periods of time that these beads were always free and undisturbed. The same beads, infected, were taken up by the omentum and formed a beautiful apron, no matter in what part of the cavity they were originally placed. Around the beads was deposited lymphoid material with the formation of lymphatic glands. I regard that work as exceedingly interesting in connection with this question of abdominal drainage.

DR. KEEFE (closing).—In some of our large hospitals we find cases of appendicitis that have been going on from four to twelve days. I do not think we can treat these cases as we do the interval cases. I think it is very important as to where we make the incision. The primary incision in the loin may be best. I have a case in point that came under my observation five days ago where the abscess was in that direction. If I had opened at the site of the appendix and searched for the appendix and later found a pint of pus in his loin, it strikes me it would be much wiser to have attacked the pus where it was. I made a small opening and drained, and found a fecal concretion which proved to me that the trouble was appendiceal, that the appendix was perforated and had become gangrenous. I did not see the appendix. I think it is much wiser not to search for the appendix in many of these cases. It is important to know whether you are going to drain or not and make your incision to conform to that decision. In comparatively clean cases we may drain through a stab-wound alone, but in the cases with large collections of pus, in the neglected cases, I still believe we should make our incision over the point where the disease is most prominent. We know that a cigarette drain will not drain pus, but we also know that a tremendous amount of serum is thrown off and the pus is diluted, and the cigarette drain will drain that fluid which contains pus and serum.