Further experience is necessary in order to demonstrate the utility of such operations.

Puncture for ascites should be an aseptic operation. The skin of the abdomen should be disinfected and the trocar boiled. The instrument may be inserted in the linea alba below the umbilicus, the bladder being previously emptied, or in either side in the lower portion of the abdomen, or half-way between the umbilicus and the anterior spine of the ilium. The objection to the last-named situation is the risk of wounding the epigastric artery which runs in the sheath of the rectus muscle. If the recti are widely separated by the increased intra-abdominal pressure, these vessels may be displaced outward; therefore it is better to puncture at a point plainly beyond the outer margin of the rectus muscle. The trocar should be plunged quickly through the abdominal wall. As soon as the point of the trocar enters the fluid the operator's hand will recognize the absence of resistance. It is scarcely possible to injure the intestine by this manœuvre unless one punctures at a spot where intestine is adherent or there is no free fluid. The ascitic fluid should not be drawn off too rapidly lest the resulting distention of the abdominal vessels produce a cerebral anæmia. If a loop of intestine or omentum floats against the inner end of the canula, the flow of fluid will cease. Such obstruction can be overcome by moving the canula from side to side or by thrusting an aseptic probe through it. It is never possible to remove all the ascitic fluid. It is best for the patient to be half-reclining, leaning backward or to one side. If he is sitting upright, he may easily become faint. The little wound may be closed with a bit of gauze and adhesive plaster. Sometimes puncture is followed by a serous drainage, especially if the abdominal wall itself is œdematous.

In the rare cases in which the epigastric artery is punctured blood will flow from the wound in a stream after the removal of the canula, or there will be signs of internal hemorrhage—anæmia, faintness, a small rapid pulse, and vomiting. The hemorrhage may be controlled by pressure of the wound against the ilium; or, if the abdominal wall is much relaxed, a fold of it may be compressed between the fingers. If no assistance is at hand, this compression may be kept up until the hemorrhage stops. The hemorrhage can be readily controlled by passing a curved needle and thread beneath the vessels and tying it over a pad of gauze; or, if this fails, the wound of puncture should be incised, and the vessels exposed and ligated.

It is often necessary to repeat this operation of tapping for ascites many times. A result which occasionally follows is a chronic inflammation of the peritoneum with hemorrhagic exudate.

CHAPTER XI.

LAPAROTOMY.

By Prof. J. v. MIKULICZ and Dr. W. KAUSCH.

PREPARATION OF THE PATIENT.

Every patient upon whom laparotomy is to be performed should be examined from head to foot. Even the simplest laparotomy should be looked upon as an operation of great importance, and the resisting power of the patient should therefore be fully investigated. When time permits, his manner of living should be so regulated that his general health will be as good as possible. The individual resistance plays an important part in treatment by laparotomy. Feeble, aged, emaciated, and ill-nourished persons, as well as individuals with pulmonary and cardiac diseases, often fail to recover from an operation which would be easily borne by a person in robust health. A weakened individual is less able to resist bacterial attack, and he also suffers more from shock, from exhaustion, and from pneumonic processes. Any recent catarrh of the respiratory passages increases the risk of pneumonia after operation. Hence under such circumstances one should postpone the laparotomy if the delay is not dangerous for the patient. The examination of the patient should, of course, include the examination of his urine, preferably the twenty-four hour urine.

Except in cases of peritonitis, the patient should be given a full bath, preferably on the day before operation. The stomach, intestinal canal, and bladder should be thoroughly emptied. If these organs are full, palpation and inspection of the peritoneal cavity and most operative procedures are rendered more difficult. The patient should therefore take nothing by the mouth for some hours previous to operation, and if there is reason to suppose that the stomach is not empty it is better to wash it out. Irrigation of the stomach is advisable in all cases of ileus and of marked insufficiency of the stomach. If the stomach itself is to be operated upon and no counterindication exists, such as fresh hemorrhage, it should be irrigated with sterile water until the fluid returns clear.

The intestine can best be emptied by giving the patient mild laxatives for two or three days before the operation (castor oil, Carlsbad salt, etc.). The strength of these laxatives should be the greatest when the large intestine is to be operated upon. During this period of preparation the patient should receive only a fluid diet. On the evening

before the operation the lower bowel should be thoroughly cleansed by high enema. To extend this period of preparation, as some surgeons do, over one week or even two weeks is inadvisable, as little or nothing is gained thereby and most patients are much weakened by a prolonged fast. The effect of fasting upon the number of bacteria in the stomach and intestine is shown by the accompanying diagrams, Figs. 55 and 56.

FIG. 55.

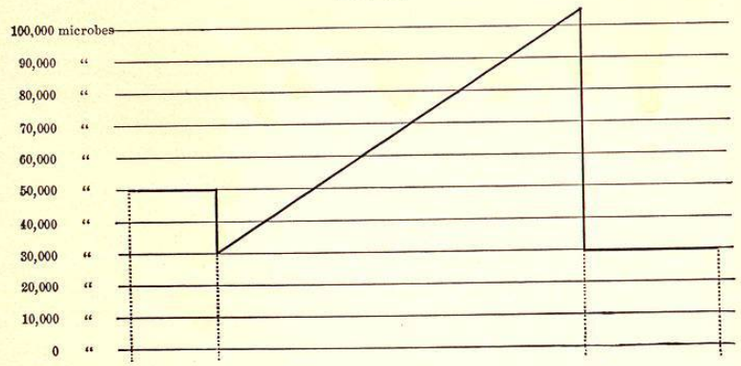


Diagram of Gilbert and Dominici, showing the relative number of micro-organisms in the dog's intestine two or three hours after a meal. (Société de Biologie, séance du 19 février, 1894.)

FIG. 56.

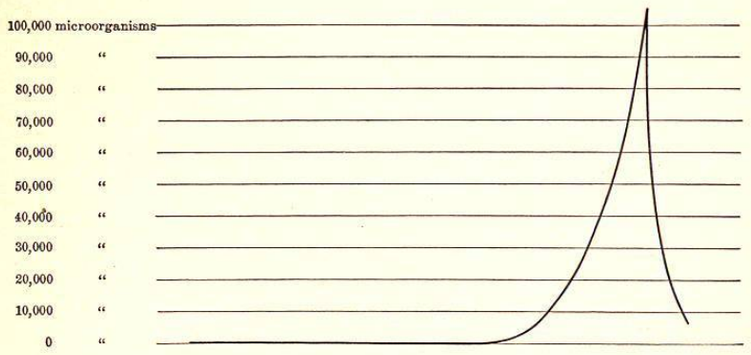


Diagram showing the relative number of micro-organisms at different levels of a dog's intestine after a prolonged fast.

If the bladder cannot be emptied voluntarily, it should be catheterized, especially if an operation is to be performed upon the organs in the lower portion of the abdomen. If this is not done, the bladder may be injured by the first incision before the peritoneal cavity is opened.

If the patient is much emaciated, as, for example, a patient with stricture of the œsophagus or of the pylorus, it is often advisable to give him a subcutaneous or intravenous injection of not more than one litre of salt solution. A rectal injection just before operation is harmful since it stimulates peristaltic action.

In most cases of laparotomy the patient can best be operated upon in a horizontal position. If operation is to be performed upon some pelvic organ, it is of advantage to elevate the pelvis. When the operation has been completed, the patient can be placed in a horizontal position so that the abdominal organs will resume their normal relations before the abdominal wound is sutured. If the operation concerns the epigastric region, it is of advantage to elevate the shoulders of the patient so as to relax the recti muscles and to avoid pressure from the organs of the lower abdomen. If the peritoneal cavity is to be opened through the vagina, a lithotomy position is desirable. The patient is usually placed upon his side if the peritoneal cavity is to be opened in the lumbar region or parasacral region, or through the thorax.

The operator usually stands at the right side of the patient, although if the left side is to be operated upon he may prefer to stand on that side. If the patient lies upon his side, the operator usually stands at his back. Some operators prefer to sit or stand between the thighs of the patient, whose pelvis is elevated for the laparotomy.

The room in which the patient is prepared for operation as well as the room chosen for the operation should be heated to about 20° to 24° C. (68° to 76° F.) and the patient should be warmly clothed. The operating-table should also be warmed. If a patient is much emaciated, he may be wrapped in cotton. The cooling which follows eventration of large portions of the intestine or other organs may have a serious effect. This should be limited by wrapping the exposed organs in cloths wrung out of a sterile hot 1 per cent. saline solution. It is beyond doubt that many patients "take cold" as the result of a loss of bodily temperature during the preparation for operation or during the operation itself. Carelessness in this regard is certainly responsible for many cases of post-operative pneumonia. Since particular attention has been given this matter in the Breslau clinic the number of post-operative pneumonia cases has markedly decreased.

The preparation of the operation-room for a laparotomy as well as the preparation of the field of operation, the hands of the surgeon, etc., are governed by the usual rules for surgical operations. In this chapter it is only necessary to give such rules as are especially important for laparotomy. The field for operation should be disinfected for a considerable distance, since one never knows how extensive the incision must be, or whether a second incision will be required, therefore the abdomen should be shaved and disinfected from the breasts to the symphysis and from one posterior axillary line to the other. Particular attention should be given to disinfection of the pubic region even though the wound is so far removed as the epigastrium. If the abdominal skin is eczematous, or if for any other reason it cannot

be thoroughly disinfected, Mosetig recommends that a piece of batiste in which a cut of suitable length has been made should be placed over the wound as soon as the skin has been incised. The edges of the cut in the batiste are then clamped to the edges of the skin by peritoneal clamps (Fig. 57, page 209) and the wound is thus protected from cutaneous infection.

In simple cases one assistant is sufficient. If complication exists, a second one is a great help. It is also necessary to have one or two persons to hand instruments and sponges, although some operators prefer to reach for these things themselves in order to lessen the possibility of infection. This seems a poor arrangement in most cases, for it prolongs the operation considerably, and if the additional assistants are suitably trained, the risk of infection is not worth considering if operators and assistants wear sterilized gloves. Moreover, sponges may be passed to the operator with sterilized forceps instead of the fingers. The use of woven gloves, aside from the fact that they protect the patient from infection, is very advantageous in abdominal operations since they give the operator a firm grasp upon the intestine and other peritoneal surfaces and thus facilitate a gastric or intestinal suture, the tying of ligatures, etc.

Ether is better than chloroform for general narcosis since it does not decrease the blood-pressure as does chloroform. The relative advantages of local and general anæsthesia depend upon a number of circumstances. The retention of consciousness during a serious operation is a disadvantage for many patients. It is possible to anæsthetize the anterior abdominal wall, the parietal peritoneum, and also the abdominal organs by a local anæsthesia. The parietal peritoneum, as shown clinically and by laparotomy experiments, is the most sensitive part of the peritoneal cavity. The visceral peritoneum is often wholly insensitive unless it is inflamed. When inflamed, and particularly in the case of the stomach, it is extremely sensitive. Traction upon peritoneal folds, such as the mesentery, mesocolon, or omentum, is extremely unpleasant for the patient and produces a strikingly bad effect upon the action of the heart, or even a collapse which combined with the shock of the operation may prove fatal. The abdominal organs themselves are for the most part insensitive. Local anæsthesia does not relax the abdominal walls as general anæsthesia does. The pneumonia which sometimes follows laparotomy, and which was previously attributed to inspiration of mucus, etc., during unconsciousness, may also follow a laparotomy in which local anæsthesia is employed. Local anæsthesia is far less dangerous than general anæsthesia in those cases in which it is impossible to empty the stomach—for example, in ileus with constant fecal vomiting. Under such circumstances it is practically impossible to prevent the vomited material from entering the bronchi. Even the introduction of a stomach-tube or elevation of the pelvis will not surely prevent this accident.

In accordance with the principles given in the preceding paragraph most surgeons employ local anæsthesia for laparotomy only in those

cases in which the operation bids fair to be of short duration and easily carried out; for example, in the case of gastrostomy or colostomy, or for operations upon hernia. A general narcosis is far preferable in serious operations, especially those in which the abdominal organs must be handled and pulled upon. If the condition of the patient makes it necessary to give him the smallest quantity of ether, the treatment should be as follows: subcutaneous injection of morphine, 0.01 gramme ($\frac{1}{6}$ grain), local anæsthesia for the abdominal incision, and then a light general anæsthesia secured by continuous dropping of ether upon the cone, which is to be stopped as soon as the painful manipulations of the peritoneum are finished.

Tuffier and some other surgeons employ spinal anæsthesia in the case of laparotomy upon the lower abdominal organs, but Mikulicz and many others are dissatisfied with the results obtained by this method.

THE ABDOMINAL INCISION.

Choice of Incision.—The peritoneal cavity can be opened in a number of places. Incisions used in laparotomy are therefore divided into anterior (median or extramedian), lateral, posterior (lumbar or parasacral), vaginal (perineal), and thoracic. The object of the incision is (1) to give the operator access and a view of the parts to be operated upon, (2) to enable him to avoid injury to other organs, and (3) to enable him to preserve the anatomical relations of the abdominal walls, so that recovery shall be followed by a firm scar.

The first object generally requires an incision close to the part to be operated upon. In many cases there is little choice of incision, as in operating for a hernia or an adherent tumor or abscess. In other cases in which the trouble is in the central part of the abdomen, or a movable tumor is to be removed, or an exact diagnosis cannot be made, the surgeon can choose his incision, and the one chosen under such circumstances is generally in the region of the umbilicus. Through such an incision one can examine the whole abdomen, and if necessary reach any of the abdominal organs.

The course of bloodvessels, such as the epigastric artery, need not influence one in making the incision, but the situation of muscles and nerves has often to be considered. Some surgeons prefer to make an incision anywhere except through the fibres of a muscle—for example, in the median line or at the outer edge of the rectus muscle; or close to the margin of the ribs or the crest of the ilium. Others prefer to make the incision through a muscle, believing that they will obtain a firmer scar by this means. In accordance with this view they make an incision to one side of the linea alba rather than through it. Some operators separate the muscle-fibres longitudinally, and others prefer to cut square across them, each believing that his favorite method yields the firmest scar.

Every incision through the abdominal wall, with the exception of one in the median line, injures some nerves. While division of sensory

nerves is of no importance, division of motor nerves is followed by paralysis of some muscle-fibres which is usually permanent. The effect of this is to favor the development of ventral hernia, as is shown by experiments upon animals (Asmy) and also by clinical observation. The more closely the incision parallels the course of the nerve-fibres the fewer of them will be divided. The nerves under discussion are the intercostal, the iliohypogastric, and the ilio-inguinal. The practical conclusion is that a lateral incision should extend from above downward and forward, and should be more nearly transverse than longitudinal. Many surgeons attempt to save the nerves by making a blunt dissection. Such an attempt is only successful in the case of short incisions, for if the dissection is a long one, the nerves are almost certain to be torn.

How to operate so as surely to avoid a subsequent ventral hernia is a question which is not yet satisfactorily answered. Methods of suturing are discussed elsewhere in this chapter. It is certain that an incision in the median line is rarely followed by a hernia if it can be firmly sutured and heals aseptically. If an oblique or transverse section through the rectus muscle heals satisfactorily, it rarely gives trouble afterward. Similar incisions through the oblique abdominal muscles are more often followed by hernia. Such may be the result even though the muscular fibres are separated longitudinally and subsequently sutured. Certainly a muscular fibre if pinched several times during an operation, or firmly pressed, will undergo at least partial atrophy. Some surgeons hope to secure a firm scar by making incisions through the different layers of the abdominal wall not directly under one another, but in different directions, so that they cross one another. This is especially true of a lateral incision, in making which many surgeons separate the fibres of the oblique muscles and those of the transverse muscle.

An incision is called median or paramedian, and, according to its position with reference to the umbilicus, epigastric, mesogastric, or hypogastric. The epigastric incision is suitable for operations upon the stomach, pancreas, left lobe of the liver, and possibly the transverse colon. The hypogastric incision is preferred for operation upon the bladder and pelvic organs, and in cases of tuberculous peritonitis. A mesogastric incision is suited to all other conditions which require an incision in the median line. Sometimes the incision has to extend over more than a third of the distance from the sternum to the pubes.

A right pararectal incision made at the lateral border of the rectus is adapted to operation upon the right lobe of the liver and biliary passages. A pararectal incision made nearer the symphysis may be used for appendicitis. A left intrarectal incision is often made for gastrostomy. Incisions made further to the side will serve to expose the ascending and descending colon and the kidney.

A transverse incision may be made at any level. It is seldom used at the present time, perhaps unwisely so. Vischer recommends a transverse incision one inch above the iliac crest for appendicitis, and

Péan uses a transverse incision from the outer margin of the rectus to the sacrolumbalis for operations upon the kidney.

The oblique incision parallel to the left costal margin was formerly universally employed for gastrostomy and is still used for this purpose. Many operators make a similar incision on the right side for operations on the liver and biliary passages, or to expose the colic flexure.

Mikulicz exposes the biliary passages through an oblique incision beginning at the costal margin in the mammary line and extending to the median line one or two inches above the umbilicus. This incision is parallel to the nerves in this region. If more room is needed, it is gained by extending the incision downward in the median line. Some surgeons make an oblique incision for appendicitis and also for the establishment of an artificial anus in the descending and in the sigmoid colon. Curved incisions are not used much at the present time, although many surgeons employ angular incisions for special purposes. These are described more in detail in connection with diseases of the different organs.

In repeating a laparotomy it is usually well to make a new incision close beside the old rather than exactly in the old scar, so as to open the peritoneal cavity at a point where the visceral and parietal layers of peritoneum are not adherent. Mikulicz excises the old scar so as to be sure to obtain a firm union of the wound. Such a step is to be performed with caution lest adherent organs be wounded. As soon as an opening is made into the free abdominal cavity it is easier for the surgeon to recognize the relations of the parts.

An exploratory laparotomy is justifiable whenever it seems probable that the patient has an affection which may be best treated by operation, although a positive diagnosis cannot be made. It is also justifiable in cases in which the diagnosis is sufficiently clear, but in which it is impossible to say before operation whether or not the patient's condition can be improved by operation. An exploratory laparotomy can often be performed under the influence of a local anæsthetic. The shorter the incision the less the shock to the patient. In many cases Mikulicz makes an incision just large enough to admit one or two fingers, and with these he palpates the abdominal organs in the same manner that examination is made with one or two fingers in the vagina or rectum. But even so small an opening of the peritoneal cavity is not wholly without risk, and this operation ought never to be performed until other means of diagnosis have been exhausted. For the sake of diagnosis alone it should never be performed, since it may reveal conditions which are inoperable—for example, a gangrenous tumor, which makes it impossible ever to close the abdomen again. Furthermore, one can never be absolutely sure that troublesome adhesions will not follow an exploratory laparotomy, and even so small an incision may give rise to a ventral hernia. Then there is also a risk of pneumonia, especially in aged people. In making an exploratory incision one naturally selects the place from which the diseased organ is most readily accessible, or, if one is in doubt what organ is diseased, the incision should be made near the umbilicus.

Technic of Incision.—In the Breslau surgical clinic a laparotomy is performed as follows: The fingers of the operator spread out upon the abdomen lightly draw the skin to be incised in the direction of the incision while countertraction is made by the assistant. This tension is unnecessary in case the skin is already stretched by a large tumor or by meteorism. It is well to make a small incision at first, especially if the extent of the operation is not entirely clear. While a large incision made in the beginning gives the operator a wide view of the field, a relatively small incision possesses several advantages of its own. It can be more quickly sutured, it favors retention of the intestine within the abdomen, it gives rise to less shock, other things being equal, and it is less likely to be followed by hernia. The risk of infection, which formerly was an important point, has to-day become less so. In any case it is easy to extend a small incision should this become necessary. If the umbilicus lies in the line of incision, most surgeons pass it by on the left side. Mikulicz removes it except in the case of young girls. He does this because it is difficult to disinfect the umbilicus thoroughly and its suture takes time. Extirpation of the umbilicus usually opens the peritoneal cavity.

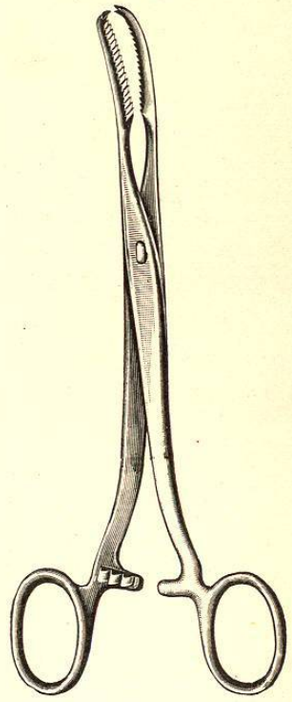
The edges of the incised skin are retracted and the succeeding layers of the abdominal wall are divided with the scalpel exactly in the median line until the peritoneum is reached. If a tumor or a great collection of fluid has stretched the abdominal wall, the edges of the wound immediately retract. If the incision is made exactly in the median line, the sheath of the rectus muscle is not opened. It is easier to avoid opening the sheath in the upper portion of the abdomen than in the lower, since the linea alba is normally 1 or 2 cm. (0.4 or 0.8 inch) broad in the epigastrium. It is still broader at the umbilicus, but rapidly narrows below until it is only 2 mm. (0.1 inch) broad and proportionately thicker. The pyramidal muscles may or not lie in the line of incision. Sometimes they are wanting, and sometimes they cross the median line. If the incision is not a median one, muscular fibres which are encountered are pushed aside if their direction is parallel to the line of incision or nearly so. In other cases they are divided by a clean cut. When this has been done, the transversalis fascia is exposed, which covers the whole front and sides of the abdomen. The thin peritoneum lies immediately beneath it and is attached to it closely in the region of the umbilicus, but more loosely elsewhere. Where the attachment is close, one gains the impression that the peritoneum is a strong membrane, since what appears to be peritoneum is really peritoneum and fascia together. Between the two membranes there is a variable amount of fat which in stout persons may be so considerable that the membranes are separated by an appreciable distance.

As soon as the peritoneum is exposed, any bloodvessels which have been divided should either be ligated or clamped if this has not previously been done. Those vessels which are clamped are twisted or ligated at the close of operation. The peritoneum at about the

middle of the incision is seized with two anatomical forceps, raised and opened with scissors or scalpel. The blade of a blunt-pointed scissors is then introduced and the peritoneal opening is extended upward and downward while the abdominal organs are protected by one or two fingers introduced underneath the peritoneum.

In certain pathological conditions it is extremely difficult to recognize the peritoneum either because it is inflamed and thickened and its vessels are dilated so that it resembles the intestinal wall, or because there are extensive adhesions, so that the wall of the intestine is mistaken for peritoneum, and cut through before its true nature is recognized. The transversalis fascia has often been mistaken for the peritoneum, and the two have been dissected apart under the suspicion that the parietal peritoneum was the covering of some abdominal organ. This mistake delays the operation and leaves a bloody cavity in the abdominal wall. In cases of doubt blunt dissection is advisable, and if a clear view of the relations cannot be obtained the surgeon should try again in another portion of the wound in which the adhesions may possibly be wanting. One is most likely to encounter such difficulties in secondary operations.

FIG. 57.



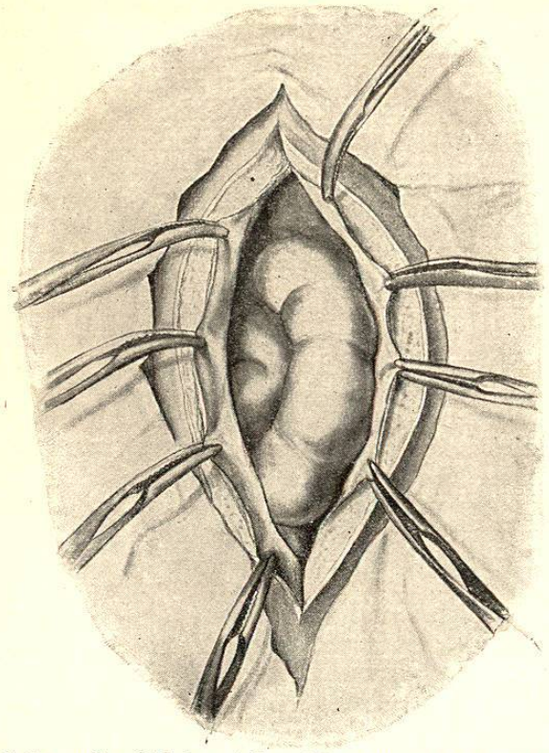
Peritoneal clamp (½ natural size).

When the peritoneum has been divided, its cut edges on either side are seized with peritoneal clamps, whose edges are somewhat bent and terminate in sharp hooks like a rat-toothed forceps. The handles of these instruments are so curved that they lie flat upon the compresses which cover the abdominal wall, while by their weight they keep the edges of the peritoneum in place. This step in the operation serves several purposes. It keeps the peritoneum in its normal relation to the abdominal wall (if it is not so held, it may easily be pulled off by subsequent manipulation), and it protects the peritoneal cavity from bloody secretion which may ooze from the wound in the abdominal wall. Furthermore, it protects to a certain extent the abdominal wound itself in case the operation is a protracted one, or in case an infectious cavity is opened within the abdomen; and it facilitates suture of the peritoneum when the operation is finished. Some surgeons accomplish the same object by temporarily suturing the peritoneum to the skin.

If the incision is made near the symphysis, care should be taken not to open the bladder accidentally. If necessary, a catheter may be

passed into the bladder in order to show its exact position. Fritsch warns against extending the incision to the symphysis except in case of absolute necessity. He says the division of the loose prevesical tissue and the increased weight with which the abdominal organs press upon a scar so low down predispose to ventral hernia. Unless there is special indication for it, an abdominal incision should not extend higher than the ensiform cartilage for fear of opening the pleural cavity.

FIG. 58.



An abdominal wound in which the cut edges of the peritoneum are drawn outward and held by eight peritoneal clamps (one-half natural size).

Technic of Laparotomy after the Peritoneum is Opened.—The coils of intestine which tend to press out of an abdominal incision are held back by aseptic compresses. The immediate neighborhood of the wound is first examined in order to determine the condition of the peritoneum, the presence of ascites, etc. Further action of the surgeon must be determined by circumstances. In general, if the disease is not apparent, one or more fingers are introduced in order to locate it, and these are followed when necessary by the whole hand. It is sometimes necessary to examine the whole peritoneal cavity.

The peritoneum should be protected not only from bacterial infection, but also from chemical and mechanical injury, hence retractors or other instruments that are introduced should be free from sharp edges and corners. Every operator has his favorite retractors, so that it is unnecessary to describe these instruments in detail; but no instrument can take the place of the operator's hand, and when this is protected with a sterile glove he introduces it freely. If he finds it necessary to pass the hand and arm into the abdomen, the glove should be taken off, the hand thoroughly washed with a lysol or bichloride solution and dried with a sterile towel. The cloth glove tends to catch upon the peritoneum and delicacy of touch is somewhat impaired by it. For these and other reasons many American surgeons wear rubber gloves during abdominal operations.

One should avoid loosening the peritoneum from the underlying tissue; and if it is torn accidentally, it should be sutured; or if this is impossible, the gap should be closed with a flap of omentum which may or may not be left attached to the rest of the omentum. If the peritoneum is separated from the underlying tissue for a considerable distance and one is not sure of asepsis, the dead spaces thus caused should be tamponed and drained.

It is well to sponge with gentleness. Most surgeons prefer dry sponges. Any secretion which is found should be thoroughly removed, even though it is not infectious. It is claimed that moist sponges are less irritating to the peritoneum than dry sponges and do not predispose to adhesions. This cannot be considered proved as yet. Sea sponges are rarely used at the present time.

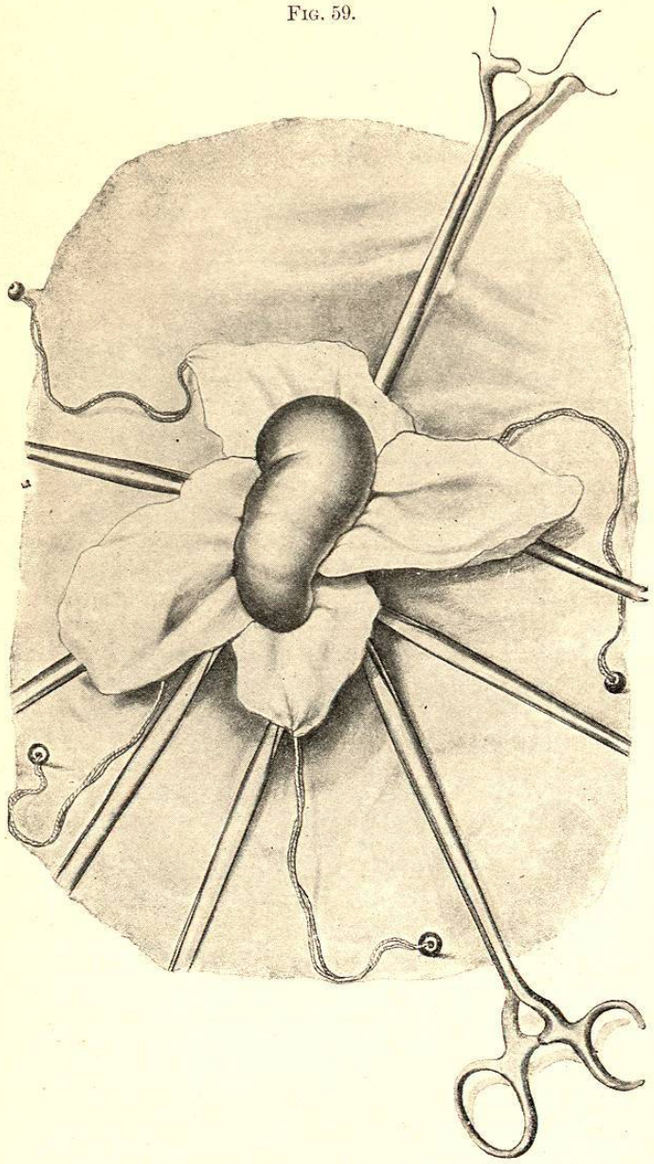
Any fluids which are used in the peritoneal cavity for irrigation or to moisten sponges, etc., must not be of an irritating character. Strong antiseptics should not be used at all, or at most for disinfecting the hands, for instruments, and for suture materials. A 1 per cent. saline solution is the best fluid for general use. On account of the rapid absorption from the peritoneum and its numerous pockets in which fluid may lodge, antiseptics may bring about serious symptoms of poisoning. Even if these symptoms are outlived, they may add to the injurious effect of the operation upon the heart and kidneys. Furthermore, antiseptics injure the peritoneal surface and produce annoying adhesions.

Coils of intestine which are brought outside of the abdomen should not be allowed to touch the skin, but should be quickly wrapped in hot moist sterile cloths so that the air may not injure the delicate organs.

Every ruptured bloodvessel within the peritoneal cavity should be carefully ligated. Even a small vessel which during operation bleeds only slightly may bleed more freely when the general blood-pressure rises after operation. Neglect to tie such a bleeding vessel may cost the patient's life. This risk is especially great in jaundiced patients. Mikulicz and many other surgeons make use of mass ligatures so as to avoid post-operative hemorrhage and also to shorten the time of operation. Thus if omentum or mesentery or broad adhe-

sions have to be divided, the tissue is separated into suitable masses and divided between ligatures. If the tissue which is thus treated is

FIG. 59.



Temporary tamponade with abdominal pads (one-half natural size).

thick, a groove for the ligature is first made by compressing it between the jaws of strong forceps. Mikulicz has seen no injurious effects follow

this treatment, but many surgeons reject it and prefer to divide the tissue first and subsequently to ligate all bloodvessels. Adhesions must be separated when they interfere with the operation, and when they produce subjective or objective symptoms, or may produce such at a later period. Slight adhesions and small cords which contain only minute bloodvessels may be torn through with the fingers or cut with scissors without previous ligation. Close adhesions to organs which are full of blood, such as the liver and spleen, are best divided by the thermocautery in order to avoid troublesome hemorrhage. The greatest care is necessary in separating adherent coils of intestine. If they are torn apart, it often happens that the intestinal wall gives way rather than the cicatricial tissue.

The material employed for sutures and ligatures within the abdomen may be silk or catgut, silkworm-gut, kangaroo-tendon, etc. The peritoneum bears readily almost any suture material whose calibre is not too great. Mikulicz uses formalin catgut for most purposes, but employs fine silk for a Lembert suture.

As far as possible a laparotomy should be carried on extraperitoneally. That is to say, if the organ is movable it is brought out of the abdominal wound and surrounded by a row of compresses which are firmly packed into the wound. These compresses may be dry or moist. They either remain in place until the close of the operation, or they may be replaced as they become soiled. This method of operation is easily carried out in the case of the stomach or intestine, and to a certain extent in the case of the bladder and female genital organs. When the affected organ has been brought outside of the abdomen, the wound may be partially closed temporarily by a running suture.

If this method of operating is not possible, an attempt is made to operate in a similar manner within the peritoneal cavity, by shutting off the field of operation from the rest of the peritoneal cavity, using for this purpose broad retractors which lift the edges of the abdominal wound outward and forward, while a row of compresses placed around the affected organ shuts it off from the rest of the peritoneal cavity. In many cases—for example, in most operations upon the stomach—Mikulicz operates half inside and half outside the abdomen. He brings the organ as far forward as possible and then shuts off the field of operation from the rest of the peritoneal cavity in the manner described. In aseptic operations this method of operating has the advantage of lessening the risk of infection of the general peritoneal cavity, and in operations in which the affected organ contains pus the advantage of the temporary tamponade is even more marked. This is the case in operations which open the stomach or intestine, or have to do with abscesses, echinococcus cyst, etc.

Foreign bodies which are left for even a little time in the peritoneal cavity may be removed by peristaltic action, etc., to a considerable distance so that it is extremely difficult to find them again. On this account instruments and sponges which are left loose in a peritoneal cavity are likely to be forgotten. Mikulicz makes it an invariable