times per diem, supplemented by tooth powders, and antacid mouth washes.

I am aware that I have not discussed this subject as its great importance would seem to deserve, and had time permitted, I should have been glad to have elaborated many points that have been only just alluded to. I trust, however, that some of these points may receive more extended treatment in the discussion that shall follow.

"The Argyle," cor. Michigan Ave. and Jackson St.

DRAINAGE IN ABDOMINAL SURGERY.

Read in the Section of Surgery and Anatomy, at the Fortieth Annual Meeting of the American Medical Association, June, 1889.

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Drainage of the peritoneum, though one of the most important subjects in abdominal surgery, is yet one which still stands in a most uncertain position. The reason of this uncertain position is primarily a dread of evil consequences from the tube; a fear that the tube will act as a source of septic infection and death. Other less important reasons militate against the use of the drainage tube, but collectively they have but little weight when compared with the terror, which most surgeons feel, of introducing a dangerous element of septic infection in any case where a drainage tube is employed.

As long as this fear exists the abdominal drainage tube can never be viewed in a proper light. And it is one of my chief objects in presenting this paper, to attempt to place the subject in a more scientific position, by showing how groundless all such fears are, if the drainage tube is properly used.

But little light on this subject can be obtained by investigating the practice of noted operators. A very few operators—as Olshausen—altogether discard the abdominal drainage tube, asserting that it is in no case necessary. (*Die Krankheiten der Ovarien*, 1886.) Others—like Bantock and Tait—use drainage freely and with confidence, never allowing fear of evil consequences from the tube to affect their decision about its use in any case. Others—and perhaps the largest body—occupy a medium place; they dread the tube, but sometimes feel obliged to use it, because they dread more sepsis from absorption of undrained fluids in the peritoneum. The last hold a most unsatisfactory and a most unscientific position; and probably have the largest mortality after their operations.

If one surgeon, or class of surgeons, can use the abdominal drainage tube in a long series of cases, with a very small mortality—a mortality no greater than occurs in the same hands in a similar series of undrained cases, it certainly proves that the drainage tube properly used is

not a source of danger. And it follows from this, that, if other surgeons have a much greater mortality when the tube is used than when it is discarded, the reason is that they do not employ the tube in a proper way.

The important point to observe, in the use of the abdominal drainage tube, is frequent and careful cleaning. Cleaning which can be performed by any neat nurse. If the statistics and practice of different operators are observed, it will be found that, in most cases, a large mortality and infrequent cleaning of the tube go together. We often are advised to make the first inspection of the tube not earlier than twelve hours after the operation—in some cases twenty-four hours. An investigation of cases subjected to this plan of treatment will, by the mortality, show, unquestionably, the value of frequent cleaning. I will refer to one striking illustration of the truth of this remark. There appeared recently a paper on drainage in which the writer says, "the first inspection of the tube for fluid need rarely be made earlier than twelve hours after the operation." He then gives his mortality in a series of drained cases as over 50 per cent. Compare this advice and these statistics with those of Bantock, who operated without a death on a series of 45 drained cases in the Samaritan Free Hospital, and who advises that the drainage tube be cleaned every two or three hours; (*British Medical Journal*, June 30, 1888). Or with the statistics of Joseph Price, of Philadelphia, who uses drainage in about 50 per cent. of his cases of laparotomy, with a mortality as small as in the undrained cases, and who cleans the tube from every one to three hours. In my own practice, I have operated for disease of the uterus or its appendages, on 40 successive drainage cases with one death. I frequently have the tube cleaned as often as every half hour: and in introducing it, I think of it no more as a source of danger, than if I introduced an extra suture in the abdominal walls.

Many similar statistics could be given, which show that, in some hands, the drainage tube adds nothing to the mortality after laparotomy, and consequently that when it seems to increase the mortality, the cause is to be sought in the method of using the tube, and not in the tube *per se*.

No fixed time can be set for cleaning the abdominal drainage tube. It should always be cleaned when it is filled with fluid, and sometimes it is filled fifteen minutes after the patient has been returned to bed. By cleaning I mean the thorough emptying and drying of the tube, and the introduction of a fresh capillary drain if one is used.

Our object, after most cases of laparotomy, is to dry, as quickly and completely as possible, all the peritoneum beyond the neighborhood of the tube; and to do this the outward flow should be

as free as possible. Such, however, is not the case when the drainage tube is full of fluid, for the intra-peritoneal accumulation is then subject to a backward pressure equal to the weight of a column of liquid four to six inches in height. A pressure, in cases where there is no distension, sufficient, not only to stop the outward flow, but to cause a backward percolation of fluid between non-adherent intestinal loops. Therefore, to favor rapid occlusion of the general peritoneum from the sink in the hollow of the sacrum, and from the drainage tube tract, frequent cleaning is of the greatest importance.

I do not hesitate to say that, if a drainage tube is frequently inspected, and if all manipulations are performed with the strictest cleanliness, a patient, after laparotomy, is as safe, if not safer, with a tube than without one.

If we admit this fact, that a drainage tube in the abdomen need not be looked upon as a source of danger, we are in a proper position to decide the question: In what cases is drainage necessary?

The object of the drainage tube is the prevention of accumulations of fluid in the peritoneum. The dangers to be feared from such accumulations are septic changes, which may produce general or local trouble. These changes, if not pre-existing, are generally caused by septic matter introduced from without; but it is also very probable that infection may occur through the intestinal walls; especially if the intestinal coats are in a pathological condition from over-distension or other cause. At the same time, it must be remembered that the healthy peritoneum is a very rapid absorber; and large quantities of fluid may be absorbed before sufficient time has elapsed for septic decomposition to take place. A very rough idea of the absorbing power of the healthy human peritoneum may be obtained from experiments on dogs and rabbits; and, if we calculate proportionally for man, we find that the human peritoneum can absorb from five to twelve pints of fluid in one hour, or, in from twelve to thirty hours, a quantity equal to the body weight. (*Der Krankheiten der Ovarien*, von Robert Olshausen, 1886.)

Cases demanding drainage can be arranged under the following heads:

1. Where the operation has been of long duration and there has been much manipulation, and we fear excessive secretion from the irritated peritoneum.
2. Where extensive raw surfaces, or bleeding adhesions are left, or where we fear bleeding from any other cause.
3. Where there is existing peritonitis, or ascites.
5. Where septic matter has escaped into the peritoneum, or where portions of tumor are left.
5. Where there is a malignant disease, and we fear subsequent infection.

By excessive secretion from irritated peritoneum I mean more fluid accumulation than can be re-absorbed before septic changes take place. And, in this connection, we must consider, not only whether the peritoneum is in a condition to absorb fluids, but also whether the patient's condition is such as to stand such absorption; whether the emunctories are sufficiently active to excrete the absorbed material. For this reason drainage of the peritoneum is much more frequently indicated in old, than in young people.

No absolute rules for drainage can be given; and consequently there is always room for a difference of opinion in any case which comes under the preceding headings. The irritated peritoneum may not secrete excessively; or the blood from adhesions may not be too great to be absorbed, but if, in any case, there is a particle of doubt about such points, the drainage tube should be unhesitatingly used.

The drainage tube is not only of service in draining blood from the peritoneum, but, in cases where excessive bleeding is feared, it serves as an important indicator to the operator. It not only itself, for some reason, seems to act as a valuable hæmostatic, but it also enables the surgeon to detect undue hæmorrhage in time to check it. In three cases Tait has controlled hæmorrhage by the injection of perchloride of iron through the tube. (*Brit. Gyn. Journal*, August, 1887.)

The necessity for drainage depends to a great extent upon the operating surgeon. Skill, rapidity and neatness in operating, by diminishing exposure and irritation of the peritoneum, enable many surgeons to do without drainage in cases which would demand it in other hands. And for this reason the practice of no one operator can be taken as a guide. Every surgeon must determine for himself whether drainage is necessary in any case, and it is much safer for him to use the tube too frequently rather than too rarely.

I have thus far spoken only of one tube, not because we need to be limited to one drainage tube in abdominal surgery any more than in other branches of surgery; but because the great majority of abdominal operations are done for disease of the ovaries and Fallopian tubes, and consequently the seat of operation is altogether in the pelvis, the upper part of the peritoneal cavity being generally entirely undisturbed. For this reason, in such cases, the single straight glass tube drains not only the hollow of the sacrum—the natural sink of the peritoneum—but also the whole field exposed in the operation. But in other cases, as in general purulent peritonitis, it may be necessary to drain, in addition to the hollow of the sacrum, the renal gutters, or other parts of the peritoneum. And if the tubes are used, not only for drainage, but also for subsequent peritoneal irrigation, the use of two or

more tubes, placed wherever indicated, is of great value.

In some cases it is desirable to use a tube combined with a capillary drain of gauze or wick, or even gauze or wick alone, placed in strips from the cavity or part to be drained to the abdominal wound.

Capillary drainage is in many instances a most desirable method; possessing the advantages of promptness, thoroughness and complete exclusion of air; at the same time giving entire rest to the patient and to the parts surrounding the drain; and permitting more movement of the body. In such cases wicking answers better than gauze, since it acts as a faster drain, and is less liable to become incorporated with surrounding tissues, and thus render removal difficult. These drains can remain in place for several days—as many as ten or fourteen—if the superincumbent gauze is frequently changed and the discharges are not septic to begin with.

For discussion of this subject with report of cases see article by Ludwig Piskachek, *Medizinische Jahrbücher*, neue Vol. iii., Jahrgang, 1888.

The determination of the length of time during which the general peritoneum remains open to drainage is of importance in discussing the use of the abdominal drainage tube. Theoretically, an aseptic, unirritating drainage tube ought never to become shut off by adhesions from the general peritoneal cavity; since peritoneal adhesions imply more or less irritation. The length of time, therefore, during which the tube acts as a general drain depends on the condition of the tube and the character of the discharges, which are carried through it. Tait (*Brit. Gyn. Journal*, August, 1887) says that irrigation of the peritoneal cavity through the drainage tube becomes impossible, on account of adhesions, seventy or eighty hours after operation. And this is probably the usual time in clean cases. That this time, however, is subject to very considerable variations, is shown by the following cases, which have occurred in my own practice.

In a case of purulent peritonitis where laparotomy was performed, and peritoneal irrigation was practiced through three tubes placed in the abdominal cavity, general drainage, and the possibility of general irrigation, ceased to exist twenty-two hours after the introduction of the tubes. (This case is reported in *Annals of Gynecology*, 1888.)

In a case of stab wound of the transverse colon, when the patient died of cerebral embolism seventy-six hours after laparotomy, the autopsy showed that there were no peritoneal adhesions around the tube, the peritoneum being dry and the tube perfectly free.

In a third case, of dermoid tumor, where general peritonitis appeared three days after laparotomy, the discharge from the drainage tube,

which had for two days been very slight, suddenly increased, and for five days later large quantities of sanguinolent serum flowed continuously; showing that much of the peritoneum was still open to drainage even seven days after operation. A singular phenomenon occurred after an operation by Dr. Baldy of Philadelphia. Abdominal hysterectomy was performed for a uterine myoma. Ascites was present at the time of operation, and for eleven days afterwards from one to three pints of serum flowed daily from the drainage tube.

These cases are sufficient to show that the duration of general drainage depends to a great extent upon the nature and treatment of the case.

As has been said the chief immediate danger to be feared from a drainage tube is septic infection or septic peritonitis, and I have attempted to show how slight is the risk of such infection if proper care is taken of the tube. There are, however, other accidents, or sequelæ imputed to drainage, which, though not of immediate danger to life, are yet at least annoying, retarding convalescence, and in some cases, if uncured, ultimately causing death. And a fear of these minor dangers is often sufficient, in case of doubt, to turn the decision of the surgeon against the drainage tube.

Such accidents, or sequelæ, are:

1. The formation of local peritoneal adhesions around the drainage tube, and the persistence of a fibrous band in the site of the tube tract, which may cause subsequent bladder trouble, or intestinal strangulation.
2. The incarceration of omentum, or shreds from adhesions, through the perforations of the tube.
3. Prolonged suppuration from the drainage tube tract, or an incurable sinus.
4. Fæcal fistula from pressure of tube on intestine.
5. Ventral hernia resulting from imperfect approximation of fascia and muscles.

I will consider these real and imaginary sequelæ of drainage in the order in which they have been stated. Though local peritoneal adhesions may be more frequent in drainage cases, yet I have never observed that these patients complained subsequently of symptoms indicative of such adhesions, any more than patients in whom no tubes had been used. These adhesions generally disappear very quickly; and this is also the case with whatever fibrous band may follow the tube. Of course a discharging sinus, especially if an old one, exists as a firm organized structure, extending from the origin of the sinus, to the parietes; but even such tracts disappear after they cease to discharge. In order to cure ventral hernia, I have had an opportunity of reopening the abdomens of two patients in whom drainage had been used; and have consequently been able to determine the existence of any ad-

hesions or fibrous band which might have been produced by the drainage tube.

In the first case the primary operation had been done for double pyosalpinx and peritonitis. The glass drainage tube had remained in the abdomen for three days, being replaced by a rubber tube which was used for several days longer. The second operation, for the relief of the resulting hernia, was done two years later. The omentum was then found slightly adherent in the hernial sac; but there were no other peritoneal adhesions of any kind. The finger, introduced to the hollow of the sacrum, found no adhesions and no trace of the drainage tube tract.

In the second case, the primary operation was done for extra-uterine pregnancy. The glass drainage tube had remained in the abdomen for eight days, and was then replaced by a rubber tube which was used for two weeks longer. After removal of the rubber tube a discharging sinus remained unclosed for about three months. Here, more than in the first case, I expected to find some pelvic adhesions and some trace of the old drainage tube tract and the resulting sinus. When, however, the ventral hernia was operated on, eighteen months after the primary operation, there was no trace of a fibrous band or of any peritoneal adhesions beyond the omentum, which was very slightly adherent to the neck of the sac.

Incarceration of omentum or shreds from adhesions is not an uncommon accident even when the perforations of the tube are not of undue size. It may be avoided by occasionally lifting or rotating the tube after cleaning. When, however, the accident has occurred, it is necessary, in order to remove the tube, to cut off the incarcerated tissue with a long knife, or other instrument introduced through the tube.

Prolonged suppuration from the drainage tube tract results, in most cases, from the breaking down of tissue which had not been removed at the primary operation; from an infected ligature; from syphilis; and from tuberculosis. The abdominal drainage tube of itself does not cause the sinus any more than does a drainage tube in other parts of the body. The sinus is the result of some pathological condition at the bottom or sides of the drainage tube tract, and frequently occurs after laparotomy even when no tube had been used. If it is due to either of the first two causes—unremoved morbid tissue or an infected ligature—it will close of itself when all foreign matter has been removed. And it is fortunate for the patient that it remains open until such removal has taken place; since otherwise accumulation would occur within the abdomen. It is not an unusual thing to be obliged to reopen an abdomen in order to evacuate pus pockets formed around infected ligatures, or unremoved morbid tissue. A sinus caused by syphilis can of course only be closed by antisyphilitic treatment. Such

a sinus existed in the second case of ventral hernia to which I have just referred.

When tuberculosis is the cause, the sinus generally will not close until all tubercular tissue has been removed. Two such cases have occurred in my experience: in one there was tubercular salpingitis, and tuberculosis of the lumbar lymphatic glands; in the other there was tubercular salpingitis with general tubercular peritonitis. In each case there still exists a ventral sinus.

A danger always to be feared from an unclosed sinus is the ultimate production of a faecal fistula, and when a sinus persists, attempts should be made, even by a subsequent laparotomy, to remove the cause.

Faecal fistula caused by pressure of the drainage tube on the intestine is by no means an imaginary danger; occurring most frequently when the tube rests on a diseased area of the bowel—such as may be left after the separation of peritoneal adhesions. This accident can be avoided by the frequent lifting of the tube after cleaning, or its replacement, after some hours, by a shorter and smaller tube.

There are certain cases where we always fear subsequent leakage of faeces. Where the outer intestinal coats have been torn in the separation of adhesions, or where a part of the bowel wall is in a doubtful, lowly vitalized condition, from adhesion to a suppurating tumor, or abscess cavity. And it is in these cases that the large glass drainage tube serves a most valuable purpose by providing for the free evacuation of faeces if any should escape from the intestine. This accident is not uncommon and is sometimes unavoidable, and often the faecal discharge, though at first composed of all the contents of the intestine, will subside as the patient recovers until all passes by the natural way.

The last sequelæ of drainage to which I have alluded is ventral hernia. The drainage tube, by preventing perfect approximation of muscles and fascia, undoubtedly to a certain extent predisposes the patient to subsequent ventral hernia. The accident, however, is not a very common one, having occurred, in my own experience, in about 5 per cent. of the drainage cases. And it must not be forgotten, in this connection, that hernia also occurs when no tube has been used.

When hernia follows laparotomy it can always be cured, safely and easily, in a subsequent operation, by the thorough exposure of the recti muscles and the fascia, the complete removal of all cicatricial tissue, and suturing as in any case of primary laparotomy.

In conclusion, I will very briefly repeat the chief principles which I have attempted to impress in this paper:

1. The abdominal drainage tube, properly used, does not increase the mortality after laparotomy.
2. Confidence in this fact is necessary for a correct determination of cases requiring drainage.

3. Frequent careful cleaning of the tube is of the greatest importance.

4. The few annoying sequelæ attending the use of the drainage tube can be avoided or easily cured.

5. It is safest to use the drainage tube too often, rather than too rarely, as we would in case of doubt use any other precautionary measure.

RECOVERY FROM SYMPATHETIC OPTHALMIA INDUCED BY A SARCOMA OF THE CHOROID.

Read in the Section of Ophthalmology at the Fortieth Annual Meeting of the American Medical Association, June, 1889.

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Mr. M., aged 56 years, a robust man of regular habits, noticed in August, 1887, a gradual failing of the sight of his right eye; and by the end of September the sight was entirely extinguished. Up to that time he had no pain or unpleasant feeling in or about his eye; but during October he had frequent paroxysms of violent pain in the blind eye and extending over the right side of the head.

October 29, after a very severe attack of this headache, Mr. M. called for a consultation, and the examination of the eye showed the following conditions:

"Slight œdema of the upper lid; fulness of conjunctival and episcleral veins; hazy and lusterless cornea; shallow anterior chamber; pupil immobile and dilated *ad maximum*; lens transparent, but vitreous absolutely impenetrable for light; T. + 3: no perception. L. E. V. = $\frac{2}{3}$ with + 2 D.; normal fundus."

As the sight had been slowly and painlessly extinguished before any of those violent symptoms of glaucoma appeared, it seemed most likely the glaucomatous state was caused by an intra-ocular tumor. The removal of the eye, therefore, was urgently advised, but as usual, the patient was not prepared to accept this advice at once. However, after he had gone through a few more and exceedingly severe attacks of hemicrania, he became very anxious to be relieved of the source of his suffering; and November 5 the eye was enucleated; the instruments were disinfected with carbolic acid (5 per cent.); the eye and lid was washed with sublimate solution (1:5000); the wound was closed with aseptic silk and dusted over with iodoform.

Neither on the day of the operation nor on the two following days when I visited the patient at his house, anything unusual could be noticed in the external appearance of the left eye; nor was there any particular occasion for using the ophthalmoscope on those days, as the patient did not observe any disturbance of the sight, and de-

scribed the feeling in his left eye as perfectly natural. As the healing progressed very satisfactorily the patient was instructed to call at the office in two or three days. He did not come until November 12 because the right eye was doing well; but since two days, he said, the left eye had been getting red, sensitive to light, and the sight seemed to grow a little dim. This was found to be true, V. being only $\frac{2}{3}$; slight pericorneal injection; clear cornea and anterior chamber; pupil of medium size; numerous posterior synechiæ which however were all easily broken by a few instillations of duboisine. When the pupil was fully dilated its field presented a very peculiar appearance under focal illumination. In the center there was a clear area exactly corresponding in size and form to the form of the pupil before duboisine had been used. The outline of this clear space was marked by a circle of very fine brownish dots (pigment from the synechiæ), and beyond this circle the anterior surface of the lens was covered with a film made up of innumerable thin and short fibres of a light brown color, irregularly curved and bent and promiscuously mixed together into a loosely woven network. Plainly visible though this film was by focal light, it offered surprisingly little obstruction to the ophthalmoscopic examination by which no disturbance in the vitreous and fundus could be detected. Under the use of duboisine the pupil was kept dilated and the pericorneal redness slowly disappeared; but otherwise no change occurred during the next ten days. In the night of November 24 a fire breaking out in the neighborhood, the patient stood for a long time at an open window to watch the fire and was thoroughly chilled. The eye became very red, painful and tender to the touch. All these symptoms, however, had subsided under warm fomentations and absolute rest in the dark room, when in the night of December 9, the patient accidentally gave his eye a severe blow with the finger.

In the morning (December 10) his sight was so poor that he could not recognize any one near him; conjunctiva of the lower lid red and swollen; copious secretion of mucus; much pericorneal injection; cornea streaked with interstitial opacities; lower part of iris swollen and dull, and the pupil not as fully dilated as before. Cocaine was used in addition to duboisine; and the eye improved so that December 17, the cornea was again clear and bright; V. good; and the fundus which could be seen very well with the ophthalmoscope, showed normal appearance. But this favorable condition did not last long; for on December 20 it was recorded "the pericorneal injection increasing; cornea streaky; dense exudate along lower border of pupil." And from that day the eye became worse every day; the cornea very cloudy; iris swollen, pupil