

be gently performed, otherwise the peritoneal covering will split longitudinally. The everted mucosa should be curetted away for the following reasons: 1. I have satisfied myself that it plays no part in the healing process. 2. The running thread of Murphy (Fig. 6) is more easily applied, and the danger of merely taking up the mucosa and not the other coats is done away with. 3. It permits of nicer coaptation, as, without curetting, the mucosa pops out between the couplers as a pulpy mass. A straight or curved needle threaded with No. 6 silk is used for inserting the puckering string (a description of which can be found in the *New York Medical Record*, Vol. xlii, p. 673, 1892) to fasten the intestine about the rubber tube after the

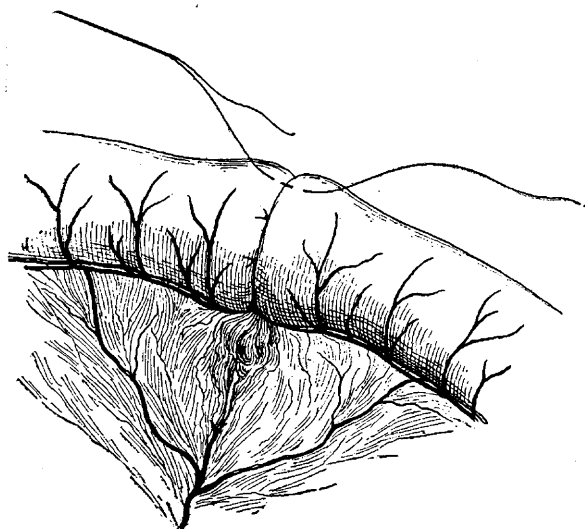


FIG. 9.—Anastomosis completed, showing Lembert suture.

former has slipped over the collars.* The puckering string is similarly inserted into the other intestinal end, and the coupler, having been previously prepared as described, is taken out of the absolute alcohol in which it was placed. The operator slips an intestinal end over one of the collars, to the line of junction, at the same time gently spreading the collars apart to facilitate the easy access of the gut. An assistant takes charge of the ends of the puckering string, and when the gut has been brought over the collar he makes one knot, and draws down until his puckering ligature strikes the rubber tubing, which he will perceive by the resistance offered; the tube



FIG. 10.—Rubber tubing showing puckering thread in center and sutures at ends after bone collars had dissolved. Experiment No. 4.

will not generally permit a too tight drawing of the puckering ligature on account of its resiliency, but to make absolutely sure that the tube is patulous, the end of a forceps or sterilized nail may be passed through the lumen; if this is found pervious the assistant finishes the tying of the puckering string. The other intestinal end is then slipped over the other collar and also tied. Of course, at this stage nothing can be inserted by which to determine that the tube is not shut off, but, after having tied one side, the assistant will know positively when he strikes the tube. The ligature is cut off short and the clamps are immediately removed, when the operated portion of the

bowel will be slowly distended with gas. An interrupted or continuous Lembert suture should be taken around the border, with an intestinal needle threaded with a No. 2 silk, to make the work more secure. (Fig. 9).

The rent in the mesentery may or may not be sewed. In those cases that were sewed, catgut was used; any bleeding vessels should be tied with catgut. The intestine is returned into the abdominal cavity as nearly as possible in a straight line, the site covered with omentum, and the abdominal wound closed in the ordinary manner. The wound is powdered with iodoform and a collodion dressing applied; gauze and cotton are placed over this, and then the bandage.

In the *Journal of Medicine*, January, 1897, will be found a detailed report of the experimental work. 17 Lincoln Avenue.

THE CAUSES OF DEATH IN ABDOMINAL SURGERY AND THEIR TREATMENT.

BY J. WESLEY BOVÉE, M.D.

PROFESSOR CLINICAL GYNECOLOGY COLUMBIAN UNIVERSITY, GYNECOLOGIST TO COLUMBIA AND PROVIDENCE HOSPITALS AND VISITING SURGEON TO WASHINGTON ASYLUM HOSPITAL.

WASHINGTON, D.C.

Great advances have been made in abdominal surgery during the past two decades and the mortality rate has been very materially reduced. As a fair illustration of this progress hysterectomy might be mentioned and may be said to have changed from an unjustifiable operation with a mortality rate varying from 80 to 90 per cent., to one of the most common of abdominal operations having a fatality of about 5 per cent. It is not necessary to state that this wonderful change is the result of the peculiar special attention devoted to this line of work. But contentment should not exist with a death rate following operation in this region, slightly less than that of unoperated cases. So far as it is directly due to surgical operations we should endeavor to reduce it to zero, and not until then will we be able to rest contented. The complete abolition of the mortality rate of abdominal operations will probably be encumbered with more difficulty than besets the arctic explorer in his attempts to reach the north pole.

We can hope to approach perfect results only by carefully studying causes of death in the individual cases and striving to apply the knowledge thus acquired.

Many deaths may be directly attributed to lack of skill on the part of the operator and assistants and it is to be hoped that with the constantly increasing advantages at the command of the younger element of the profession, together with the decided tendency of the age to specialism, that untrained, pragmatic operators, if they exist, will not invade the domain of abdominal surgery. But the most experienced and skilful have a considerable death rate, very low, it is true, but higher than they themselves desire; yet it is from this class of workers we must expect the methods for still greater success. Of course a small percentage of deaths after these operations has been due to intercurrent diseases, but it can not be denied that some of these sufferers yielded to the disease more readily or perhaps directly because of the operation. There is little doubt that ether will cause pneumonia when administered for surgical purposes and I have seen cases of phthisis that closely followed abdominal or pelvic disease and operation. This I

have noticed in a number of cases of hysterectomy for uterine fibroids and in cases where there was considerable shock, hemorrhage, sepsis or other complication, that for a time severely taxed the recuperative power of the patient. Whether there was any relation between the disease for which the operation was done and the subsequent lung involvement can not now be stated. I am inclined to blame the operation rather than the disease for the appearance of the tubercular infection, but as yet we are not warranted in absolutely tracing this cause and effect.

Whenever possible, and usually it is, a careful study of the condition of patients before subjecting them to such an ordeal as an abdominal operation, is imperative.

Systematic autopsies on fatal cases will furnish valuable information for future use. In this way we can find why we failed to save our patient and thus be fore-armed for another case nearly similar. We have had occasion to note this in cases of chronic suppurations of the adnexa and of the vermiform appendix. Occasionally we will find an extra collection of pus behind the liver or even over by the spleen in appendicitis and oftentimes collections of pus exist in the liver and kidney in puerperal sepsis.

The causes of death from these operations may be conveniently divided into five classes, viz.: 1, operation and complications; 2, bad condition of the patient before operation; 3, intercurrent diseases; 4, bad after-treatment, and 5, accidents.

Many operations are done at a time when death seems imminent from sudden severe hemorrhage, as in ruptured ectopic pregnancy or severe gun-shot wounds of the abdomen, or from bowel obstruction or pressure from large tumors, or even, from prolonged suppuration or acute sepsis. Many different injuries may demand immediate section and these cases will necessarily increase the mortality rate of laparotomies. In these cases very little time is at the disposal of the operator for investigation of the condition of the patient before operation, other than a very superficial one that determines his decision to operate without loss of time, and usually during it haste is one of the most important features of his work.

Many times the abdominal condition is not the only one threatening life and in many cases the risk from anesthesia is greater than from the presence of an abdominal tumor. Oftentimes, too, uranalysis may reveal the presence of kidney suppuration at the same time as pyosalpinx or other form of pelvic or abdominal suppuration. Again a large abdominal tumor may have caused prolonged and strong pressure on the lungs, heart, abdominal blood vessels and other portions of the body and have caused a considerable relaxation or atonicity of those structures. If this be the condition and the tumor removed, then there exists great danger of engorgement of the veins thus relieved from pressure and of resulting death from heart exhaustion. We have previously referred to this more in detail in a paper published in *The Virginia Medical Monthly*, 1892, xix, 101.

Concerning the operation nearly everything devolves upon the operator, and the manner in which he performs the operation will usually govern the result. The principal complications of intra-peritoneal operations are shock, severe hemorrhage and sepsis. It is usually one of these three that causes the fatal issue in the unsuccessful cases and its work is generally not long delayed. Death from shock usually occurs some time within the first 72 hours.

Severe primary hemorrhage may prove fatal during the operation or within a few hours afterward and secondary loss of blood may occur at any time during the convalescence and be sufficiently severe to cause death. Fatal cases of secondary hemorrhage as late as from twenty to forty days after operation have been reported. Sepsis resulting from infection during operation may prove fatal after the first day or may be introduced in wound dressings some days later and then hasten the patient's death.

Other conditions produce fatal results, though less frequently, and generally at a time more remote from the operation. Of these mention might be made here of bowel adhesions producing obstruction, injuries to the various viscera, as liver causing hemorrhage not noticed at time of operation, kidney or ureter causing either hemorrhage or urinary extravasation with subsequent infection, or perforations of the intestine that through negligence or necessary haste, have been overlooked. I have been surprised in practicing experimental surgery on the ureter in dogs by the severe hemorrhage that often follows section of this duct and its nutrient vessels.

While separating adhesions of tumors to bowel it is easy to injure that tube and if the wall be friable, as often is its condition when attached to suppurative masses, necrosis may later produce an opening through the bowel wall, even though sutures have been employed for reinforcement. Small openings accidentally made in the omentum during operation may admit and strangulate a loop of small intestine, thus terminating life. A considerable number of autopsies have demonstrated this as the cause of death. Urinary and fecal fistula may cause death by exhaustion. We had a death from fecal fistula three weeks after operation and recall one case, not our own, in which death was produced a few weeks after operation, by a fistula in the lower end of the abdominal wound discharging fecal matter and urine. In incarcerated hernia there is great danger of exhaustion following diarrhea that sometimes attends the liberation of the bowel. We had one case in which there was obstruction of the bowel before operation and immediately after it was finished the bowels began to move, twenty-three movements occurring within the next six hours and during the remaining hours of life, a constant discharge from the bowel continued in spite of vigorous treatment to check it. It also terminated a case of volvulus for us in 1891, on the day following operation. Ventral hernia in the line of incision of the abdominal wall caused death in a case not long since in the practice of a surgeon of this city, about the fifth day after operation. She was thought to be suffering from la grippe and the hernia was never suspected, but the autopsy readily revealed the cause of death. Shock is produced in some degree, in every surgical operation, but many causes contribute to it. Anesthesia alone in prolonged operations may be sufficient to produce a fatal degree of shock. Hemorrhage, already mentioned, though slight, may have a like effect. Mutilation of vital organs is a frequent cause and removal of large tumors, by taking a large amount of blood from the circulation in some cases, as well as by bleeding the patient into her own veins as a result of removal of the pressure from large abdominal veins, and from heart, lungs and other viscera, has a similar tendency.

One of the most potent causes is slowness of decision and execution on the part of the surgeon. The

very slow surgeon will probably not have nearly as good results in severe cases as does the quick-thinking and rapid-working one. Exposure of viscera during operation is a frequent cause of fatal shock and this is, of course, very materially aggravated if temperature of the operating room be low. I have repeatedly seen abdominal surgery done in rooms having a temperature of scarcely 60 degrees F. The danger of this is certainly very apparent to all.

The ureters have been injured during operations followed by urinary extravasation and discovered only at the autopsy. These canals have often been unconsciously ligated as in hysterectomy or the removal of a large intra-ligamentous cyst. The peritoneum has often been badly injured and bowel adhesions occurred often causing obstinate obstruction that was relieved by secondary operation, but more often has resulted fatally. The author has lost one case in this manner after secondary operation and Marcy, of Boston, has reported very unpleasant experiences of this kind. The absorption of ptomaines, following this impairment of bowel movement, often results in death. An irritable stomach may prevent the taking by the mouth of sufficient nourishment and these cases are not the best for bowel feeding, consequently gradually increasing exhaustion ends the drama. Some patients are panic-stricken soon after operation and can not well be controlled, gradually wearing themselves out. Others may be attacked with insanity in some form that may or may not terminate fatally. These conditions always render recovery doubtful. The effect of ether on the kidneys or lungs often leads to a fatal termination by producing defective respiration, pneumonia and by urinary suppression. Chloroform, aside from its action on the heart and lungs, may also produce anuria.

If the preparation of a patient for operation be neglected we may here have furnished a fertile cause of death a few hours or days after operation. Insufficient or extreme purgation are not a part of the proper preparation of patients for operations of this kind. In one of the author's cases that is now recalled, operation was compulsorily postponed, as within a few hours immediately preceding the time set for the operation eighteen bowel movements resulted from over-purgation, and the patient, though usually strong, fainted on rising from the bed. One week later the operation was successfully done. So also must the after-treatment not be improper. Fatal bowel adhesions may result from the long postponement of the use of purgatives, especially if severe pelvic or abdominal adhesions existed before operation. Injudicious diet has caused no small number of deaths weeks after operation.

Enough has been said earlier in this paper concerning the influence of intercurrent disease as a factor in the production of a fatal result to abdominal surgery, but we must ever be alert for organic diseases intercurrent or concurrent with this work. It is easy to overlook the possibility of such an occurrence until death has placed its hand on our patient. It is not to be understood that they necessarily prohibit such important surgery, but that they are always to be given sufficient consideration.

The accidents always besetting the abdominal surgeon are varied and numerous, and serve to keep him constantly on guard. They are by no means unavoidable in many instances. They will always complicate the work of the inexperienced and careless surgeon

far more than one careful, wide-awake and experienced. In fact, a very large proportion of accidents in this line of surgery are the direct result of improper surgery. A very common one is secondary hemorrhage. This often follows removal of the spleen, kidney or a uterine appendage. I must acknowledge having lost a case in this manner in spite of a second opening of the abdomen. The cause of this accident is, of course, improper ligation of the blood vessels severed in the operation, or too much freedom of movement allowed to the patient after the operation. Too much tissue, besides the blood vessels, is included in the ligature, followed by shrinkage of the stump. This allows the ligature to slip off or, by the lessened pressure on the vessels, the blood to be forced out through their cut ends. Both these results are facilitated by a restless patient moving suddenly and vigorously about the bed, and perchance getting out of bed when the eye of the nurse is directed elsewhere.

After this quite casual recital of the principal causes of the mortality incident to abdominal surgery, it may not be out of place to point out some of the procedures that will assist in lessening the proportion of cases that do not survive operation. In doing so I regret I can offer no new suggestions that have been found worthy of note. It may be the principle of some surgeons to refuse operation to some cases that do not appear to have much chance to survive it, even though they are in a practically hopeless condition if left without surgical treatment. They, no doubt, believe they are doing more for the reputation of surgery in pursuing this course. While not agreeing with men of that opinion, I am not prepared to say I am right and they are wrong. Certainly, their mortality rate should be much better than that of the operator who will do for any living person all his skill and experience will permit. As many times death has resulted from insufficient knowledge of the real condition of the patient at the time of the operation, it follows that to be very familiar with the physical condition of a patient before operation is an essential feature of abdominal surgery. The principal organs of the body should be studied, both as to their function and organic condition. In the vast majority of cases, the operator has an abundance of time for careful study before operation. The detection of the localized tumor or other abnormality is not sufficient, but careful exploration should be made of all the principal organs of the body. The condition of the kidneys, heart, lungs, liver and gastro-intestinal canal are particularly important, and when possible, the function of these organs and their accessory structures should be normal or nearly so, before an operation is performed. This will assist in the after-treatment, as well as lessen the susceptibility to shock. A healthy, vigorous organ or system of the body is less easily influenced by shock, ptomain absorption, etc., than is one that is sluggish, incompetent or impaired. Urinalysis is a very important matter in this work. We have learned that an examination of the urine that tells of the presence or absence of albumin, the specific gravity and reaction of a specimen voided by the patient, is of no earthly consequence. We must know the amount of solids passed by the kidneys in twenty-four hours, the presence or absence of renal casts, and whether any abnormal ingredients are present. The urine must be drawn by catheter to prevent its being contaminated by extraneous matters, and we must know how much these points are modified by insignificant conditions. Urin-

alysis is a perfect index of the kidney function, and oftentimes will tell us much about other organs that might not be noticed by any other kind of examination.

After we have carefully studied the condition of the patient we turn our attention to the operation, upon which depends greatly the result. We should always know when to stop, and not to place upon the patient a greater load of shock and other handicaps than she can stand and recover under. Preparations should be made in every instance for rapid and proper operation. As very few are competent to administer anesthetics, special attention should be given to the selection of the anesthetizer. Many deaths are directly due to the anesthetic, and therefore we should carefully study the action of the anesthetic upon the patient. The most intelligent and best informed assistant should be the one to give the anesthetic; trusting this part of the operation to nearly any one that can be procured is extremely reprehensible.

The author has found the admixture of oxygen with chloroform to be very satisfactory. The amount of time consumed in giving the anesthetic is important and, of course, the rapidity of the operator will to a great extent control this. Careful and clean surgery should always be done, but no time should be used during an operation for study. The operator should be quick to appreciate the work before him in any case, and to do it in the shortest possible time consistent with good work. In cases in which we have reason to expect much shock it is very important to do everything to prevent it. The heating of the operating table by hot applications in the way of hot water pipes or hot water bags is of untold value. The temperature of the room should be about 85 degrees F., and every assistant well trained to the work. In this way only is rapid work possible. Some of the principal points to be remembered by the surgeon are to do as much of the work as possible by sight, to expose no viscera not to be removed, either to contamination with discharges in the field of operation or to the outside air. Drainage is oftentimes necessary, and probably if more drainage was practiced more permanent cures would be secured. Close all peritoneal tears if possible, and thus remove danger of intestinal adhesions; endeavor to leave no bleeding surface. It is not necessary to wait until the patient has been removed from the operating table to begin the use of stimulants. Very frequently a liter or less of normal salt solution run under the breast of a woman during operation will turn the course of her condition toward recovery. I am firmly convinced that I have seen a great many women saved by the prompt use of this agent on the operating table. I have seen bad cases recover in which artificial respiration was necessary throughout nearly the whole operation. If clean surgery has been done, when shock lessens convalescence begins and continues steadily. If intestinal tears be made during operation they should be isolated completely, that the peritoneal cavity will not be infected, and repaired as soon as possible. If the bowels are kept moving by cathartics adhesions are not so apt to occur. Over-feeding and under-feeding are bad for these cases, though the latter is the less harmful. We must not feel that our patients are out of danger when the bowels have been moved once, for many cases of bowel obstruction have been noticed as late as the second or third week, when all seemed serene, and rapidly proved fatal. Fecal fistula following operation is, to say the least, a very disagreeable complication

at all times, and if large and connected with the small intestine, will perhaps kill the patient. We very vividly remember a fistula connecting the ileum with the vagina that proved fatal about three weeks after operation.

Ureteral and kidney fistulæ may cause death by infection of these organs. Those connecting with the bladder will usually close spontaneously if that viscus be properly drained.

Sepsis is a very difficult condition to contend with. Many of the operations are for this cause, and a good many die from it that were infected during or following operations for other causes. As bacteriology is making such praiseworthy progress in sero-therapy, we can with reason hope for the successful treatment of this condition in some such manner as is being applied to puerperal sepsis.

But at present we are almost powerless against it, and the patient who has already undergone the ordeal of an abdominal operation has very little chance against it. Fortunately, we have it to contend with far less often than formerly. We must not allow this opportunity to pass for saying a good word for the infusion of normal salt solution in these cases of sepsis. It is certain we have had cases in which it acted almost magically both in reducing temperature and improving the condition of the pulse. We need say nothing more concerning accidents, except that good judgment is required, and that in ligating blood vessels in the abdominal cavity it is advisable to include in ligatures as little of the tissues about vessels as possible, thus preventing the tendency to secondary hemorrhage.

DISEASES OF RAILWAY MEN CAUSED BY THEIR OCCUPATION.

Read by title at the Third Annual Meeting of the American Academy of Railway Surgeons, held at Chicago, Ill., Sept. 23, 24, 25, 1896.

BY J. F. PRITCHARD, M.D.

DISTRICT SURGEON ON THE CHICAGO AND NORTHWESTERN RAILWAY.
MANITOWOC, WIS.

All occupations nearly, affect the human economy in some peculiar manner. Where there arises a strain of the physical system we find diseases affecting the muscles, joints, bones, etc., and when the strain is mental the nervous system is found involved. These facts are so common that they are truisms and need no demonstration.

We would expect to find among railroad men a complication of diseases from the very nature of the occupation. There is no doubt of intense mental strain at times, and the general muscular system is subject to a degree of fatigue almost past endurance, which must produce its effect; but I find upon investigation that but little attention has been paid to the subject, and my only hope now is to direct your attention in this direction in order, if possible, to reach some clear conclusion regarding the effect of occupation on railway men, and its ultimate effect in case of injury.

The following, quoted from a stray medical publication, shows evidently that others have been giving this subject attention.

"Neurologists are watching with great interest a new expression of nervous malady which has appeared since the introduction of the Broadway Cable cars and the Brooklyn trolley system. With the exception of Chicago there are no cities having so much street traffic as New York and where these methods of trans-