

DISCUSSION ON

THE CAUSES OF DEATH FOLLOWING ABDOMINAL OPERATIONS.

Infections: Source, Prevention, Treatment.

DR. WM. M. POLK.—The source of infection is, of course, the pathogenic germ or germs underlying inflammation. Some more virulent than others, but all opposed to physiological forces. We are concerned to-night with the many lines of communication through which they gain access to the wounds we make. Were these wounds less intimately related to so vital an organ as the peritoneal sac, we might afford a less searching inquiry than is proposed by our President this evening. But when we reflect that looseness in dealing with this problem means death to so many of our patients, we welcome the opportunity to take stock of our methods and work.

Eternal vigilance is the price of more things than liberty. It is essential to freedom from wound infection. But people differ in their conceptions of vigilance and this brings up the question of the individual conception of cleanliness, the essential factor in combating infection. Daily experience tells us that ideas of personal cleanliness vary considerably. No matter what the cause, the effect is seen in the varying results obtained in the same hospital by different workers, surgeons and nurses. The testing point then in seeking out the source of infection is removed from the contemplation of the pathogenic germ and fluids to the habitat of their destructive forces, and the first of these is in the lax conception of personal cleanliness on the part of those who come in contact in every way with fresh wounds. The higher the ideal of cleanliness the surer the work done to secure it. Presuming that the operator is clean, his first duty is to make himself sure that those who aid him fulfill his ideals. Taking, then, the accepted methods of combating wound infection, let him instruct his aids as to the best manner in which to fulfill them, and if every hand is then honest, there is little to fear from the outside. But the human mind is an uncertain quantity and should not be

overweighted with too much detail. Simplicity of procedure is then to be commended, rather than elaboration. Study to do work in the simplest and most direct way compatible with the end sought.

It is not worth while going into the question of just how ligatures, sponges or pads, instruments, gloves and other accessories of an operation should be prepared, for this would be to this audience but the alphabet of our subject. There is one end to be attained, viz., sterility of everything brought in contact with a wound. The manner of accomplishing this is well understood; it remains for us to be sure that it is done.

Turning now to the sources of infection inherent to the wound itself, we approach a more difficult problem. One which deals with condition of the tissues wounded and with the resistance of the patient. First as to the condition of the operative field. The normal skin is a well recognized source of infection. No one can say beforehand how deeply into its numerous glands and follicles pathogenic germs may have penetrated, but it is a fair assumption that proper cleansing of the surface will so far reduce this element of infection as to render futile the efforts of the little that may remain concealed beneath. A suppurating skin surface cannot be made even approximately sterile, and incision through it into such delicate regions as the peritoneum or open plains of cellular tissue should, if possible, be avoided—but if made extraordinary care should be taken to protect and cleanse the more delicate and susceptible structures beneath—and yet it is remarkable how much infecting material a sound peritoneum will tolerate. But a wounded peritoneum, or one containing already fluid, or one too long exposed or too freely manipulated is robbed of much of its resisting power. Hence the need for the most painstaking care on the part of the operator whenever that sac is involved. The scope of my subject would relieve me from the task of dealing with the vagina as a source of infection were it not that we so often are compelled to drain through it. This makes it incumbent upon everyone who (at any rate), enters the female abdomen at any point below the umbilicus to see that this canal is clean. I doubt if any vagina can be made even approximately sterile, but gravity comes to our aid and by holding such infiltration as may originate there in the bottom of the pelvis, gives time for the peritoneum to erect its barriers against a general invasion. The exception to this is to be found in cases such as carcinomatous ulceration and when cleansing of the vagina and cervix or vulva has been neglected.

Turning next to conditions within the abdomen—the intestines first engage our attention. They are a constant menace and cannot be handled with too great care, and, if wounded, too promptly or too thoroughly repaired. Long operations always expose the patient to defective action on their part, and even if we could feel sure that no pathogenic germ could pass through its

inert though uninjured wall, yet the nerve inaction is a menace in that it promotes adhesions, while by completing obstruction comes death. Therefore, it is incumbent upon us to clear them from the field as much as anatomical attachments will permit, and for this purpose a plentiful supply of gauze is imperative.

In dealing with collections of pus within the abdomen, precise dextrous ingenuity comes into play as fully as in any field that can be entered. The appliances for accomplishing this are well it is only necessary to employ them judiciously, and herein lies a supreme test of the operator's conception of cleanliness and his ability to enforce them upon himself and his aids.

The adequate treatment of surfaces denuded of peritoneum is of prime importance in this problem of infection. Such spots have a feeble resistance to infection compared to the normal surface, hence a need for covering them whenever possible. They are not merely foci for a dangerous and speedy infection, but by their proneness to become attached to impending viscera may ultimately mar a beneficent work. But we are frequently beset by the horns of a dilemma when working in the abdomen, and in aiming to avoid one we must not be impaled on the other; therefore judgment must be exercised in dealing with such accidents as raw surfaces that we may avoid too long exposure of the delicate structures in the field.

We now come to the question of the resistance of the patient, a fruitful source of disaster in our work, where opportunity for preparation of the patient is so often at our convenience is the temptation to overestimate the resistance of the patient. The only way to avoid this error is the careful study of their resources as afforded by the state of the organs in general. When, therefore, an emergency such as hemorrhage or the rupture of a pus sac does not call for immediate action give heed to the general condition available for resistance to the unavoidable demands of the operation.

DEATHS FROM INTESTINAL OBSTRUCTION AFTER ABDOMINAL SECTION.

DR. JOSEPH BRETTAUER.—When asked by your Chairman to take part in the discussion of the subject before us to-night, with a specific view as to the occurrence of intestinal obstruction as a cause of death following abdominal incision, I hesitated to accept the task, being conscious of my limited personal experience. Since, having looked over my records of abdominal surgery for twelve years, I find myself in a position even less qualified to discuss the subject, as there is not one case mentioned of intestinal obstruction (post-operative, abdominal), as a cause of death; I find a record of a distinct and clear case after vaginal hysterectomy, which I suppose was recognized too late, as a second operation was of no avail. While I do not place myself on a pedestal like a writer who, in 1893 said: "Of peritonitis follow-

ing an operation, I know nothing, except that in a general way it is treated by salines," I feel that my good fortune in not losing one out of several hundred of cases from intestinal obstruction, is due not only to the strictly limited gynecological field of my material, but also to certain methods of technique and after-treatment.

During my service as assistant at a large surgical clinic, I saw a number of cases which were placed on record as deaths from peritonitis, which would now undoubtedly be recognized as cases of intestinal obstruction; they are still vivid in my mind and make it somewhat easier for me to treat the subject, though in a general way.

There are several causes of post-operative intestinal obstruction, all more or less mechanical at the outset. A loop of intestine may be adherent to the raw surface or to the pedicle; several loops around an inflammatory focus may become adherent to each other, a slit in the omentum may cause an internal incarceration, or the mesentery of a loop of intestine may become twisted and form a volvulus; finally by some accident a loop of intestine may be included in the suture closing the abdominal incision. These are the most common causes for the occurrence of post-operative ileus; on account of the presence of adhesions the bowel, during peristalsis is bent upon itself; at first the lumen is only partly obstructed, but with the increase of distention in the afferent part, obstruction becomes more and more complete and the adhesions firmer; the circulation of that particular loop is interfered with to such an extent that the walls become gangrenous, the localized process becomes general and the ultimate picture is one of acute sepsis, which cannot be differentiated from that of acute septic peritonitis. When we consider the etiology of ileus, it is at once apparent why cases where operation was performed for some acute inflammatory trouble within the peritoneal cavity, lead in the frequency of this complication, especially cases of acute gangrenous appendicitis. These, however, belong more to the domain of the general surgeon. We are more interested in the cases of pelvic inflammation which come next in order of frequency. Statistically, other conditions for which operations were performed, like fibroids, cysts, tubal pregnancies, etc., are of no import when compared with the number of cases of ileus occurring after the removal of the appendages during an acute inflammatory process. I am sure that those of you who, during their career as surgeons, had a period when they deemed it advisable to operate during the acute stage of septic or other infection, will corroborate me in the statement that then, and only then, intestinal obstruction was met with rather frequently; those were the days of the glass drainage tube and of gauze packings, when the favorable aspect of the post-operative prognosis depended upon the number of yards of yellow gauze stowed away in the pelvis. To me who have never passed through such a period, it was astonishing that ileus did not occur oftener.

The cases which I have seen were of this character, and as well as I can remember none of them recovered. They were either believed to be cases of septic infection with general peritonitis from the onset, or were recognized only in extremis.

It is true there are instances of early intestinal obstruction which are so nearly like the type of a peritonitis, that a differential diagnosis is barely possible; fortunately they are rare.

The typical picture of a case of intestinal obstruction is as follows: The patient has recovered from the effects of the anesthetic and shock; after the third day the functions of the bowels are established and everything seems to run smoothly, until at the end of the first or the beginning of the second week an inability to defecate, sometimes accomplished by severe colicky pains, is noticed; the pain becomes more frequent, distinctly paroxysmal, abdomen distended, pulse and temperature normal or slightly elevated; efforts to move the bowels may at first be followed by the escape of some gas and small fecal matter, but after twenty-four hours are without result, nausea, followed by vomiting sets in. The typical facial expression of a patient with incarcerated hernia is never missed. Of course, left to destiny, there is only one outcome possible at this stage; gradually pulse and temperature rise, a sudden collapse and the end. All this may happen within 48 hours or be prolonged for some days, dependent upon the general condition of the patient and the ability to resist the resulting septic toxemia. Were it always like this I am sure ileus would be eliminated as a cause of death, and only mentioned as an unpleasant complication, as anyone, even with limited experience, would recognize the condition and take prompt action.

After operations during which a severe handling of the intestines could not be avoided, either on account of adhesions or on account of the topographical relations of large growths, very often a condition is met with which used to be called pseudoileus, and has now been properly named "paralytic ileus." It may simply be due to an irritation of the inhibitory centers through mechanical insults to the visceral peritoneum, or may be an initial symptom of septic peritonitis. Now in this condition we find the distention, the nausea, possibly the vomiting; the pain, however, if due solely to paralysis, is hardly of the severe character, if due to sepsis lacks the attack-like recurrence. Twelve hours' close observation will show a more or less distinct difference in the pulse, possibly in the temperature. The general condition, if sepsis is absent, is not changed, the anxious expression is lacking. In these cases which start earlier, on the third or fourth day or sooner, close observation may lead to a proper diagnosis, but it is clear that inasmuch as both conditions may be present at the same time, no strict rules for diagnosis are possible; from personal experience I can say that now is the hardest and most responsible moment in the post-operative treatment of our patients.

Of course, we have all seen cases of obstruction due to firm adhesions, bands which tightly constrict loops of intestine oc-

curing weeks, months and even years after the primary operation. These, however, do not come within the scope of this discussion.

Recognized intestinal obstruction, if enemata, high or low, lavage of the stomach, change of position and slight abdominal massage have been of no avail, can, of course, be relieved only by reopening the abdomen and loosening the constricted part. This may at times be an easy matter, at others extremely difficult on account of the lack of room due to the enormously distended bowels, which may make it advisable to puncture them in different places before attempting to find the offending cause. Naturally conditions have to be dealt with according to their appearance. Intestinal resection with or without immediate anastomosis, anus *præternaturalis* are possibilities. The condition is a grave one, and the sooner it is recognized the better the prognosis.

Next to prompt and proper action when once the condition has arisen, prophylaxis is of great importance. While it is beyond our power to prevent the formation of peritoneal adhesions after operations, it is possible by the employment of proper technique to reduce the chances of their formation to a minimum in the vast majority of cases. Prolonged exposure to air, extensive handling of viscera and the employment of dry abdominal pads are apt to result in lesions to the endothelial lining of the peritoneum; therefore, the shortest possible exposure, Trendelenberg position and the employment of moist pads are advisable. The covering of ligated stumps, pedicles and raw surfaces with peritoneum is of the utmost importance and should always be attempted. Before closing the abdominal incision it is imperative that the patient be placed in the horizontal position in order to detect a possible displacement of a loop of intestine, through some opening in the omentum.

And now a few words as to the after treatment, especially as to the management of the bowels. In my opinion it is immaterial when and how the bowels are moved; in the majority of cases adhesions cannot be prevented in this way, nor septic infection aborted. In spite of what has been said and written on this subject I am to-day a firm believer in the temporary use of opiates in cases of paralytic ileus as well as septic peritonitis.

To the strict adherence of these rules, to the conservative attitude I have always taken in cases of acute inflammation, and to the rare employment of drainage I attribute my good fortune in not being able to report a case of my own.

SHOCK AND HEMORRHAGE AS CAUSES OF DEATH FOLLOWING ABDOMINAL OPERATIONS.

DR. CHARLES CLIFFORD BARROWS.—There are perhaps no conditions complicating abdominal operations or following immediately upon their performance of more absorbing interest to the surgeon than those of shock and hemorrhage. The symptoms

arising from these two conditions are at times so closely allied and the results dependent upon them so nearly similar that it seems entirely correct to discuss these two causes of death after laparotomy under the same head.

When a patient dies during an abdominal operation, or within, say twenty-four hours thereafter, the death is practically always due to one or the other of these causes.

During the past five years there have occurred in the Second Gynecological Division of Bellevue Hospital, twenty-five deaths from all causes following abdominal operations. Of this twenty-five, four have been attributed to shock and one to secondary shock, dependent upon hemorrhage. So that twenty per cent. of the fatal cases on this service have been due to these two causes. When one reviews the literature of surgical shock he cannot fail to be impressed by the unanimity of opinion which exists among practically all writers to-day as to the causes and diagnosis and treatment of this condition. And if we leave out the problem of treatment, the opinions expressed to-day are fundamentally the same that were taught us as medical students. The facts are so positive and clear that the surgical mind seems to have become crystallized on this subject. In no form of surgical procedure, excepting possibly brain surgery, do shock and hemorrhage prove so potent a factor in producing a possibly fatal result as in surgical operations within the peritoneal cavity, and the reasons are patent to all of us. Surgical shock has been described as a peculiar state or reflex depression of the vital functions, especially the circulation. Its onset is usually sudden, and results from severe irritation of the peripheral ends of the sensory and sympathetic nerves following an injury. It requires but little thought then for one to realize how apt injury of these nerves so abundantly supplied to the peritoneum is to be followed by this most serious complication.

In shock we have a diminution or paralysis of the vascular tone, particularly in the arteries, and with this a coincident weakness of the heart's action resulting in a disturbance of the circulatory balance from the unequal distribution of the blood. There is vasomotor paralysis, dilatation of the venous system, especially the large venous trunks of the abdomen and corresponding lessening of the quantity of blood in the arteries. The right heart becomes unduly dilated, the lungs and brain anemic in consequence, and unless the equilibrium of the circulation is restored, the heart ceases to beat, and the patient's life is sacrificed. The primary cause of shock is traumatism and in the prolongation and repetition of traumatism lies a potent factor for the fatal termination of one's work. In no sort of surgical work does the question of time bear a more important relation to freedom from shock than in operations within the abdominal cavity.

The predisposing causes of shock are those conditions which tend to lower the vitality and general power of resistance of the patient. Previous prolonged illness or loss of blood, high tem-

perature, general septic conditions of even the mildest type, impairment of the functional activity of the heart, lungs or kidneys, all may prove serious predisposing factors in the development of shock. Prolonged anesthesia and undue handling of the abdominal contents; traction on the pedicle of a tumor or forcible displacement of any of the intraperitoneal organs frequently aid in the development of shock.

The symptoms of shock are those of general depression; the pulse is rapid and feeble, the temperature of the body is lowered; the respiration becomes shallow and irregular and the functional activity of all the organs of the body is retarded. Muscular tone is diminished, and the sphincters may fail to act, causing involuntary evacuations and vomiting frequently occurs. In fatal cases the heart's action becomes more and more feeble; the pulse more rapid and thready in character; the extremities cold and a combination of cardiac and respiratory failure ends in death.

The diagnosis of shock depends upon a recognition and proper interpretation of this group of symptoms and is not, as a rule, a difficult problem, but its differentiation from the condition dependent upon hemorrhage after laparotomy is of great importance. For it may readily be seen that symptoms pointing toward one of these conditions may develop after the abdominal wound has been closed and it becomes necessary to decide promptly and positively whether the condition be due to shock or hemorrhage, since, if the latter be the cause of the condition present, it may become advisable to reopen the abdomen and search for the source of the hemorrhage—a very grave procedure and one frequently in itself followed by fatal results. So that the differential diagnosis between shock and hemorrhage after laparotomy becomes one deserving our most serious consideration, and in many cases it is by no means a simple proposition; since in both we have rapid and feeble heart action, shallow and irregular respiration, dilatation of the pupils, coldness of surface and lowered body temperature, impairment of general muscular tone and possibly vomiting and disturbances of the mental faculties.

In hemorrhage, as a rule, the patient regains consciousness promptly from the anesthetic, is extremely restless, with a panting respiration from oxygen starvation; great thirst and fear of impending danger. On the other hand, in shock the patient gradually, sometimes rapidly, lapses into a semi-comatose condition, or into coma without restlessness or expressions of much bodily discomfort; the respirations are, as a rule, shallow and not so rapid as in hemorrhage.

Where the symptoms are of such gravity as to give us serious anxiety, we should at once resort to the use of the hemoglobinometer, which by demonstrating the decided impairment of the ratio of the red coloring matter, will lead us clearly to a diagnosis of hemorrhage.

The treatment of shock following laparotomy may be divided

into prophylactic treatment and immediate treatment. The securing of the best possible bodily condition of the patient before subjecting her to an abdominal operation; quietude of mind as nearly as it can be secured; the healthy establishment of all the bodily functions, so far as it is possible; the choice of the time of day when the vitality is at its best—all these have an important bearing on the subject. In cases of poor vitality where I have feared the supervention of shock during the course of a laparotomy, I am satisfied that I have derived great benefit to my patients from a suggestion made to me by Dr. Goffe several years ago; that is the intravenous injection of a normal saline solution prior to the beginning of the operation, in this way anticipating a condition which might arise. I have resorted to this procedure in several cases with much satisfaction.

When we come to the question of operation itself, an enormous amount depends upon the skill, deftness, promptness, accuracy and rapidity of action of the surgeon. In no field of surgery does dexterity and speed when combined with absolute thoroughness tell so well as in abdominal operations. Hasty and careless work may, because of unnecessary traumatism, be the very cause of shock, but dexterous and skillful work rapidly and safely done, by limiting the time of operation and thus cutting down the period of anesthesia, will surely be a valuable adjunct in reducing the possibilities of shock in abdominal operations. I believe that the use of a properly fitting rubber glove in all intraabdominal work proves of great advantage in lessening the possibilities of shock. When moistened with hot saline solution the hand thus gloved can be carried about the abdominal cavity with far less danger to its contents, covered by the peritoneum that most delicate and sensitive of all membranes, than the naked hand roughened by frequent scrubbing and other attempts at sterilization. No surgeon should needlessly manipulate organs which are not involved, but when this becomes necessary it can, I believe, be done with much less danger of shock by the gloved than the naked hand.

We are all, alas, too familiar with the routine treatment of shock as it is followed to-day. The lowering of the head, the securing freedom of respiration, the inhalation of oxygen, the application of heat to the body and extremities, and the administration of morphia and general stimulants go to make a picture clear to us from our earliest hospital days.

The two forms of stimulation that we have come to rely upon most in the service to which I am attached are strychnia hypodermically and the introduction, as promptly as possible, of hot salines into the circulation. From one to two thousand cubic centimeters of normal salt solution at a temperature of 110 degrees F. are introduced into the median basilic vein, followed by the same quantity by high enema and another thousand c.c. by hypodermoclysis. The saline introduced into the vein usually brings about a prompt reaction, which is continued and sustained by that

administered by enema and hypodermoclysis. Strychnia we give hypodermically in doses of 1-30 gr. every two or three hours. This with the routine treatment outlined above forms the basis of procedure employed by most surgeons in shock following laparotomy.

Personally, I believe that I have seen very beneficial results from the intravenous injection of a 1 to 25,000 solution of adrenalin chloride in quantities of 500 c.c., repeated in one hour. I have tried this drug hypodermically but with much less evidence of success.

The time limit imposed upon me will not permit of a very extended discussion of hemorrhage. I think we may accept as a self-evident proposition the statement that the death from hemorrhage after laparotomy should not occur. The imperfect ligation of vessels or pedicle, the slipping of ligatures, the retraction of vessels from the ligated pedicle, such causes of hemorrhage may be dismissed as not being liable to occur in the practice of gentlemen of this Society—these accidents being due to bad surgery. But there is a condition where hemorrhage of sufficient gravity to cause death may exist without discredit to the surgeon; that is where it has become necessary to make extensive separation of adhesions, leaving denuded surface of much extent so as to furnish hemorrhage sufficient to threaten life. Prolongation of the time in which the patient occupies the Trendelenberg position seems to favor the production of this form of hemorrhage after the body has been restored to the horizontal position.

Restlessness of the patient, a weak, rapid, small pulse, rapid, shallow respiration, indicative of oxygen starvation, great pallor, cold clammy skin, great thirst, distention of the abdomen, and if there be drainage, the free escape of blood will usually make clear to us the occurrence of hemorrhage of sufficient gravity to warrant interference. Satisfied on this point, we reopen the abdomen and mechanically control the bleeding points. The general plan of treatment already advised for combating shock will serve us also in hemorrhage.

SOME UNUSUAL CAUSES OF DEATH FOLLOWING ABDOMINAL OPERATIONS.

DR. G. H. MALLET.—In looking over the mortality of a series of eighteen hundred laparotomies the causes of death other than those of infections, ileus, shock and hemorrhage are found to be quite numerous, but many of them are so rare that they deserve but a passing notice.

In the early days of abdominal surgery, it was not uncommon to leave foreign bodies, such as towels, sponges, instruments, and even a seal ring has been left in the abdominal cavity to be recovered at a subsequent operation, or at the autopsy. Fortunately of late years, owing to the extraordinary precautions taken, such accidents are rare.

Of the pneumonias following operations, the so-called non-septic class add little to the mortality of the laparotomist. It arises from the irritating effects of the anesthesia, from exposure of the body during operation, or from inhalation of foreign matter. The septic variety arises from the lodgment of septic emboli from an infected focus. The so-called non-septic pneumonia has occurred seven times in Dr. Kelly's recorded seventeen hundred laparotomies. Six times the anesthetic used was ether, chloroform once. The prognosis of a pneumonia resulting from an anesthetic is favorable. It usually begins with a bronchitis and runs a typical course. Most of the cases that have come under my observation have had a bronchitis before taking the anesthetic.

Nephritis.—In every hospital with which I have been connected, it has been the custom to examine, more or less carefully, the urine of every patient, and a record kept from their admission to the time of their discharge. In cases where no evidence of kidney disease was discovered, I cannot recall a single case that died of acute nephritis after laparotomy, nor one that died of uremia.

In those in whom the kidney lesion was discovered, measures were taken to put the urinary organ in the best possible condition both before and after operations, and how few have died after operations when the kidneys alone showed evidence of disease.

In hospital statistics deaths are quite frequently attributed to nephritis when the diagnosis cannot be verified, and if disease of the kidney is found on autopsy, in many cases it has contributed to death only secondarily by reducing the resisting power of the tissues to the invasion of infecting bacteria.

Suppression of urine after abdominal operations is due to ligation of one or both ureters or to an acute exacerbation of a pre-existing nephritis. This can be determined in some cases by an examination of the urine or by the presence of symptoms of hydronephrosis, in other cases the diagnosis is made on autopsy. Ureters have been ligated by some of our most experienced surgeons, and both ureters have been tied by operators who were not novices, the cause of death having been discovered in the dead house.

In discussing unusual cases of death should be mentioned two cases of tetanus following aseptic celiotomies, reported by Dr. Coe, to the American Gynecological Society, in 1901. Those occurred in his own service with an interval of eighteen months. The first patient was operated upon for double pyosalpinx, and the operation consisted of curettement and the removal of both pus tubes intact with the diseased ovaries. No irrigation or drainage was used. Catgut ligatures and strict aseptic precautions were employed. No pus had been in the operation room for several days. Nothing unusual was noted about atmospheric or telluric conditions. The convalescence was afebrile. No symp-

toms of tetanus occurred until the sixteenth day, when the patient had been well enough to lie upon a lounge. The stiffness of the jaw and usual symptoms of the disease progressed slowly until the eighteenth day of this complication, when frequent attacks of general convulsions with marked episthotonus set in, and she died of exhaustion on the thirty-sixth day after operation, and the twentieth after the initial symptom of tetanus.

The other case occurred in the same hospital eighteen months later. The operation was for fibroid of uterus and ovarian cyst. Total extirpation of the uterus was performed in the usual manner. The operator was assisted by Dr. Jarman. Dr. Jarman immediately followed with a similar operation in which he was assisted by Dr. Coe. The other condition being identical with the former case, this patient made a perfect recovery. Dr. Coe's case made a normal convalescence until the ninth day, when stiffness of the jaw was noticed. The symptoms progressed rapidly, and notwithstanding that everything possible was done for her relief, she died on the eleventh day. These are the only cases of tetanus which have ever occurred in the General Memorial Hospital, and the mode of their introduction there is food for speculation. H. A. Kelly has noticed that three cases of death resulting from hemorrhage into the intestine after abdominal sections produced by intestinal ulcers.

In 1886 Dr. James Hunter reported a death following an abdominal operation where the autopsy showed the cause of death to be due to acute dilatation of the stomach.

In a series of cases that I have reviewed, apoplexy is assigned as the cause of death in two instances.

The most important of the so-called unusual cases of death following abdominal operations, is what Byron Robinson in a recent paper on "Sudden Death" calls the "uncontrollable embolus"; most sudden deaths arise from embolus. According to Robinson, embolus causes death (a) by anemia of vital centers (in the floor of the fourth ventricle), (b) by asphyxia, mechanical (in the pulmonary artery), (c) by infection, sepsis, (d) by destruction of parenchyma infarcts, devitalizing the maximum power of the organs. An embolus in general is broken up from the local thrombus through trauma, extra bodily activity or liquefaction of the thrombus. The chill following is the result of infectious distribution.

In the record of eighteen hundred laparotomies that I examined, death occurred in six cases from embolism. In but two of these was an autopsy permitted. In all the symptoms were such as to warrant a diagnosis. In three of the six cases the operation was performed for fibroma of the uterus, in one sarcoma of uterus, in one carcinoma of the ovaries, and the remaining case cystic degeneration of the ovaries. In all of these cases death occurred suddenly. The fatal terminations in one case, which was an exploratory laparotomy performed upon a patient having a

large fibromyoma, in twenty-eight hours after operation, in another forty-eight hours (fibroid), another case also fibroid, in four days; the case of carcinoma of the ovaries died on the third day; the sarcoma of uterus on the ninth day, and the cystic degeneration of ovaries on the tenth day.

In none of these cases was there any evidence of femoral thrombosis or phlebitis. Of the seven fatal cases of pulmonary embolism following abdominal sections reported by Wyder, and quoted by Dr. Coe in his paper on "Crural Thrombosis Following Aseptic Celiotomy"; in only one was pain felt along the course of the vein in the leg before the symptoms of dyspnea appeared, and in only one case was there more than one attack of dyspnea.

Kelly relates a typical case of sudden death due to pulmonary embolism when the symptoms pointed directly to previous femoral thrombosis, and also relates one case when several attacks of dyspnea preceded the fatal termination.

Pulmonary embolism is so intimately associated with femoral thrombosis that any light thrown on the etiology of this condition should be of value.

Dr. J. C. Clark (University of Pennsylvania Medical Bulletin, July, 1902), from an analysis of forty-one cases of femoral thrombosis, comes to the conclusion that this condition may follow a very simple abdominal operation almost as frequently as a grave one. In fact, the gravity of the operation, the amount of shock attending it or the condition of the patient before its performance does not have any apparent bearing as a predisposing influence in the production of this post-operative sequel. This thrombosis is not of infectious origin, neither is it due to traumatism of femoral or iliac vessels, but to a direct continuance of a propagating thrombosis arising in the deep epigastric veins which grows slowly downward until the femoral or iliac vein is reached, and then gives rise to a mural or partially obstructing femoral thrombosis with its attendant train of symptoms.

Three chief theories have been offered in explanation of the formation of thrombosis: (1) Alteration in blood; (2) Mechanical disturbance in circulation; (3) Lesions of the vascular walls. Dr. Clark believes the latter two explanations or the co-operation of them both to be correct.

Van Recklinghausen's theory of the mechanical disturbance of circulation Clark believes to be the best. Van Recklinghausen claims that it is not so much a slowing or irregularity of the blood current that leads to thrombosis, but that it is more directly produced by a whirlpool or eddying movement set into action by one blood current being injected into another at right angles or against the current. It is a physiological fact that the condition of the endothelial lining of the vascular channel is of prime importance in maintaining the fluid state of the blood and lesions or traumatism to the endothelium may, therefore, lead to throm-

bosis either by destroying the smooth non-adhesive surface of the endothelium or by producing necrosis of the endothelial cells—the deep epigastric veins enter the external iliac veins at a right or obtuse angle against the current and thus favors the formation of a thrombosis.

Can anything be done to prevent post-operative death from embolus? One may be forewarned by an accurate diagnosis of any pathological lesion in heart, artery or vein, and an ample time for preparation taken. Byron Robinson thinks that those deaths would occur less frequently if the patient were given anatomical and physical rest for from forty-eight to seventy-two hours before operation; and that visceral drainage more thoroughly induced by means of water and the intestinal tract thoroughly evacuated by about a half a dozen movements. He suggests that eight ounces of half physiological salt solution be drunk every two hours, six times daily, before the intended operation.

DR. EDWIN B. CRAGIN.—It seems to me that the causes of death are perhaps best understood by considering the improvements in technique which during the last ten years have lowered the mortality. The first thing that impresses me is the improvement in the method of administering the anesthetic. Formerly it was the custom to have a junior in the hospital, without any previous experience, give the anesthetic and nearly drown the patients; while to-day we have a skilled man administer it. Another thing which impresses me as overcoming a cause of death is the omission of drainage. I think that all of us who have used glass drainage tubes, and gauze drains through the abdominal wound, and compared the results obtained then with those obtained to-day without drainage, cannot but be impressed with the fact that the drains were the cause of death in many cases. Another thing which impresses me is the care that all take now to cover raw surfaces with peritoneum. We must look upon the leaving of raw surfaces as a cause of increased morbidity, if not mortality, from absorption of pus or fluids in the abdomen, from adhesions forming intestinal obstruction, etc. Now we know that these raw surfaces should be covered if possible.

I must confess I have not the same fear that Dr. Polk has of the vagina not being sterile. We can look upon the vagina, unless recently exposed to the source of infection, as being comparatively sterile. We must also bear in mind the possibility of removing some of the germicidal and protective power of the vagina by the thorough scrubbing to which it is sometimes subjected. In other words, we must be careful not to remove Nature's own protection, which is her inheritance.

DR. WILLIAM S. STONE.—There are one or two points in Dr. Mallett's paper regarding some of the unusual causes of death that I would like to refer to, especially that which he said as to the possibility of doing something to prevent such accidents as em-

bolism. It has occurred to me that it is of considerable practical importance in a certain class of cases that we should do that which is so often overlooked. It is now generally recognized how frequently in the presence of fibroid tumors, for example, there is present many degenerative changes in various organs, as the kidneys, the liver, the myocardium and in the intima of the blood-vessels. While these degenerative processes are present, particularly in the heart, they are not necessarily contraindications to operative procedures because of the direct causal relation between these tumors and the degenerations. It seems to me that possibly in this particular class of cases we are not apt to observe them closely enough and perhaps prepare them properly for operation by rest in bed and various hygienic and dietetic methods.

With regard to the diagnosis there is one prodromal symptom, the so-called Mahler's symptoms, which is found to be present in a certain percentage of these cases, *i.e.*, an increased rate of pulse without apparent reason.

DR. J. MILTON MABBOTT.—It has been demonstrated, in obstetric practice at least, that the vagina is usually sterile, and that the normal vaginal secretion is antiseptic, the gonococcus being the only microbe commonly encountered which is capable of withstanding its germicidal action. After labor the lochial discharge affords no such protection, but naturally remains sterile unless contaminated from without.

As I recall it, Williams has expressed the unqualified opinion that puerperal sepsis is always introduced from without by an attendant. I am inclined to agree with him with the exception that I do not believe that the attendants are always responsible. I believe the infection is sometimes caused by access of air to the vagina, due to a gaping condition of the vulva, the presence of microbes in the air explaining subsequent sepsis.

So far as the vagina is concerned, I did not mean to imply in my very general remarks that any rigorous measures should be resorted to to make it sterile. I believe that in the cases we see in the hospital it is impossible to render the vagina sterile. The kind of vaginas we deal with in our gynecological work points to this statement. It is evident that you should leave a normal resistance in the tissues themselves if one expects them to maintain normal resistance to infection, and this would not be the case here if very rigorous measures were adopted to render the vagina sterile.

This drainage through the vagina is one cause of subsequent infection, and further there is an unavoidable exposure of the gauze to the atmosphere during its introduction, and so the meshes of the gauze carry the microbes which are responsible for the sepsis. Therefore, I am surprised that in these days, when so much has been said regarding cleanliness, that so little is said regarding antiseptics. I believe we can secure asepsis more certainly by a rational use of antiseptics. I do not mean to say that

I draw any inferences regarding the possibility of a sound membrane taking care of a certain number of microbes. But I believe I now make more use of antiseptics than seems to have been done in recent years.

DR. L. GRANT BALDWIN.—A point frequently overlooked or not observed in many of our hospitals is the frequent handling of instruments, etc., by assistants in attendance upon operations. I believe it is a very important part of our technique to cut down the number of people assisting to a minimum and make the operation as simple as possible. I should also like to emphasize the matter of anesthesia; in my experience the anesthesia causes more deaths than any other one thing.
