

# TRANSACTIONS

OF THE

## Clinical Society of the University of Michigan

**Stated Meeting, December 2, 1914**

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Reported by REUBEN PETERSON, M.D., Secretary

### AN ANALYSIS OF THE MORTALITY OF ABDOMINAL SURGERY.

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During the past five years considerable discussion has been provoked by renewed inquiry into the cause of surgical death and Crile especially, followed by Bloodgood and others, has been active in emphasizing anew the factor of insult to the nervous system in its relation to operative mortality. This has resulted in bringing out statistics from various sources regarding the mortality of surgical operation, and this paper is presented with the purpose of adding a mite to the group of figures that are accumulating, trusting that in the course of time something fairly definite may be determined which will abolish the already small mortality of major surgery in favorable cases and diminish the death rate in desperate ones.

The study is that of the abdominal operations performed by the writer in St. Luke's Hospital of Cleveland from July 15, 1908 to July 15, 1914, a period of six years.

A fair number of patients operated upon during the same time, both in other institutions and private houses is not included, although the results are approximately the same, but the technic was not so thoroughly under control, neither could the morbidity and final results be so accurately ascertained. It, therefore, rendered a rather complicated task more simple and accurate to confine the analysis to the patients in one institution.

The study furthermore is confined to abdominal operations because they comprised more of the work than that in any other one region and also because the published statistics of others are more frequently found to be in this field.

One difficulty presented itself immediately and that was the absence of any standard by which mortality is estimated, no uniformity whatever existing as to the basis upon which results are reported by various surgeons the greater number giving none of the data underlying their figures. Under these circumstances the percentages must vary according to the personal equation of the operator. This fact has led to a discussion in the body of the paper of the cause of death in each case, so nearly as that could be ascertained, together with the duration of life in the fatal cases, leaving the reader free to compile his own statistics if he does not agree with the writer's ideas as to classification. No case was tabulated if death occurred after leaving the hospital but none was hurried out to die at home. On the other hand some of the explorations were upon patients who lingered for many days in the hospital, neither better nor worse for operation, but if they died before returning to their homes the death will be found in the percentage column of surgical deaths. An attempt is made to separate the obvious operative deaths from those upon which the operation *per se* had no apparent bearing, and this again, is done in such fashion that the reader may make his own deductions. A comparison of "surgical mortality" which may be defined as death in the hospital of any patient from any cause if that patient had been operated upon, and "operative mortality," that is, death directly or indirectly as the result of operation whether the disease for which operation was performed was necessarily fatal or not, gives abundant latitude for a wide variety of percentage figures and justifies the distrust of such figures when published without accurate attention to details.

Another factor quite as potent in its influence upon the apparent mortality as the basis upon



which percentages are figured has to do with the *type* of cases upon which any reporter is operating.

The surgeon whose work is bounded above by the pelvic inlet should have a hardly appreciable death rate and if he belongs to the sclerocystic school of ovarian surgeons there should be no deaths in the hospital, although the population of the nearest hospital for the insane may be perceptibly increased. Again a surgeon who deliberately rejects the very bad risks, even though operation offers the only hope, may present a series of recoveries which are quite startling when compared with the results of one who operates regardless of the risk involved, provided only that operation offers more hope of recovery than a non-intervention. Again, in operations upon certain organs such as the gall bladder and stomach, a long series of recoveries and relatively few deaths may be contingent upon the fact that physicians referring cases for operation advise early intervention, while a hopeless looking set of statistics may be dependent upon the fact that the reporter is drawing his work largely from men who do their own easy operating and refer their advanced or technically difficult cases only. This is met by a discussion of the details of individual deaths so far as is consistent with a necessary regard for conciseness.

Although this paper is entitled "An Analysis of the Mortality" the subject of morbidity cannot wholly be avoided and mortality and morbidity do not necessarily run parallel. For example, the vitality of the tissues through which incision is made may be seriously comprised, and local infection follow in a great number of instances without death occurring.

Still another factor enters into any consideration of mortality statistics especially in elective operations for non-fatal chronic disease. A patient may make an operative recovery but not be cured, as when an appendix is removed and gall stones are undiscovered, or a gastric ulcer is excised but stomach symptoms continue because an appendix full of concretions is overlooked. It is obvious that the surgeon working under difficulties induced by imperfect anesthesia, or anxious to bolster his statistics will do one thing and one thing only and perhaps have fewer deaths statistically than the more thorough consistent operator, but in the long run the necessity for further intervention in a number of cases will equalize the deaths, and this can not be made to show statistically since two operations upon the same patient, but with

death resulting from the last one makes a statistical mortality of but 50 per cent. while the same death under a combined operation would show 100 per cent. An attempt to obviate this error is made tabulating the number of patients as well as the number of operations performed as there frequently was a duplication of abdominal operations. It must be understood, however, that a large percentage of the patients had several extra-abdominal operations performed which are not mentioned. Practically all the round ligament shortenings, uterine suspensions and fixations, and many of the salpingo-oöphorectomies had plastic work done upon the cervix and vaginal outlet at the same sitting.

Throughout the paper attention is given to a discussion of some of the cardinal principles governing the indications for operation and the anesthetic employed, and considerable consideration to those operative accidents and sequelae which, while not uniformly fatal, are always serious and sometimes lead to death, such as shock, hemorrhage, post-operative obstruction, etc.

*Salpingo-oöphorectomy.*—One hundred forty-two salpingo-oöphorectomies resulted in no deaths. There is little to say concerning them save that with one exception all were performed for true inflammatory lesions, following either gonorrhoeal, puerperal, or instrumental infection. An occasional case, of course, presented no adhesions, but for the greater part, the typical inflammatory exudate was encountered with adhesions to the uterus, bladder, or intestine, and the separation of such adhesions is not counted as a distinct operation. An ovary, or portion of ovary, was always left when such a course was at all practicable. On the other hand the radical operation was never undertaken intentionally during the hyperacute stage of infection, a let alone policy in acute gonorrhoeal salpingitis, and vaginal or abdominal incision with drainage in acute puerperal oöphoritis being preferred. No operation of any kind was undertaken deliberately during the acute stage of gonorrhoeal salpingitis with peritonitis, because life is not seriously menaced by the disease and operation is so safe after the subsidence of acute symptoms, and in addition the permanent status of the ovary is established by this time. During the acute stage the ovarian conditions is an unknown factor unless operation is performed before leakage from the tube has occurred, a stage when the surgeon rarely sees the patient. Occasionally a case has



presented itself in which pain, a little evening elevation of temperature, leucocytosis, etc. have persisted for several weeks in spite of constant rest in bed, and such patients have been operated upon without hesitation, but as a rule with few exceptions the salpingo-oöphorectomies for gonorrhæal infection were done after the subsidence of acute symptoms, and as a rule with practically no exceptions some ovarian tissue was saved.

Those cases of adnexal disease which follow septic infection in our experience have proved almost universally to be ovarian in origin, so-called puerperal pelvic peritonitis being an extension from a puerperal oöphoritis. By this is meant, of course, only such patients as have survived the onset of the infection sufficiently long to permit of diagnosis and operation. It is not doubted that a streptococcic infection may be sufficiently virulent to penetrate the walls of the uterus without localizing either in the lymphatics of the broad ligament or in the ovary, but the usual type of pelvic peritonitis following abortion or full term labor has a distinctly ovarian origin and no drainage operation is complete, whether performed through the vaginal vault or anterior abdominal wall, which does not discover and evacuate the pus in the interior of the ovary; neither does a drainage operation result in cure unless this is done or the ovary ruptures spontaneously either before or after pelvic drainage is established. The wisdom of draining acute collections of pus is, of course, axiomatic, but for some years there has been a marked reaction against the use of drainage following abdominal operations unless the indications were quite plain—the old dictum “when in doubt drain”—having been exchanged for “when in doubt do not drain.”

The writer has felt that the reaction against drainage went too far and has never been ashamed or afraid to use drainage after salpingo-oöphorectomy when questionable pus had soiled the field or when the separation of many adhesions left an oozing surface upon which hemostasis was imperfect. In acute cases which are gone into unexpectedly this drain takes the form of a gauze cofferdam, separating the infected area from the general abdominal cavity, the gauze being “lost” in the pelvis and recovered through an incision in the vaginal vault after the abdominal incision is closed.

Twenty-seven patients were operated upon for tubal pregnancy without mortality, and in only one case was operation deferred until the patient was in better condition. This one had

an infected hematoma in the cul-de-sac which was walled off from the general abdominal cavity by adhesions above it and this was opened and drained, but repeated hemorrhage from the tube into the abdominal cavity made radical operation imperative a few days later.

The advocates of conservatism in the treatment of ectopic pregnancy have taught us that we need not operate in breathless haste with the first evidence of bleeding, but they have failed to convince us that we should not operate as soon as we can make proper arrangements therefor.

Following eighty-five ovariectomies for tumor there were two deaths. The first of these occurred in the third week after operation while the patient was up and about the ward. The symptoms were those of pulmonary embolism and this diagnosis was confirmed by autopsy. The second death was that of a patient who not only had two large papillomatous ovarian cysts removed, but who suffered also from mitral insufficiency with cardiac dilatation, parenchymatous nephritis and ascites. The operation was done to relieve the enormous abdominal distension and the discomfort which it caused, but without any hope of cure. The patient remained in the hospital two months and then succumbed to the cardio-renal changes.

Few myomectomies were performed and these for small or pedunculated growths only, the uterine myomata being so universally multiple that when operations was called for hysterectomy was usually chosen.

Of the ninety-two supra-vaginal hysterectomies for benign conditions none died in consequence of the operation, but one death occurred in the hospital from perforation of an undiagnosed cecal ulcer. This casualty took place after the patient had been discharged and if her arrangements for leaving had not miscarried death would have taken place in her home. As it was she was delayed and remained another night in the hospital where the accident occurred. As a diagnosis had not been made this must be reckoned as a surgical death even if the operation had nothing to do with it.

Of the complete hysterectomies for benign conditions the one death which took place was due to nephritis followed by broncho-pneumonia three weeks after operation. This was an instance of profound anemia from preoperative hemorrhage due to a submucous myoma. Vaginal myomectomy was attempted but found to be impossible and complete removal of the uterus from above was accomplished without



incident. The patient had no evidence of nephritis previous to operation and the anesthetic used was nitrous oxide. It is therefore impossible to say whether the death was merely a coincidence, or due in some way to her pre-operative hemorrhage, or to the operation itself, but the patient died.

Panhysterectomies for malignancy are infrequent in our practice since almost without exception the patients are seen too late unless the condition is discovered accidentally. The one death was from uremia probably due to too much interference with the ureters which were dissected out from a carcinomatous parametrium—a perfectly useless procedure by the way—but occasionally one uses poor judgment and gets in so deeply that to retreat is as bad as to proceed. The most remarkable case among the malignancies was one in which an extensive carcinoma of the portiovaginalis was mistaken for a protruding placenta and in his efforts at removing it the patient's physician had torn away a portion, ruptured the uterus, and entered the abdominal cavity. Panhysterectomy was performed as an emergency operation and the patient was living at last reports although recurrence certainly must have taken place.

Uterine suspensions and fixations resulted in one death. It was rare indeed that operation in this class was undertaken for uncomplicated retroversion or retroflexion, those which are tabulated under this heading being performed because the patient also had some other lesion needing attention. Either there was prolapse, deep laceration of the cervix or perineum, chronic appendicitis, or salpingitis, so that an anesthetic had to be given in any event and to the main operation a round ligament shortening, suspension, or fixation was added as the conditions, age, and social status of the patient justified.

This death was purely operative and accidental and has been reported before. The cause of death was a Littrès hernia through a small opening which was left in the broad ligaments after a round ligament shortening. There were no true obstructive symptoms and the origin of the vague abdominal discomfort was not understood until a small perforation had occurred in the intestine followed by sudden collapse and death.

There were, therefore, six deaths following 495 classified pelvic operations. (In the unclassified list, including Cesarean sections, operations for rupture of the uterus, etc., will be found two deaths following pelvic operations,

both being instances of ruptured uteri and both dying from the accident, the operation in each of them being a matter of last resort undertaken when the patient was practically moribund).

In the suprapelvic portion of the abdomen we have eighty-six operations upon the biliary tract, with five deaths.

The first of these deaths was due to injury to the pancreas and was a clear operative death, the pancreatic secretion digesting the catgut sutures used to close a pre-existing fistulous opening into the duodenum. Catgut alone is never depended upon in stomach and intestinal work, but in this instance only one row of sutures could be applied, a fact which was not ascertained until the duodenal opening had been closed with this material.

The second death was due to diabetic coma. This operation was undertaken deliberately with full knowledge that sugar was present in the urine in large quantities, but the patient had a palpably distended gall bladder and jaundice and her only hope seemed to lie in the possibility of draining the biliary system. No good was accomplished by this, however, and the patient died on the third day in deep coma.

Another death was due to intestinal hemorrhage ten days after an operation for chronic cholecystitis in a patient who was not jaundiced. Unfortunately no autopsy could be obtained, but later reflection has convinced me that some overlooked pathologic condition, possibly a chronic pancreatitis, was present in the digestive tract. She died, therefore, because of a faulty diagnosis rather than a faulty operation.

The last deaths were those of two patients who had lost much weight through years of suffering, one of whom had discharged great quantities of fluid through a biliary fistula which persisted after a cholecystostomy by a very competent surgeon. It is recognized that the use of the word "asthenia" as a cause of death is improper and imperfect, but no other term seems to fit these cases. Neither suffered any shock nor had marked elevation of temperature or pulse, and until within a few hours of death both seemed in about the same general condition as before operation.

We have more fear of the outcome of late operation on the biliary tract than of operation for any other chronic nonmalignant abdominal lesion and this is equally true if the patient is not jaundiced.

Eventually we feel that some of these deaths will be proven to be due to a change in those chemical processes normally taking place in the



liver by which certain poisons absorbed from the intestine are prevented from entering the general circulation.

The strangulated hernias were remarkably few. The intestine was either returned or resected in each case, no fecal fistulae being made, and all recovered.

Of ninety-three herniotomies for conditions short of actual strangulation, one—a patient with double irreducible scrotal hernia with one side incarcerated—died from pneumonia which began on the third day after operation and terminated on the eighth. This may have been a true postoperative pneumonia and not a coincidence, although at certain seasons when pneumonia is prevalent its etiology often must remain in doubt.

*Operations for acute appendicitis and its complications.*—It is a matter for regret that time did not permit me to ascertain the exact number of instances in which abscesses were opened and drained without removal of the appendix, but a liberal estimate would be two each year or twelve in all. We find such an indication in retrocecal and pelvic abscesses only, with an occasional case of intra-abdominal abscess in which the patient is so near dead that more radical interference seems impossible. After 170 operations five deaths occurred, all in late cases, that is, in patients who had been ill more than two or three days. One patient whose entire cecum was gangrenous died from intense toxemia, one from septic pneumonia, and one from intestinal obstruction, whether septic or organic was never determined, but the persistence of normal temperature until just before death makes one suspect that it was organic, although an enterostomy gave no relief.

Another had been ill seven weeks and succumbed to profound general sepsis ten days after operation. The last death in the series occurred in the person of a man of sixty who had been ill for six days before operation, during the last three of which fecal vomiting had been constant. After incision and drainage under local anesthesia, he lived four days without vomiting, but like the former died profoundly septic.

In this list all the common complications were met with, but in only one instance was operation deferred because the patient was too ill, this being a case of general peritonitis so far advanced that a pulse of 140 corresponded to a subnormal temperature and vasomotor paresis with cold, cyanosed extremities. After three or four days in the sitting posture with

absolute starvation, the temperature came up and the pulse down when he was operated upon under local anesthesia.

Most progressive internists at the present time agree with the surgeons that a patient with appendicitis which is severe enough to be positively diagnosable should be operated upon at once, not because the patient must die without operation, but because he might, and by reason of this attitude the mortality rate in acute appendicitis is constantly diminishing. We now feel that it should be kept in the neighborhood of one per cent. in any long series of cases which has been under the care of a competent physician from the onset, this occasional unavoidable death being due to obscurity in diagnosis, unwillingness on the part of the patient to submit to early operation, virulent streptococcal infection, septic pneumonia, or intestinal obstruction.

The 380 patients upon whom appendectomy was done for chronic or recurrent appendicitis, or as an incident in the course of other abdominal operations, recovered as a matter of course, it being a curious fact that none of the patients died from whom the appendix was removed casually excepting the round ligament shortening mentioned earlier.

The unclassified operations present the greatest absolute number of deaths as well as the highest percentage of those having any considerable numbers. They might readily be classified, but either so small a number of each particular type of operation was performed, or else the circumstances were so unusual that the results would be wholly misleading. For example, there were no deaths after pylorotomy, circular resection of the stomach, or gastrectomy, but there were five deaths following gastroenterostomy, an operation, which considered by itself, seldom should be followed by death. The first occurred in a victim of acute dilatation of the stomach which was the terminal event in a patient with carcinoma of the pylorus. This operation should not have been performed as the patient was moribund, but he was not seen until after he was anesthetized. The other four have occurred in the past three years. One death was from lobar pneumonia which began eight hours after an operation in which nitrous oxide was the anesthetic. The disease was benign stenosis of the pylorus, the operation was easy and accomplished in thirty minutes, and it seems certain that in this instance the pneumonia was a coincidence and not the result of either operation or anesthetic. Another death



took place eleven days after an operation for benign stenosis in a man of sixty-two who had been ill for years. Previous to operation his aspect was that of an individual who had undergone slow starvation to a point beyond recovery, and his postoperative history bore out that conclusion. He was given a chance, however, suffered no shock, had no postoperative vomiting or elevation of temperature, and no decided change in pulse rate. He continued to fail in spite of liberal feeding and saline and nutritive enemas, and at the end he simply ceased to breathe. Autopsy showed complete atrophy of the mucosa of the stomach and upper intestine with a perfectly clean operative field.

Another case was most interesting from the standpoint of diagnosis. This patient had a baby of three months and during pregnancy it was noted that her vomiting was exaggerated. After labor she had a marked femoral phlebitis lasting six weeks. Just convalescent from this, vomiting began again and on her admission to the hospital a week or ten days before operation one consultant insisted upon a pelvic lesion while I, myself, was perfectly confident that a cerebral embolism of septic character was present. She grew rapidly weaker and markedly emaciated and an indefinite mass finally was located in the epigastrium. Exploration under local anesthesia showed an enormous ulcer in a contracted stomach with almost complete closure of the pylorus. To complete the operation could not cause a worse disaster than to close up, so a gastro-enterostomy was performed under nitrous oxide. The patient died on the second day, probably from shock although the exitus was very sudden. Autopsy showed no leakage and no peritonitis. The whole of the pyloric end of the stomach and a part of the lesser curvature was occupied by a large deep ulcer from whose surface pus was exuding freely. The entire previous history, including the femoral phlebitis, was thus explained.

The last death following gastro-enterostomy took place three weeks after operation and was due to an unrecognized myocardial degeneration, no evidence of which was observed until after the patient began to move about the ward, when one attack of acute cardiac dilatation followed another and he finally died after five days of struggling with the heart complication.

As mentioned previously two deaths occurred after operation for rupture of the uterus. In one case the uterus had been ruptured during an attempted dilatation and curettage several days before and the pelvis was filled with the

mercuric solution used for irrigation. This patient had through and through drainage but died from true mercurial poisoning with a combination of nephritis and dysentery.

The second case was one of ruptured cornual or interstitial pregnancy at four months. The specimen obtained was the most interesting I have ever seen, the fetus floating free in the abdominal cavity while the placenta remained attached to a mushroom shaped excavation at the left uterine horn. This specimen was destroyed by the order of the head nurse to the nurse in charge of the morgue after the former had been told of its extreme value; that peculiar naiveté which sometimes actuates a head nurse being revealed in the cremation of the uterus and careful preservation of the fetus. I now think I might have saved this patient had I simply sewn the ruptured uterus into the abdominal incision and packed it with gauze instead of removing it, as the hysterectomy was complicated by adhesions left from a preceding pelvic operation. I think, too, that she might have been saved had I at that time known of any rapid safe method of indirect transfusion, one not requiring absolute quiet on the part of the patient; the thirsting and air hunger being so great that direct transfusion was at no time possible.

Intestinal resection following a high enterostomy for acute obstruction caused one death from straight operative shock.

Three other deaths were due to acute obstruction. One was that of a woman eight months pregnant in whom a coil of ileum was gangrenous, the obstruction being caused by a band low down behind the uterus. This band was cut but the mesentery proved to be too short to permit withdrawal and resection of the gangrenous loop which was consequently placed as near the incision as possible, surrounded by gauze and the wound left open. The patient went into labor on the second day in spite of large doses of morphine, and to obviate eventration a vaginal Cesarean section was performed. She survived both of these operations but on the third day the gangrenous gut gave way and flooded the abdomen in spite of the packing and she succumbed within a few hours.

Another death from acute intestinal obstruction was that of a patient who had been moderately ill with the classical symptoms of obstruction without strangulation for more than a week. On the night preceding operation her temperature rose to 104° with startling congestion of the face and she died a few hours after



operation with a temperature of 107°. My assistant insisted that this death was really due to sunstroke, but I prefer to leave the actual origin of the hyperpyrexia in doubt.

The fourth death from obstruction was inexcusable. The patient was a male, 59 years of age who had been losing weight rapidly for a year and a half. For a week there had been typical symptoms of acute obstruction which had been treated with cathartics. Finally a change of physicians was made and the last one recognized the condition promptly. The patient arrived at the hospital nearly moribund. Nevertheless an enterostomy was performed under local anesthesia but death took place twenty-four hours later without abatement of any of the symptoms excepting the intense pain. Autopsy confirmed the pre-operative diagnosis of carcinoma of the sigmoid with acute obstruction.

One patient in the unclassified list chose to gamble that I was wrong about his having a general abdominal carcinomatosis, asked for an exploratory incision, and died a week later from the toxemia of the disease. Another in the unclassified list had three operations for chronic intestinal obstruction of unknown character but which at first was presumed to be from adhesions between the gall-bladder and transverse colon. When these were overcome a gradual obstruction higher up became apparent and she died two months after the first operation, the last one being an enterostomy.

Still another died two days after an exploration for supposed subphrenic abscess which proved to be a melanotic sarcoma of the liver.

The last one in the unclassified list died from pneumonia just four weeks after an operation for acute hemorrhagic pancreatitis. This case was most interesting but time does not permit the rehearsal of its details in this report.

A recapitulation of the causes of death is of interest:

As distinguished from ordinary surgical deaths there were eight plain operative deaths; two from shock in patients already mortally ill; one from operative injury to the pancreas, one from postoperative obstruction and perforation, one from uremia, one from pulmonary embolism, and the two gallstone cases tabulated as dying from asthenia. In addition there were two deaths from pneumonia which succeeded clean operations at such a date that the origin of the pulmonary infection is in doubt.

Excluding the pneumonia deaths the operative deaths were eight out of 1032 patients, or

.78 of 1 per cent. including the pneumonias, 1 per cent.

The gallbladder patient with pancreatic injury, the patient upon whom a round ligament operation was performed, and the patient with incarcerated hernia were the only ones who did not have an early death staring them in the face at the time operation was done.

The four classical causes of death after abdominal operations are shock, hemorrhage, septic peritonitis, and intestinal obstruction. Both deaths from shock in this list were found in patients desperately ill from obstruction in the digestive tract. Nothing else was productive of enough shock to cause serious anxiety.

No death took place from septic peritonitis excepting as it followed intestinal perforation, and no death from peritonitis occurred in the series of operations for acute appendicitis with all its complications.

No death occurred from postoperative hemorrhage, the one death from hemorrhage being due to bleeding before operation.

Postoperative obstruction caused two deaths, one clean and one pus case. So much for mortality for the present.

#### MORBIDITY.

In the patients who recovered there was one instance of postoperative obstruction following operation in a clean field, and one following the removal of a gangrenous appendix.

The first was diagnosed early and relieved by the separation of adhesions, the last had an enterostomy performed by which intestinal resection was later necessitated from which the patient readily recovered.

Four clean cases are known to have incisional hernias, two cholecystostomies and two hysterectomies. It is likely that others have the same annoyance and many of the appendicitis cases complicated by abscesses or peritonitis and drained are known to have hernias which give but little trouble.

*Postoperative Hemorrhage.*—No abdomen was reopened for hemorrhage, although the walls of some of the late appendicular abscesses oozed rather profusely. Absolute and certain control of all primary vessels is considered imperative, one hand knots and whipping sutures never being depended upon to control large vessels and when catgut is used the knot ends are always left long. Oozing from large areas is invariably met with a gauze tampon which assists coagulation, drains off the serum, and prevents postoperative intra-abdominal hematomata.



*Infection.*—Two-patients in the entire list suffered a low grade infection in the abdominal cavity which probably was introduced at the time of operation and both recovered after the incision of a localized abscess. There was one instance of localized peritoneal infection caused by intestinal injury at the time of operation. This was a hysterectomy for an adherent myomatous uterus in which the rectum was opened and immediately closed, but a late pelvic abscess developed and drainage through the cul-de-sac was made necessary. The old fear that septic peritonitis may follow operation in clean cases has been abolished by modern, painstaking aseptic technic carried to the academic limit. Infection of the abdominal wall, aside from an occasional stitch abscess, occurs once or twice from clean appendectomies after every change of house surgeons, each of whom in turn must be trained to the conception that an appendicular stump is an infected portion of the intestine.

True stitch abscess is unknown in *clean cases* since the preparation of the abdominal skin has been simplified, unless some one ties a stitch too tightly or a local anesthetic has been used.

*Postoperative Shock.*—Serious postoperative shock was absent unless there was hemorrhage or an operation on a desperately ill patient. Hemorrhage during operation is a rare accident. Aside from hemorrhage, traction on mesenteries more than any other intra-abdominal manipulation seems to be most frequently shock producing and this is carefully avoided. Dry pads are always used in walling off the operative area. The latter originally were used dry to guard against infection as it seemed the height of folly to expect a pad already saturated to absorb pus or other suspicious fluid and keep from contamination the field not invaded, but Henderson's theory of carbon dioxide exosmosis from the peritoneum as a cause of shock has led to a firmer belief in the advantage of dry sponges over the much lauded "sponge wet with warm normal saline solution."

*Postoperative Dilatation of the Stomach.*—There was one example of the extreme type of postoperative dilatation which followed an operation for general peritonitis due to gangrenous appendicitis. This patient recovered after frequently repeated lavage. Another instance of acute dilatation illustrates the attention to detail which is necessary if we are to have the highest measure of success. Shortly after a gastro-enterostomy and occlusion of the pylorus for duodenal ulcer, biliary vomiting made its appearance. This is so unusual after the pos-

terior no-loop operation that the dressings were removed and the abdomen inspected when the much dilated stomach was visible in the left iliac fossa. Repeated lavage gave temporary relief but recurrence took place so promptly that re-operation was seriously considered. While sitting by the bed and palpating the thin walled abdomen it was observed that the resistance at the point of anastomosis was directly under a groove made by the taped adhesive strap which held the dressing in place. Leaving this one knot untied resulted in recovery without further attacks of vomiting.

We are confident that a good number of beginning cases of gastric dilatation were throttled in their incipiency by the use of the stomach tube, epigastric distress and persistent vomiting associated with increasing distension of the abdomen always being met in this manner.

*Postoperative Tympany.*—Tympany beyond the most moderate degree is rarely seen save in patients whose abdominal cavities are infected before operation. In such patients tympany is recognized as a conservative effort on the part of nature to localize the infection and unless vomiting and elevation of temperature and pulse coincide in pointing to toxemia from stasis, nothing is done save to keep the lower bowel empty by means of enemas.

Postoperative tympany and gas pain seem to be much increased by the early introduction of food and drink into the stomach, and by the use of cathartics. Cold water soon after an abdominal operation inaugurates peristalsis in that portion of the intestine not parietic from handling, and causes the accumulation of gas and liquids in the parietic portion, and food and cathartics act in the same manner only more acutely. As I have remarked elsewhere, if the nervous surgeon would take a dose of bromide and forget to order calomel and salts for his patient, both would be in better condition during their convalescence from operation.

*Anesthesia.*—No discussion of postoperative mortality is complete without some discussion of anesthesia. Chloform is given to asthmatics only, so we are unable to discuss it intelligently. Ether, nitrous oxide and oxygen, and local anesthesia are used, the frequency of their use being in the order named.

Ether is the anesthetic of choice for routine abdominal work in the absence of coryza, bronchitis, nephritis, and tuberculosis, but it is our belief that anesthetics should be selected as carefully as narcotics, sedatives, stimulants, or any other class of drugs, and while ether is



always avoided in the foregoing conditions it is not invariably used otherwise. For example, postoperative ether vomiting makes nitrous oxide the anesthetic of choice for stomach work, but nitrous oxide rigidity almost eliminates it from consideration in gallbladder operations upon stout patients. Aside from operations upon the biliary tract and salpingo-oöphorectomies nitrous oxide rigidity scarcely interferes with the easy performance of any *single* abdominal operation, but with our present lack of precision in abdominal diagnosis it often does prevent complete exploration of the upper abdomen, the operator resting content with the extirpation of the organ for which the operation was undertaken but not investigating allied organs from which the symptoms complained of might arise. On the whole, patients are more nearly normal at an earlier date after the use of nitrous oxide than after ether, but this loses its importance in many instances in view of the fact that operative recovery is not necessarily synonymous with symptomatic cure.

A combination of nitrous oxide-oxygen anesthesia with a sufficient amount of ether to overcome rigidity is pleasant for the patient and minimizes postoperative nausea, but it has two drawbacks, the expense and the necessity for a skilled gas anesthetist—the latter being absolutely imperative unless one is callous to the risk involved. In this connection a volume might be written regarding the advantages and disadvantages of nitrous oxide as an anesthetic.

While many surgeons have used this agent more extensively I should like to call attention to the fact that we have used it more or less continuously for ten years and from this experience some rather fixed ideas have been formed.

On February 15, 1905, Dr. C. K. Teter first gave nitrous oxide to a patient of mine and before that Dr. Ernest E. Brown had for some time given nitrous oxide extensively for Dr. N. Stone Scott and occasionally for myself.

In practically all work outside the abdomen it is the anesthetic of choice, a skilled anesthetist being available, but in the abdomen it has some disadvantages as the writer has previously pointed out. (*Ohio State Medical Journal*, September, 1912. *American Journal of Obstetricians & Disease of Women & Children*, Vol. LXVII No. 1). Combined with a small percentage of ether many of these disadvantages are overcome, but nitrous oxide-ether anesthesia is not nitrous oxide-oxygen alone.

Local anesthesia plus nitrous-oxide was first used by the writer December 13, 1906, the

method of use being a cocaine, nitrous oxide sequence, and this method has been followed in many desperate abdominal cases since then. The object of this local anesthesia general anesthesia sequence, was to minimize the amount of general anesthetic inhaled by shortening the period during which general anesthesia was necessary should it be needed at all. By this method the abdominal incision is made under local infiltration alone and either nitrous oxide or ether administered when the exploration or operation reaches an extremely painful stage. No thought has been given to its minimizing shock through blocking all the sensory nerves from the operative field *since if all the sensory nerves could be blocked the operation would be completed under local anesthesia and a general anesthetic would be required only in unmanageable patients*. The method is thus not to be confused with the anoci-association method of Crile, although the writer's opinion based upon his experience with local anesthesia is that total abolition of sensation from an abdominal field is impossible and that therefore the advantages of both methods are due exclusively to the fact that the quantity of general anesthetic administered is greatly reduced. In this way the resisting power of the patient is not lowered and his vitality is conserved so that an operation which would be extrahazardous if carried out and completed under full surgical anesthesia is done with less comfort both of patient and operator but also with a greatly diminished risk to the former.

Some deductions from the writer's observations not especially brought out in the paper are that ether is safe so far as primary mortality is concerned in the hands of a fairly competent anesthetist if anesthesia is not so prolonged as to cause ether poisoning. Patients vary in their susceptibility to ether as they do to alcohol and poisoning will result in any case provided a sufficient amount is given.

Nitrous oxide as a surgical anesthetic is tolerated for a much longer time than ether, is the safest known general anesthetic in the hands of an expert, and in the writer's opinion the most dangerous of all general anesthetics when given by any other.

In the presence of pneumonia, bronchitis, nephritis, and tuberculosis, or at any time when respiratory affections are epidemic, local anesthesia or nitrous oxide should be used rather than ether.

Reverting again to the subject of mortality, the question could be taken up from an entirely



different standpoint, viz. the known duration of the disease before operation was performed. Upon this phase much more might be said than time will permit, but a few of the more striking facts will be given.

Of the five deaths following operation upon the biliary tract every patient had been known to have gallbladder disease, not only for months but for years, and a positive diagnosis could have been made in all but one of them from the clinical history alone. Notwithstanding this they had been allowed to drift until dangerous symptoms persisted over a long period of time before operation was seriously considered.

Both patients who died after ovariectomy had tumors so large that a snap diagnosis could be made on inspection, which means that these tumors had grown for many months.

Four of the five patients succumbing after operation for pyloric stenosis had had a clear cut history of stenosis of many years duration.

But one of the four patients who died from acute intestinal obstruction was seen within forty-eight hours of the onset of characteristic symptoms, and but one of the five patients with acute appendicitis which were lost was operated upon before the constant progress of the disease from the bad to worse had convinced both patient and attendant that operation was the only hope. To be sure many patients recovered under similar circumstances, but the significant fact remains that all but one that died were delayed not hours but days.

This short summary covers more than one-half of all the deaths tabulated and more could be cited from the list, but enough has been said to demonstrate that delayed operation in certain conditions which have a perfectly well known tendency toward disaster accounts for a large proportion of all the surgical deaths after abdominal operations.

An analysis of the facts presented, together with others familiar to the writer but too long to incorporate in this paper, seems to justify the following conclusions regarding *surgical* as distinguished from *operative* mortality.

First. There are certain combinations of circumstances in which surgery is helpless once the whole condition stands revealed. Such combinations are found in Nos. 21 and 26, and a very small but definite mortality is inevitable no matter when operation is done.

Second. That intercurrent disease like pneumonia, which in the present list is the largest single mortality factor, presents a definitely

perceptible risk. Whether it is a coincidence, the result of the disease for which operation is performed, the result of the anesthetic or the operation itself is not always clear.

Third. That explorations are bound to be made for conditions usually malignant, that are not otherwise diagnosable, and which on exploration prove to be inoperable; the patient sooner or later succumbing to his disease.

Fourth. That, in spite of all these, delay is after all the greatest single cause of surgical abdominal mortality.

As regards operative deaths:

First. There always will be an occasional death from pulmonary embolism and intestinal obstruction, bearing in mind that the latter condition is far more difficult to diagnose as a postoperative complication than as a primary disease.

Second. The death rate from shock should be constantly lowered by painstaking care in controlling hemorrhage, gentle handling of the abdominal contents, avoidance of traction on mesenteries, simplifying technic, and adjusting the duration of the operation to the patient's condition.

Third. Death from sepsis is not to be apprehended unless the patient is already septic or the intestinal tract is opened. Painstaking asepsis combined with constant effort to preserve the vitality of the tissues and conserve the patient's general resistance has reduced the deaths from sepsis to the vanishing point.

Fourth. Primary anesthetic deaths should be almost unknown since chloroform has been banished to oblivion. Local infiltration with weak solution of novocain presents no danger, and the novocain-ether or novocain-nitrous oxide *sequence* renders the danger of ether poisoning or nitrous oxide asphyxia practically nil no matter how desperately ill the patient may be.

It is the writer's belief that proper selection of the anesthetic for the case and proper handling of the tissues together with correct determination of the amount of operating which the patient can safely stand will do more to lessen the mortality rate in the hands of the average surgeon than any attempt to follow spectacular methods under fanciful names which appear like a comet, loom large for a time, and are forgotten so soon as the commotion produced by their unusual character has had time to subside.



## TABULATION OF DEATHS.

Name	Age	Disease	Operation	Duration of life after operation	Cause of death
2. Mrs. G.	31	Rupture of uterus	Supra-vaginal hysterectomy	2 days	Acute anemia
4. Mrs. C.	39	Cholelithiasis	Cholecystostomy	1 day	Diabetic coma
5. Mrs. R.	50	Cholelithiasis	Cholecystostomy	2 days	Pancreatic injury
7. Miss C.	49	Uterine myoma	Supra-vaginal hysterectomy	31 days	Perforated cecal ulcer
8. Mrs. W.	41	Carcinoma of cervix	Wertheim's hysterectomy	6 days	Uremia
9. Mr. B.	42	Acute appendicitis, general peritonitis	Appendectomy	6 days	Septic pneumonia
10. Mr. S.	42	Pyloric obstruction	Gastro-enterostomy	5 days	Lobar pneumonia
11. Mr. S.	49	Incarcerated hernia	Double herniotomy	5 days	Lobar pneumonia
12. Mrs. F.	33	Intra-uterine myoma	Abdominal pan-hysterectomy	21 days	Broncho pneumonia
15. Mr. R.	46	Gangrene of appendix and cecum	Appendectomy, isolation of cecum	4 hrs.	Toxemia
16. Miss L.	24	Retroflexion, chronic appendicitis	Appendectomy, round ligament shortening	8 days	Intestinal obstruction
17. Mr. P.	45	Acute appendicitis, appendiceal abscess	Appendectomy	5½ days	Intestinal obstruction
18. Mr. H.	45	Acute intestinal obstruction	Enterostomy-intestinal resection	2 days	Shock
19. Mrs. A.	24	Gastric ulcer	Gastro-enterostomy	2 days	Shock
20. Mr. A.	62	Abdominal carcinomatosis	Exploratory laparotomy	6 days	Carcinoma
21. Mrs. F.	61	Acute intestinal obstruction	Laparotomy, Drainage, Vag. Cesarean Sect.	3 days	Intestinal perforation
22. Mrs. C.	61	Chronic intestinal obstruction	Release of adhesions-enterostomy	2 days	Chr. intestinal obst.
23. Mrs. G.	50	Ovarian cystoma	Ovariectomy	23 days	Pulmonary embolism
25. Mr. K.	56	Pyloric stenosis	Gastro-enterostomy	11 days	Starvation?
26. Mrs. W.	35	Perforation of uterus	Vaginal section, laparotomy	1 day	Mercurial poisoning
27. Mr. —	—	Acute gastric dilatation	Gastro-enterostomy	2 hrs.	?
28. Mrs. B.	44	Acute intestinal obstruction	—	12 hrs.	Hyperpyrexia?
29. Mr. C.	35	Acute hemorrhagic pancreatitis	Laparotomy, drainage	29 days	Lobar pneumonia
30. Mr. D.	67	Acute appendicitis, intestinal obstruction	Appendectomy, drainage	4 days	Sepsis
31. Mr. K.	54	Acute appendicitis, abscess	Appendectomy, drainage	10 days	Sepsis
32. Mr. P.	66	Biliary fistula	Cholecystenterostomy	4 days	Asthenia?
33. Mr. S.	45	Cholelithiasis	Cholecystostomy	7 days	Asthenia?
34. Mrs. S.	48	Ovarian papillomata	Double ovariectomy	53 days	Cardio-renal disease
35. Mrs. T.	67	Chronic cholecystitis	Cholecystostomy	9 days	Intestinal hemorrhage
36. Mr. W.	67	Pyloric stenosis	Gastro-enterostomy	19 days	Myocarditis
37. Mr. K.	59	Acute intestinal obst. carcinoma of sigmoid	Enterostomy	1 day	Intestinal obstruction
38. Mr. J.	32	Melanotic sarcoma	Exploratory laparotomy	2 days	Sarcoma



PERCENTAGE TABLE.

	Deaths	Per Cent
Salpingo-oöphorectomy for inflammatory disease .....	142	0 .0
Tubal pregnancy .....	27	0 .0
Ovariectomy for tumor .....	85	2 2.35
Myomectomy .....	7	0 .0
Supra-vaginal hysterectomy for benign conditions .....	92	1 1.00
Pan-hysterectomy for benign con.	10	1 10.00
Pan-hysterectomy for malignancy	7	1 14.28
Suspension, fixation and round ligament shortening .....	125	1 .8
<b>Total classified pelvic operations..</b>	<b>495</b>	<b>6 1.4</b>
Gall tract operations .....	86	5 5.81
Strangulated hernias .....	9	0 .0
Other herniotomies .....	93	1 1.07
Operations for acute appendicitis ..	170	5 2.94
Chronic and incidental appendectomies .....	380	0 .00
	738	11 1.49
Unclassified	127	15 11.81
<b>Total abdominal operations ....</b>	<b>1,360</b>	<b>32 2.35</b>
<b>Total patients .....</b>	<b>1,032</b>	<b>32 3.10</b>
Deaths directly traceable to operation .....	1,032	8 .78
*Deaths directly traceable to operation .....	1,360	8 .59

\*Incorrect method of computing mortality.

DISCUSSION.

DR. C. G. DARLING: I knew we were going to have something good from Dr. Skeel. He lives in a town where there is a great deal of competition and you may always look for something good from the man who has reached the top of his profession under such conditions. Above everything else we can see by the report which he has given us tonight that he is very honest in drawing his conclusions.

In operations upon children the type and amount of anesthetic employed has much to do with the mortality. I was struck in reading a paper by Dr. Cushing the other day by a statement that in his operations upon children two and three days old he used chloroform as the anesthetic. That is not so peculiar as that they survived. Now, we operate on very young children here without any anesthetic, for we have found that the danger from the anesthetic is usually greater than the danger from shock where an anesthetic is not used. We have learned that the highest death rate in children comes from the use of the anesthetic or that pulmonary complications following the anesthetic will cause the greatest number of deaths. So we have come to regard the anesthetic as a very important factor just as Dr. Skeel has pointed out in his paper.

He mentioned deaths from pneumonia. Etiologically these deaths might be classified differently, according to whether they came from exposure, from lowered temperature or from the irritation of the anesthetic. The following points may be con-

sidered although they were not mentioned: The care of the patient on the table, the heat of the room, the exposure of the patient as well as the prolongation of the anesthetic. In this Hospital we have been very much impressed with this latter danger and have tried to cut down the amount of anesthetic employed as much as possible.

I want to compliment Dr. Skeel upon his courage in presenting the mortality statistics. Most everyone who writes a paper nowadays is more anxious to tell of the number of patients who survive and the brilliant results obtained.

DR. REUBEN PETERSON: I know that I voice the sentiments of all present when I thank Dr. Skeel for the privilege we have had in listening to his exceedingly valuable and scientific paper.

First of all let me say that I am in hearty accord with his statement that operative statistics will vary according to whether the operator is looking after his own or his patients' interests. I have always advocated and tried to practice the elimination of the ego in surgery and the keeping in the foreground the interests of the patients. I have seen operators turn down cases because the risks were too great and they were fearful of spoiling their records. This is surgical cowardice and can not be too strongly condemned. Every surgeon dreads a high operative mortality but he should never let this stand in the way of saving a life, when without surgical interference death is inevitable.

Recently I have been engaged in a statistical study which has a certain bearing upon the work Dr. Skeel has outlined for us. During the past ten years I have palpated the gall-bladder in 1,066 patients when the abdomen has been opened for distinctly pelvic lesions. In many cases of abdominal section in this and my private clinic, it was impossible to palpate the gall-bladder for fear of infecting the healthy peritoneum with the products of the disease for which the pelvic operations were performed, so that these figures do not by any means represent all the abdominal work performed during the past decade. Gallstones were found in 12.66 per cent. of the 1,066 cases. The mortality in the 1,066 cases was 3.2 per cent., one-tenth of 1 per cent. more than in Dr. Skeel's 1,032 cases or practically the same in the two series.

I have not had time to group the cases as Dr. Skeel has done and perhaps it is just as well for I fear that such a grouping would show the superiority of his work over ours. This possibly can be explained by the fact that he was the sole operator in his series while in my series the work was performed by myself and quite a number of assistants who have during the past ten years operated in this Clinic. For this is distinctly a teaching hospital and while experience is gained at much less cost than in private practice, there is no question that a certain proportion of the fatalities can be explained in this way. Again this is shown by the fact that the mortality in my private clinic is only a little over 2 per cent.

There were two deaths in the fifty-seven cases where the gall-stones were removed at the same operation where the pelvic lesions were attended to. Although at the time it seemed perfectly safe to palpate the gall-bladders, subsequent events showed



this to be an error in surgical judgment, since both patients died of peritonitis, in neither case attributable to the gall-bladder incisions but to unsuspected purulent foci in the tubes. The remaining fifty-five patients made good recoveries, which is not to be wondered at since uncomplicated gall-bladder surgery should not be accompanied by more than a 2 per cent. mortality.

Without an analysis of the 1,066 cases it is impossible to show the many severe cases of surgery we have had to deal with in this clinic, but I can assure you that the proportion of such cases is very large, since the less difficult cases are apt to be operated upon at home nowadays. Moreover, these statistics include radical abdominal operations for carcinoma of the uterus where the primary mortality is 20 or 25 per cent. Incidentally it is interesting to note that the percentage of gall-stones in the carcinoma cases was very high, the calculi being present in 19.6 per cent. of the fifty-six carcinoma cases in the series.

In the statistics quoted, there were 1,066 patients; not the same number of operations. Had we yielded to the temptations referred to by Dr. Skeel in the statistics of a certain hospital, we should have had a number of thousand operations, since the gynecologist endeavors to perform all necessary operations at one sitting.

It is my practice to make use of the posterior vaginal incision in pus cases whenever possible. A number of the deaths have been due to errors of diagnosis when the abdomen has been opened in the presence of pus. I also favor the posterior vaginal incision in ectopic pregnancy if there be a chance of the hemotocoele being infected.

We are fortunate in having a competent demonstrator of anesthesia connected with our Hospital who knows how to administer and teach the administration of ether. In a few instances nitrous oxide is employed but in the majority of cases ether is used. Since this is a teaching hospital we believe a student should be taught to give one anesthetic and give it well.

I quite agree with Dr. Skeel that much of the mortality in abdominal work is due to delayed operations. In the 1,066 cases were many cases where death resulted from this cause. There were 103 sizeable ovarian cysts in our series, some of them suppurating from infection following twists of the pedicle and many did not come to operation until the patients were greatly reduced by sepsis. Severe anemia from bleeding fibroids plus delay is a complication difficult to deal with.

As Dr. Skeel says one cannot always avoid pulmonary embolism. Some of the most unexpected and saddest surgical deaths I have had have been from this cause. I do not know how one can absolutely avoid such fatalities, although I do believe as one's work improves in accuracy and gentleness that this complication will be met with less frequently.

It may be interesting to refer to the statistics from the Mayo Clinic, where there is no teaching and where every effort is made to evolve the most perfect surgical machine.

In 4,000 operations on the gall-bladder and biliary passages there was a mortality of 2.75 per cent., a remarkable showing if we take into consideration that many of these must have been de-

layed operations. In 2,165 cases of cholecystostomy there was an operative mortality of 1.5 per cent. while in 755 cholecystectomies the mortality was 2.4 per cent. and this mortality was not due to the kind of operation on the gall-bladder but to the conditions calling for the removal of the gall-bladder. In this connection I may say that in all but three of the cases in my series the gall-bladder was drained.

Again I want to thank Dr. Skeel for his most valuable paper, one of the best we have ever had before this society.

DR. H. H. CUMMINGS: I am glad to hear Dr. Skeel advise that appendicitis be subjected to operation as soon as the diagnosis is made. This attitude is coming to the front. Last year among the students we had forty frank cases of appendicitis. I don't believe we urged these young men to be operated upon. Eight were brought into the Hospital and operated. We had one fatality. This young man was in the Hospital, but left contrary to advice, saying he would return in June after he had received his master's degree. He had to be brought to the Hospital, however, before obtaining his degree, was operated upon and died. This year a medical student came in with a temperature of 104°. He delivered papers about town with this temperature. It was impossible to save this young man. In the last two days we have had two patients. Both have been operated upon and both are doing well. In the future we are not going to advise these patients, but we are going to bring them in, inasmuch as it isn't necessary this year to discuss the financial side of the question.

DR. W. A. HOYT: I am especially interested in Dr. Skeel's remarks concerning the postoperative care and treatment of these patients. I am of the opinion, however, that our mortality from acute appendicitis would not be as low as he has given in his series. This I think can be accounted for by the fact that we see very few of our patients during the early days of their attacks, since a very small percentage of our cases of appendicitis come from the city of Ann Arbor. On the other hand, the majority of them come from a distance and attempts have first been made to carry the patient through the attack to an interval operation. As a result most of these patients are admitted in a bad toxic condition with abscess formation which makes the prognosis much graver.

DR. SEELEY: There is one point Dr. Skeel made that I was rather interested in, that is, low mortality in cases of pelvic inflammatory disease. It is a well known fact that in most gynecologic cases as far as the activity of the infection is concerned, you can depend very well upon the temperature, leucocytosis and the palpatory findings. However, there is one class of cases in which we have found that you cannot always depend upon this, i. e. patients who come for operation after infection following either full term delivery or miscarriage. They are usually cases of streptococcal infection. In our cases of acute peritonitis our deaths have come in cases where we had no leucocytosis, no temperature, nothing active so far as we could determine, and yet, after operation when the pathologic report came in, we would get the report of an active focus of micro-



organisms present with no pus, simply active bacteria. Personally, I do not see how a surgeon can guard against this. If there be pus we can drain. If there be no pus, no temperature, no leucocytosis, there is no indication for this.

Another point that struck me as being rather uncommon is that Dr. Skeel makes no mention of poisoning from acetonemia. In a large number of cases we have found that acetone is more frequently found after operations than is usually thought, and I firmly believe that a large number of cases of persistent vomiting which heretofore have not been diagnosed are due to this condition. We have found that administration of sodium bicarbonate by mouth or by rectum immediately relieves this condition. In my recollection we have had two fatal deaths from autonemia, both of these showing the typical findings postmortem.

DR. SKEEL: I fear that I did not appreciate how fortunate I have been until Dr. Peterson explained the character of the cases with which he has had to deal. I am certain the type of cases in this Hospital is quite different from that which one finds in the average non-teaching, semi-public institution.

The data which I have given do not include my teaching service in the Cleveland City Hospital, a service which I discontinued a year ago, although I had the good fortune to have lost no patients during a service of several years there. It should be explained, however, that this service was purely gynecologic and very light. In any municipal or state hospital, however, there are more alcoholics and drug habitues, more patients who have been overworked and underfed.

Reference has been made to the statistics of the Mayo clinic. It should be remembered that this clinic is in a small town and has few either of the overworked, underfed, or other victims of abject poverty, neither does it handle many of the acute cases, acute intestinal obstruction for example, which contributes so largely to the mortality of those whose material is drawn from a large city.

Mayo's manner of compiling statistics is fair, however, in that he includes all patients dying in the hospital, although they remain in that institution a short time only and it may be assumed that the malignant cases which are found inoperable on exploration are out of the hospital before death overtakes them.

Referring to Dr. Darling's remarks, I am again fortunate in having but few children to contend with. I believe there is not a death under the age of twenty in the list presented. This alone shows that I operate upon few children, in fact our pediatrician has the greater part of the children's service and therefore one great source of operative mortality, i. e. immaturity of the patients, is not shown in my figures. Postoperative pneumonia has disturbed me more than any other one complication. Postoperative shock is unimportant in routine abdominal surgery in comparison to pneumonia. In its production the first thing likely to be thought of is chilling of the patient and in that respect an experience of my own shows how an error may occur without the surgeon being himself aware of it.

At a time when respiratory infections seemed to be almost epidemic, we had a chief nurse with some opinions of her own regarding the matter of proper

clothing for the patients. It was noticeable that persons developing bronchitis and pneumonia were not confined to one ward or even one division but were scattered all over the house. As the epidemic continued less ether and more nitrous oxide was used, but without any abeyance in the number of respiratory tract infections. Purely by accident it was observed that all patients sent in for operation were treated alike in that they were deprived of all their usual clothing, given a bath, equipped with a light surgical jacket and put to bed without their underclothes: whereas many of the foreigners, Italians, Bohemians, Germans, etc. had been accustomed to sleeping not only in their underclothes but often with more clothing than they wore by day. After this every patient was asked as to his night clothing and if he were in the habit of sleeping in underclothes he was not deprived of them on the night preceding operation. I am unable to say whether or not it was a coincidence but the pneumonia ceased simultaneously with the cessation of an effort to teach personal hygiene at the expense of life long habits.

At the same time we changed the method of abdominal preparation using iodine after the patient was on the table, instead of scrubbing, alcohol and Harrington's solution, thinking the latter wet the patient too much, but we soon reverted to our old plan after the occurrence of two or three cases of severe dermatitis.

I can hardly agree with Dr. Peterson that teaching itself has much influence upon mortality as we also have a rotation of service and are obliged to give our assistants and internes some instruction in order to keep them. As I said in the body of the paper every new surgical assistant means one or two infections of the abdominal wound in clean appendectomies owing to poor management of the stump.

I am inclined to believe, however, that any appreciable difference between Dr. Peterson's mortality and my own is due to the type of cases submitted to him for operation together with the notorious and lamentable fact that state and municipal institutions are rarely so well or so adequately equipped as the semipublic and private hospitals.

I feel that any teacher can be sufficiently rigid, ugly if you like, with his assistants to check any break in their aseptic technic within a very few days. I know that when I was taking my first surgical training under Dr. de Nancréde I rarely made the same mistake twice else, figuratively speaking, my head would have come off and violently at that.

As to the mortality in gall-bladder surgery: this series is too short to mean anything and in a long series of cases I have no way of knowing whether the mortality would be 1 per cent. or 10. This is proven by the statistics of Dr. John F. Erdman of New York and his statements are reliable. In four years he operated upon 270 patients with a total mortality of 4+ per cent. but in one year he had forty-three operations without a death, the next fifty-four with four deaths, the next sixty-three with no deaths, again seventy-eight with six deaths, and in three months in 1914, twenty-six with three deaths. (*American Journal of Obstetrics*, November, 1914.)

Hans Keler in his monumental work on the surgery of the biliary tract classifies his cases as simple gallstones, moderately complicated, and those with



bos-artig complications. In the first the mortality is in the neighborhood of 1 per cent., in the second it runs much higher, and in the third 20 to 40 per cent. of deaths is not unusual.

The question of the re-formation of gall-stones is a serious one. It is claimed by some that so-called recurrence is practically always due to overlooked stones. In one case of my own small stones were discharged daily for two weeks after a cholecystostomy in which I know the gall-bladder was completely evacuated at the operation. In another instance I removed several stones from the stump of the cystic duct two years after a cholecystectomy. In still another a cholecystectomy was followed within six months not only by all the old symptoms, but also by jaundice which had heretofore been absent. I am sure an occasional common duct stone is overlooked and it seems to me to be quite impossible to avoid leaving some very small stones in the gall-bladder and cystic duct unless cholecystectomy is made the routine operation. That stones in the hepatic duct may be present and can neither be seen nor felt is obvious, so that whether stones re-form or are overlooked is still an open question. Of one thing I am convinced, that gallstones are often formed elsewhere than in the gall-bladder and that symptoms may recur after the most thorough operation. I always approach an operation upon the biliary tract with a certain degree of timidity both as regards the immediate outcome and the ultimate symptomatic cure.

In answer to Dr. Loree, I would say that prostatectomies and operations upon the bladder and kidneys are not tabulated because the paper is limited to operations which invade the peritoneal cavity.

Some questions were asked regarding appendicitis and the unexpected deaths which take place in patients operated upon after having been ill three or four days. It is precisely in such cases that I advocate and have used for nine years the local anesthesia general anesthesia sequence, believing that many of them die from the poisonous effect of ether given to the stage of general narcosis and maintained at that stage for a considerable period of time. The local anesthesia should be cocaine or one of its congeners, never quinine and urea, and if a large abscess is encountered with the patient in bad condition the operation may cease with its evacuation. On the contrary if the patient's conditions is fair and the appendix readily found a few whiffs of nitrous oxide or ether may be sufficient to enable one to do a complete operation with removal of the appendix. The patient is not deeply anesthetized although only too willing to go to sleep and the quantity of general anesthetic used is very small. Thus one does not have to fear the toxemia of infection plus the toxic effect of ether.

It is to be noticed that none of the acute appendicitis deaths were due to peritonitis. During the time covered by this report two patients died following operation for acute appendicitis in other institutions and neither of these died from peritonitis. I certainly do not believe any patient should die from peritonitis following operation for appendicitis unless peritonitis were present before operation, and very few even then. Postoperative peritonitis following operation for appendicular abscess can be avoided by thoroughly walling off the infected area

and if the abscess is huge and not adherent to the abdominal wall, by leaving the gauze in place for from seven to ten days.

What we really fear is acute general sepsis and postoperative pneumonia following lymphatic involvement in retrocecal appendicular abscess.

One gentleman raised a question as to the etiology of the fatal peritonitis in some salpingo-oöphorectomies, the tubes and ovaries containing no pus at the time of operation, the operation having been done for the late results of puerperal infection and after the subsidence of all acute symptoms. In one of these streptococci were found in the specimens removed.

Dr. Hunter Robb of Cleveland made a somewhat similar observation some years ago, and there is of course the best of authority for his belief that a walled-off focus of infection, giving rise to no symptoms, was responsible for the catastrophe. Nevertheless, I can hardly believe that so virulent a peritonitis as has been described could be due to a previously quiescent streptococci infection, and it seems to me to be much more probable that the fatal infection was introduced at the time of operation either from without or else through injury to the intestinal tract during the separation of adhesions. Certainly in no other portion of the body do we assume the presence of live virulent streptococci without tangible symptoms unless it be on mucous surfaces and the mucous surface of the tubes is in direct contact with unprotected peritoneum.

The question of persistent nausea and vomiting from acidosis was raised at the same time. We have little trouble with persistent vomiting except following gall tract operations and I have, perhaps wrongly, attributed this to the handling, packing, drainage, etc. An explanation of the absence of this symptom of acidosis may be the fact that we routinely use a great deal of sodium bicarbonate. So many abdominal cases complain of "heartburn" and "gas in the stomach" both of which seem to be relieved by this simple remedy, that I imagine that three-fourths or even more of them receive it on the second or third day after operation.

I think this covers all the questions asked, but I should like to record my conviction that any great difference in the mortality rate is not to be found among surgeons who are doing careful work excepting such as may be due to the character of the cases upon which they are operating.

One of the principal things which I desired to bring out was the actual source of our surgical deaths, and also to show that *under present conditions* most of them are unavoidable and but few are true operative deaths.

Incidentally the tabulation of "operative deaths" and "surgical deaths" reveals the truth in the much quoted statement that "there are lies, d—d lies and statistics." Bearing on this I could present 1,360 operations with but .59 per cent. operative deaths and be perfectly truthful, but on the other hand there were 1,032 patients actually operated upon of whom thirty-two died for one reason or another before leaving the hospital, thus giving a hospital mortality for my own abdominal patients of 3.1 per cent. This discrepancy justifies us in making every man who presents a startlingly low mortality



rate to publish simultaneously the basis upon which his mortality is estimated and state for our consideration just what he considers to be a surgical death.

### A CASE OF CONVULSIONS IN A NEW-BORN BABY.

ALBERT H. BEIFELD, M.D.

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This case, which occurred in the service of Dr. Peterson, is reported because of the rather misleading nature of the symptoms which led to a false diagnosis.

The family history is negative except for the fact that the baby was born out of wedlock. In the birth history the facts that the so-called "twilight sleep" anesthesia was used, and that the membranes were ruptured by the physician and that meconium was found in the amniotic fluid are noted. The labor was of short duration for a primipara and was normal in mechanism.

There was the usual degree of asphyxia encountered in cases where this anesthetic is used, but twenty-four hours after birth the respiration rate rose to 90 per minute and took on a Cheyne-Stoke's character. The infant was drowsy but not distinctly stuporous. Some hours afterward while the patient was under observation, it was seen to slowly turn onto the left side and a convulsion lasting a half minute, involving the left half of the body exclusively took place. That night thirty-six hours after birth, the child uttered a shrill cry and was found by the nurse to be in a position of exaggerated opisthotonos.

Examination of the child made when the dyspnea was the only symptom showed a premature ossification of the cranium involving the frontal and parietal bones to such an extent that the anterior fontanelle measured but slightly more than a centimeter in diameter. No bulging was made out. The lungs showed an unusual number of moist râles at the left base posteriorly. No other pathologic conditions other than the drowsiness and the dyspnea were noted. The examination of the placenta and of the blood of both mother and child were negative for syphilis.

From these symptoms and the course of the disease it seemed justifiable to assume that a condition of cerebral irritation existed and in view of the convulsion so clearly localized, a diagnosis of right sided meningeal hemorrhage was made. A lumbar puncture made the next afternoon failed to bring fluid of any kind to

the syringe. Against hemorrhage was the fact that this puncture failed and that there was no bulging of the fontanelle. This latter, however, may have been due to the fact that the small size of the fontanelle masked or prevented bulging. In the differential diagnosis syphilis and asphyxia were to be considered. The former was ruled out by the history and negative blood findings. The character of the symptoms made it seem possible to rule out asphyxia.

Exploratory operation was accordingly suggested and the right motor cortex was exposed by Dr. Darling. No evidence of bleeding was found. Death occurred twenty-four hours after the operation.

At autopsy the chief findings were hemorrhages situated in the pial covering of the base of the left lobe of the cerebellum (not involving the cortex) and in the pericardium and the pleurae. Atelectasis was found in the bases of the lungs, especially on the left side where signs of beginning pneumonia were made. The small size of the anterior fontanelle was found to be due to actual premature ossification and not to an over riding of the parietal bones. From these characteristic findings a diagnosis of asphyxia neonatorum was easily made.

In view of the complicating factors in the case it is impossible to make a definite diagnosis. The fact of the convulsion makes it probable that an abnormal degree of intercranial pressure existed. On the other hand, the fact that scopolamine-morphine anesthesia was used might have a bearing on the case, acting as an accessory influence in increasing the asphyxia.

#### DISCUSSION.

DR. REUBEN PETERSON: I have been so busy lately with hospital executive work that I did not have an opportunity of investigating personally the case reported by Dr. Beifeld. The case is interesting because the fetal death occurred when the morphine-scopolamine anesthesia was employed and naturally leads to the inquiry of whether this particular obstetric anesthesia can have had anything to do with the fetal death. We have only to look back over our obstetric experiences to be convinced of the fact that not infrequently newly born children died of asphyxia. So in this case, because the death occurred after the use of scopolamine, we are bound to consider the possible relation between the asphyxia and the use of the drug, although it does not necessarily follow that one was due to the other.

Some years ago we used scopolamine in the maternity clinic but the results were not satisfactory, largely I believe because our method of administration was faulty. Hence I have decided upon a more careful and extensive use of twilight sleep in the maternity clinic with the determination of reporting results honestly whether they be good or bad. For this reason I cheerfully gave my consent to have