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**ORIGINAL COMMUNICATIONS.**

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ON POSTOPERATIVE SEPARATION OF LAPAROTOMY  
WOUNDS (POSTOPERATIVE PROLAPSE OF  
INTESTINES).\*

BY  
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THE surgical accident indicated in the title of this paper is a rather common occurrence, the literature of which is undoubtedly very much smaller than it might be. The tendency to report successful cases and to leave to oblivion cases in which the recovery has not been of the proverbial uneventfulness, is too human to be overcome very readily.

Madelung, in 1905, in *Archiv. für Chirurgie*, vol. lxxvii, published the results of a painstaking investigation of the literature to which he added his own experience and that of some of his colleagues; so that his paper is based on altogether 157 cases. For the purposes of my paper it is not necessary to increase the number of quotations from the literature.†

Madelung's laborious work has not led to any definite result. The very multiplicity of conditions which, according to him, may favor postoperative separation of the laparotomy wound is a fairly accurate indication of our ignorance of the real cause. A number of observations which I have made seem to me to throw an entirely new light on the etiology of this accident in our sur-

\* Read before the Chicago Gynecological Society.

† The authors quoted by Madelung will be referred to in this paper under the same numbers under which they go in Madelung's list of references. I have read all the papers quoted by Madelung as far as they could be found in Chicago libraries and a number of papers which have appeared since 1905, but have found nothing in them that would render superfluous the publication of this paper.

gical technic, for such I hope to be able to prove it in a large number of cases at least.

According to the condition of the laparotomy wound certain classes of cases have to be differentiated. First, there is the difference between the aseptic and the septic wounds. If the wound is septic, none of us are surprised if the histolysis due to the septic microorganisms prevents the healing of the wound or allows the partially healed wound to separate. I therefore exclude septic cases from our further discussion.

Secondly, laparotomy wounds differ according to whether they have been closed completely or have been left partially open for the purpose of drainage, packing, formation of intestinal fistulas, fixation of stumps in the wound, etc. This paper will discuss more particularly the wounds which have been closed completely. Partially closed wounds are particularly liable to be or to become infected. But besides infection the most important cause of postoperative separation of the wound which is to be demonstrated in this paper, affects these wounds as well as, or even more than, completely closed wounds. The methods of suturing and the kind of suture material employed are immaterial (Madelung, pp. 367 to 369).

The first observation which caused my interest in this problem was made in 1902. A Mrs. L., 45 years old, short and stout, had a ventral hernia following a cholecystectomy, in which packing had been employed. The hernia was the size of a fist. The hernial opening was dissected free without opening the peritoneum and then a suture with formalin catgut (Hofmeister) in layers was performed (one continuous suture of No. 0 catgut for the posterior sheath of the rectus, one interrupted layer for the muscle, one layer No. 0 for the fascia, skin suture with celluloid linen thread). At the conclusion of the skin suture the anesthetic was discontinued and the patient began to awake, became nauseated and vomited. *With a distinctly audible noise something snapped in the wound.* Under renewed anesthesia the skin sutures were removed, and it was seen that *the suture of the fascia had torn, so that the muscle lay bare.* The fascia was sutured again with catgut No. 2 continuously, and after the skin sutures had been placed again the patient's vomiting which accompanied her awakening from the anesthetic was without effect on the sutures. The patient made a rapid recovery, and according to the statement of her physician has no recurrence of the hernia.

This case suggested a line of reasoning as follows: Evidently catgut No. 0 was too thin to withstand the tension of the efforts at vomiting. Now let us suppose that the vomiting had taken place not immediately after the operation while the patient was still on the table, but later on when the patient was in her bed. If the nurse in attendance happened to be absent at the moment, when the patient vomited, or if she did not understand the import of the noise produced by the snapping of the sutures, then we would have been surprised to find later on nonunion of the fascia and possibly a recurrence of the hernia. Furthermore, supposing that not only the fascial layer of sutures, but the muscular layer too, snapped in the absence of a person familiar with such eventualities, there would have been nothing to hold back the intestine except the peritoneum which had not been opened and the skin, and it was to be expected that the peritoneum would bulge out between the gaping edges of fascia and muscle and that there would appear a hernia a very short time after the operation and as large as before. Going a step further, what was to be expected if the peritoneum had been incised and sutured as well as the other layers and if the sutures holding the peritoneum also had given way? Then the skin sutures alone would hold back the abdominal contents, and if the stitches were removed, only the union of the skin, notoriously delicate and friable at the time customary for the removal of skin sutures, would prevent separation of the wound and prolapse of the intestines. Any undue tension affecting the skin scar might cause it to separate after it had been deprived of the support of the sutures.

The next question was: Could it be proven that here was the underlying factor in the causation of postoperative prolapse of the intestines? And the answer must be this: the tissues under the integument, if seen soon after the occurrence of the prolapse, must show by their appearance whether their separation had occurred at the moment at which the prolapse took place or sometime before. If the peritoneum, muscle and fascia had all torn open at this time, they would have to appear like a freshly torn wound and would have to bleed more or less. On the other hand, if they had been allowed to separate by a break of the sutures immediately after the operation, then at the time of the prolapse only the skin would have to show the evidence of a recent tearing, while the deeper layers would be found in the

condition which any unsutured wound would present after days, that is to say, it would be found *granulating*.

The literature which I had at hand at that time was strangely silent on this point, and even now with the help of Madelung's extensive research this point cannot be cleared up from the literature. Almost none of the papers refer to the condition of the edges of the wound (aside from the question of infection), and the one author, who mentions it, seems to attribute no importance to his findings (see below).

Not until over five years later came the opportunity for a personal observation. My colleague, Dr. T. J. Sullivan, Professor of Surgery at the Post-Graduate Medical School, operated in September, 1907, on a woman of thirty-eight years, performing gastroenterostomy for an inoperable carcinoma of the pylorus. The peritoneum, which was thickened, was sutured continuously edge to edge with No. 1 pyoctanin catgut. Muscle and fascia were sutured continuously with pyoctanin catgut No. 2. The skin was sutured with interrupted silkworm. The patient, who had vomited before the operation, continued to vomit after it for days. But the wound appeared to have healed by primary union when the stitches were removed on the fourteenth day, the day of the discharge from the hospital. On the following day the patient noticed a little moisture on the dressing, but was otherwise perfectly normal and free from pain. When Dr. Sullivan saw the patient on the same day and lifted up the dressing, he found small intestine prolapsed under the dressing. He dropped the dressing back into place and had the patient transported to the hospital, where I was invited to be present at the operation. Before the dressing was removed on the operating table, the above conclusions were gone over, and it was decided to pay particular attention to the edges of the wound in order to confirm or disprove the correctness of the theoretical deductions.

The findings were these:

The dressing contained a small amount of serous fluid with a slight bloody tinge. The skin was free from pus, redness or swelling. Between the edges of the skin protruded a few coils of small intestine, which were a little pink, but glistening and not adherent to the edges of the skin. On retracting the edges of the wound it was seen that *the skin incision showed tiny, fresh, bright, bloody points, while the deeper layers which shelved inward (see diagram) were pink, glistening, perfectly free from hemorrhage and presented a perfectly smooth surface in*

*which the various layers of the abdominal wall could not be differentiated.* The peritoneum inside was absolutely normal, but its edge was hidden in the granulations. Suture was followed by recovery.

In other words, the condition of the edges of the wound fulfilled completely the postulates constructed after the observation of the first case. My sincere thanks are due to my friend, Dr. Sullivan, for permission to investigate and to publish this very instructive case.

CASE. III.—In November, 1908, a second observation was made which confirmed the first. Mrs. F., a small, rather thin woman, who had never borne children, had been operated on by a physician in September, 1907. He had resected the right ovary and the fimbriated end of the right tube and performed ventrofixation. One year later, in November, 1908, the patient came to me, and after unsuccessful conservative treatment laparotomy was performed under scopolamine-morphine-ether anesthesia (ether, 350 c.c.). The operation lasted 50 minutes. The scar in the skin was excised. In the fascia a gap was found at about the middle of the scar. The incision went through the scar of the deeper layers. The inflamed stump of the right tube, a left pyosalpinx, and adherent and kinked appendix were removed. The uterus which was adherent posteriorly, had drawn out the adhesions produced by the ventrofixation to a ligament over 10 cm. long. This ligament was removed. The abdomen was sutured with sterile catgut, No. 1 continuous for peritoneum and with another layer of the same kind for the muscle. The fascia was sutured with continuous catgut No. 2. Skin suture with interrupted celluloid thread. The patient vomited and coughed for three days after the operation and was uncomfortable for four days after the operation, distinctly more so than we usually see after such operations. The temperature reached 100 only once on the fourth day, but her pulse remained around eighty. The bowels were moved easily with enemas. The patient was up in bed on the day of operation, up in chair on the second day, and walked on the fifth day. After the fifth day she felt perfectly comfortable and she took mixed diet from the third day on. However, as in the absence of any grave symptoms she did not appear just right for a number of days after the operation, the possible causes of the disturbance were discussed in the clinic and the separation of the deeper layers of the wound was mentioned and the treatment discussed.

On the seventh day the skin sutures were removed and there was apparently perfect primary union. About 10 P. M. on the same day the patient sneezed, she held on to her abdomen during this act, but felt her wound open. However, she had little pain and slept most of the night. She rose once during the night and went to the bath-room to urinate. Afterward she went to sleep again. After the sneezing and especially after she had been to the bath-room, she noticed that some fluid was running over her skin, and toward morning she noticed that the dressing was wet with a slightly bloody fluid. The interne was notified, looked under the dressing and saw prolapsed intestine. As the previous clinical discussion of the case remained in his memory, he wisely left the wound alone and notified me. I saw the patient about 10 A. M., that is to say, about twelve hours after the sneezing. The patient had a temperature of 98.6, pulse of 92, and looked perfectly comfortable. She was placed on the operating table and anesthetized with ether. The sterile gauze of the dressing was slightly adherent to the intestines. After its removal it was found that the wound had separated to its full length with the exception of 2 cm. at the lower end. Coils of small intestine presented themselves in the lower part of the wound, in the upper angle omentum was visible. The patient pressed a little and an additional coil of intestine was extruded on the left side of the wound. After the patient had been anesthetized completely, the following observations were made: The skin around the incision was perfectly normal. Bowel and omentum as far as they were prolapsed were a little pink, but glistening, with a few white flakes of fibrin on the surface. On the left side the prolapsed organs were not adherent at all and could be replaced with great ease. On the right side the intestine was attached slightly and the omentum in the same way, but not more than, for instance, the bowel would be attached to a sponge at the end of an operation with dry sponges. The entire prolapsed organs were replaced with great ease, and a minute quantity of serous fluid with a slight bloody tinge escaped between them. *The edges of the skin showed a few bright red points. The rest of the abdominal wall shelved inward. The surface of the deeper layers was free from hemorrhage and perfectly smooth. Muscle and fascia could not be differentiated under this smooth glistening surface.* The peritoneum appeared as a white, slightly thickened membrane which extended a short distance outward on the other layers of abdominal wall. The peritoneal edges were easily stripped off

and united by continuous catgut suture. Muscle and fascia were separated by sharp dissection and sutured separately with continuous catgut suture. The sutures grasped the tissue at a good distance from the edge and did not cut through. The skin was sutured with interrupted celluloid thread.

Again, therefore, the findings were in entire accord with the theory that the deeper layers had given way long before the skin did.

The patient stood the operation well. It had lasted twelve minutes. On the fifth day after the operation there was a little separation of the edges of the wound in the middle with discharge of a little oil and serum, but no pus. On the eighth day the stitches were removed. On the seventeenth day patient was discharged. Five months after the operation the skin scar was found wide, there was diastasis of the recti, and when the patient pressed there was some bulging of the skin.

A third case not only confirmed the previous findings, but added new features of interest.

CASE IV—In May, 1909, I performed an abdominal hysterectomy on an enormously fat nullipara, weighing 225 pounds, for a fibroid of the size of a two months' pregnancy. The patient had scopolamine-morphine and besides 300 c.c. of ether. The operation lasted one hour and forty minutes. The abdominal suture presented some difficulty on account of the enormous amounts of fat. The peritoneum was closed with continuous plain sterile catgut No. 1, a second layer of the same kind united the muscles and a continuous catgut suture of No. 2 was used for the fascia. The skin was sutured with celluloid thread. The patient vomited considerably the first day, less on the second and third days. On the third day she began to cough a little, but nothing was found on the lungs except a few moist râles here and there. The patient slept little and complained of pain for the first two days, had no appetite, was troubled with flatulency, but her bowels were moved easily with enemas. She sat up in bed and in a chair. At the end of three times twenty-four hours after the operation it was noticed that there was a bloody discharge on the binder, but when the dressing was removed for inspection, the skin suture appeared perfect. A dry sterile dressing was applied. The patient felt more comfortable, coughed less, slept well, and took nourishment with better relish. She sat up in a chair for some time every day. In the clinical presentation the possibility of separation of the deeper layers and its proper treatment was discussed.

The dressing was changed daily and nothing but serous fluid was ever found on the dressing, the skin apparently healing well. At no time was there any gap to be seen between the stitches which allowed the fluid to escape. The temperature reached 100° every evening, the pulse ranged around 110 to 120 for the first four days, then went down to 90 or 100. The crease in the skin under the overhanging pendulous abdomen became slightly eczematous.

Eight days after the operation my assistant removed every second stitch from the skin. He noticed a small amount of serum coming from the lower angle of the incision and applied a dry sterile dressing. One-half hour later I saw the patient and found the dressing moist with a serous fluid. On opening the dressing, small intestine, very slightly distended, was seen lying exposed in the lower angle of the wound, which was separated to the length of about 7 cm. The intestine lay in the level of the skin and did not protrude above that level. The patient stated that after the removal of the stitches she had had an evacuation of the bowels, had pressed and had felt something give. But she was so little incommoded by it, that she took her midday meal in perfect comfort. The operation was postponed on account of the full condition of the stomach, a dry sterile dressing applied, and the patient advised to lie still. Five hours afterward the patient, who in the meantime had received scopolamine-morphine, was placed on the operating-table and anesthetized. The skin was disinfected with tincture of iodine, especially in the crease above the pubes.

The edges of the wound were raised up for inspection where they had separated and were free from hemorrhage. A clear serous fluid escaped from between the bowels in small quantities. *The separated surface of the abdominal parietes was perfectly smooth, shining, and free from hemorrhage.* The bowels were only very slightly adherent and were detached easily.

*Now the first skin suture above the separated part of the wound was cut. Immediately the skin separated and intestine was seen lying under it.* This intestine again was perfectly smooth and shining. One after the other the skin sutures were removed and *as often as one was cut, the skin separated and bowel appeared under it.* Only the uppermost 3 or 4 cm. of the wound did not open up of their own accord and were separated by very slight pressure of the finger. Omentum was seen adherent under this part of the incision. Otherwise the intestine was



perfectly free and lay in a large cavity in the subcutaneous fat with hardly any adhesions to the walls of this cavity. The mass of intestine under the skin was of the size of a child's head at least. Bowel and omentum were then covered with two large sponges and handled in this cover as one mass. As the mass was moved sideways the cleft in the deeper layers was seen, through which the bowel had escaped. This cleft was long and narrow, slit-like. *The fascia and the muscle were covered with pink granulations which were smooth and shining.* The peritoneum had retracted a little more on the left than on the right side, but was smooth and glistening. In the lower angle in the neighborhood of the infected skin there were some white fibrinous flakes on the granulations, otherwise the whole wound was free from pus or fibrin. Suture was difficult on account of the enormous amounts of fat inside the abdomen and because the tissue did not hold the stitches, but allowed them to cut through. Through-and-through sutures of catgut No. 2, which were passed through peritoneum, muscle, and fascia together, at last brought the edges together. A reenforcing suture of catgut was placed through the fascia taking hold of the tissue at quite a distance from the edge. The skin sutures were placed at rather considerable intervals on account of the infected condition of the skin at the lower angle. The operation had lasted about twenty minutes and the patient had taken 100 c.c. of ether. The patient made a good recovery and left the hospital fourteen days after the secondary suture with an apparently firm abdominal scar.

The findings, as far as the granulating condition of the tissues was concerned, again proved correct the above discussed theoretical deductions. Besides in the largest part of the wound *the condition, which we had constructed theoretically, was reproduced exactly in the living subject. Here was the skin as the only cover of the abdominal contents. Here were the deep layers separated and granulating, and here was intestine and omentum pushing in between the deep layers. And the skin gave way as soon as the sutures were cut.*

In addition thereto there was found *an apparently perfectly developed ventral hernia* with the wide lateral subcutaneous development with which all surgeons are familiar who have operated on large umbilical or post-operative hernias. If further observations should prove the above findings to be regular characteristics of early postoperative hernias, then we must

assume that the peritoneum which invests the sacs of post-operative hernias is a secondary growth of peritoneal epithelium over a preformed cavity, the original lining of which; smooth and shining as it is, is granulation tissue, not peritoneum. For it is not likely that peritoneum should cover surfaces of the size of three or six times the palm of the hand in the course of a few hours or days. Actual macroscopic examination of the peritoneum in this case demonstrated it as terminating at practically normal limits. The growth and development of the post-operative hernia would therefore be entirely different from that of an umbilical hernia.

The greatest interest is attached again to *the granulating condition* of the abdominal walls which in this case was observed about *one-half hour after the separation of the skin*, considerably earlier than in the cases II and III, where twelve and twenty-four hours, respectively, intervened between separation of the skin and investigation of the walls of the prolapse. It is beyond controversy that an interval of one-half hour could not be sufficient to change a torn wound into a perfectly smooth granulating wound. This observation 4 is therefore of the greatest value. The only mention of such findings in the literature is made by Neermann(65) who, in discussing the proper method of suturing after postoperative prolapse, says that suture in layers is out of the question, as the wound surfaces are always smooth, even, mostly bright red and differentiation of the individual layers is out of the question. Neermann therefore made the correct observation, but failed to draw the logical conclusions.

It is not directly stated anywhere in the literature that at the time when the rupture takes place it is a rupture of the entire thickness of the abdominal walls. That, however, seems to be tacitly and generally understood. The theory which we are trying to establish in this paper says, on the contrary, that *the time at which the deeper layers separate precedes by a considerable interval the moment at which the skin separates.*

The observation of the early snapping of the deep sutures as it occurred in our case I is by no means isolated. It was repeated in our work in May, 1908. Mr. F. (Case V), thirty-three years old, a powerfully built man of about 240 pounds, was operated on for acute appendicitis under gas-ether anesthesia. The incision was made through the right rectus muscle, and at the end of the operation peritoneum, muscle, and fascia

were sutured separately by continuous catgut suture (No. 1 for peritoneum and muscle, No. 2 for fascia). The skin was closed with Michel clamps. As the dressing was being applied, the patient pressed, gagged, and vomited. Something was heard to snap with an audible noise. The skin clamps were removed and it was found that the entire suture of the fascia had burst open. It was renewed with interrupted catgut No. 2. The patient recovered. Again the question arises: what would have happened if the patient had vomited ten minutes later in the absence of a person familiar with such an accident?

Madelung's extensive research has furnished us with only one observation of this kind. Tournemelle(96) reports that after an operation for ventral hernia the catgut sutures snapped audibly before the dressing was finished and a tumor the size of an egg became visible under the skin, whereupon the proper treatment could be instituted immediately. But it is not recorded that Tournemelle drew any further deductions from this observation.

The above observations explain why so many different causes have been considered in the etiology of the postoperative prolapse. It is noteworthy that in many cases a sudden effort of the abdominal walls has been deemed guilty of causing the separation of the abdominal walls. Madelung records (page 376) that pulmonary affections with cough prevented the healing in thirty-one cases, while in twenty-four cases a sudden coughing spell caused the apparently healed wound to burst open. In altogether fifty-one of his 157 cases the authors accuse cough as the essential cause of the postoperative prolapse. In other cases vomiting is mentioned. Repeated and constant vomiting is referred to ten times, immediately after a vomiting spell the abdominal wound separated in fifteen cases (page 377), altogether in twenty-six out of 157 cases a causal relation between vomiting and the postoperative prolapse is assumed by the authors. Hiccoughing is mentioned once, sneezing once, pressing during defecation five times, and so on. In short, a number of conditions which are accompanied by sudden increase in pressure on the abdominal wounds are reported as having led to postoperative prolapse.

But *in themselves they are all unimportant*. Many patients vomit and many sneeze, cough, and press at defecation without becoming victims of postoperative prolapse. *The essential step is the separation of the deep layers* and only in so far as this

is the consequence of any of the above-mentioned acts have they any connection with the postoperative prolapse.

The French authors have tried to differentiate between predisposing and determining causes. According to what has been demonstrated in this paper, there is only one predisposing cause, the separation of the deeper layers due to breaking of the sutures or similar occurrences (see below). With the abdominal contents lying directly under the skin, any sudden tension produced on the delicate scar in the skin is sufficient to burst it.

As long as the stitches in the skin hold the skin together, the skin has a support, which is as strong as the stitches are. Rupture of the skin is therefore particularly liable to take place after the stitches are removed. My three cases all occurred after removal of the stitches, and in Madelung's compilation it is mentioned (page 370) that in thirty-nine cases the postoperative prolapse occurred within three times twenty-four hours after removal of the stitches. Madelung also mentions (page 358) that between the seventh and tenth days after the operation the rupture took place in fifty-nine cases, and as the date on which the stitches were removed in those cases is not recorded here specially, it is worth remembering that the days on which the stitches in the skin, if nonabsorbable, are usually removed are just these days.

There are therefore always *two steps in the postoperative prolapse which are separated by longer or shorter intervals. The first step is the separation of the deeper layers. The deeper layers then granulate, but do not heal together, because the abdominal contents push in between the granulating edges. The second step takes place days or weeks afterward, when the skin also gives way.*

In my cases I and V it was seen that the *catgut sutures had snapped*, but though probably the most frequent, this is by no means the only way in which the suture can become defective. There are, as I see from the literature, three other possibilities besides the first one of the tearing of the sutures. Mittermaier(63) mentions this first form and says that in his case part of the catgut appeared torn clear across.

2. There is secondly the suture which becomes defective by *the knots coming open*. Rueder (Madelung, page 368) speaks of defective knotting of the suture. Brettauer(12) reports as follows concerning his case: "On inspecting the buried sutures the knots of two silkworm sutures were found to have opened and

a third one loosened, though they had been tied firmly and were not cut closely."

3. Instead of the sutures breaking or coming open, the suture remains solid, but *the tissue gives way*. This can happen in two ways:

3a. *Each stitch can cut across the tissue transversely*. Every operator has seen that when operating on abdominal walls which were under some tension. Ryall(81) reports a case of rupture in which, he says, "the deeper layers of sutures had completely given way, the sutures having torn through the tissue."

3b. A more exceptional and rather peculiar mode of this accident is represented by two observations: Sapiejko(82) reports one of these cases as follows: In an operation for umbilical hernia he had sutured the abdominal wall with silk in three layers, one for peritoneum, one for muscle and fascia, one for skin. Fourteen days after the operation prolapse of the intestines occurred. After separation of the skin edges, it was seen that the two deep rows of sutures had held firmly, but *the fascia and the muscle had torn in the line of the stitch-holes* in the whole length of the wound. One and one-half cm. from the median line a new laparotomy wound had been formed by the tearing of the wall. He cut out the entire sutured mass of tissue and made a new suture in layers. Brettauer(12) in his case III reports that "*the fascia in the whole length of the incision had torn immediately behind the line of stitch-holes*, while the buried thirteen stitches held the two original edges of the fascia very tightly together." Every experienced operator will remember cases, in which at the insertion of a stitch into the peritoneum or especially muscle or the fascia a little longitudinal slit formed immediately instead of the little stitch-hole, which is usually barely visible. If the stitches are all placed very neatly at exactly the same distance from the incision, these slits, if such have formed *or form after the wound is closed completely*, are liable to run together and make a large longitudinal opening, a new laparotomy wound under the skin, which prevents our observation of the deep layers. For a simple comparison I may refer to the multiple perforations on sheets of postage stamps which serve to render easy the detachment of individual stamps. It is quite likely that this form of separation of the deep layers is more frequent than we have been led to believe by the very scant reports in the literature.

4. Form 4 is known in only one instance, which occurred in Madelung's personal experience (page 365). Madelung operated on a young man of twenty-one years for peritonitis following buckshot injury of the abdomen. "Careful suture in layers inside with catgut, outside with silk. A piece of iodoform wick was placed in the lower angle." On the third day after the operation the dressing was changed and the wick removed. A piece of omentum the size of a pea prolapsed through the gap in the suture. On the fourth day patient had severe pain in the abdomen. At the change of the dressing some pus and some foul-smelling bubbles of gas escaped. The skin sutures were cut. "Under the skin lay a bundle of necrotic tissue as long and as thick as a finger, to which all deep sutures were attached." The bundle contained the necrotic peritoneum, muscle, and fascia which was held by the sutures. The case recovered. I mention this case, though I am not otherwise discussing cases in which the wound had not been closed completely. But it is reasonable to assume that the gangrene could have taken place just as well if the wound had been closed completely.

One conclusion from the above is unavoidable: *The separation of the deeper layers is an accident which is not always preventable by any amount of care the surgeon may exercise.* Nobody can prevent the tissue from tearing through, nobody can with absolute certainty prevent necrosis of the bundle of tissue held in the sutures. Every surgeon should know how to tie knots so that they will not reopen; but if such an accident happens in the practice of an experienced man like Brettauer, who will say that it is absolutely preventable? The postage-stamp form of separation of the deep layers might be prevented by using care not to place the sutures at absolutely equal distances from the incision. As far as the snapping of the sutures is concerned, it is a matter of judgment and experience to say what size suture material is the proper one for a given wound. We are all anxious not to place too much or too thick foreign bodies into a wound and most of us probably agree with the advice that the thinnest suture material in the smallest amount which will hold the tissues is the best. But it is a matter of judgment what may be expected to hold, and our judgment is not infallible.

These statements should be borne in mind particularly with reference to the *legal liability of a surgeon* for such an accident. The application of the observations and deductions contained in this paper to the question of postoperative hernia is sufficiently

evident without special discussion to cause us to be guarded also in our opinions of the responsibility of a surgeon in case of post-operative hernia.

We have to add that while the tearing of the stitches is not likely to take place without some sudden increase of tension in consequence of vomiting, gagging, coughing, etc., the other three or rather four forms may all take place in the absence of such sudden occurrences. Meteorism after operations is so frequent, that it may suffice for the explanation of almost any case in which the knots slipped, the tissue tore through, or the postage-stamp form of separation occurred. In addition we have to state that even *after the deeper layers have separated* through any of the above-mentioned causes, *postoperative prolapse need not take place*. One very important reason why it should not take place is given by adhesions, as Madelung (page 375) mentions with regard to tuberculosis. Ordinary mild pus infection might do the same.

After we have separated postoperative prolapse into two steps, it becomes our duty to see what can be done in the way of diagnosing the separation of the deeper layers before the skin gives way and the prolapse occurs. This is an entirely different diagnosis from that which Madelung discusses (pages 380 and following).

The diagnosis which is desirable is not the diagnosis of the completed prolapse, but *the diagnosis of the conditions which have been brought forward in this paper as the essential causes of postoperative prolapse*. This diagnosis is of necessity left out of all previous papers, because none of them have shown the essential cause of the prolapse.

As a rule, laparotomy wounds are not inspected until it is time to remove the skin sutures, unless there is some special reason for it, like a rise of temperature, pain, discharge of secretions through the dressing, etc. And usually when we remove the sutures the abdominal walls are not handled nor subjected to any special tests for their firmness. Some changes in this routine might be advantageous.

It is needless to dwell on the indications given by audible snapping of the sutures at the end of the operation. But if, after the operation is finished, the patient for days seems uncomfortable, has flatulency, feels soreness in the wound, has a tendency to vomit without peritonitic symptoms otherwise, and, generally speaking, does not appear just right, it may be well to

consider among other things the possibility of separation of the deeper layers of the wound. If then a discharge of serum or blood-stained serum takes place through the apparently clean skin wound, the suspicion is strengthened. Then, if the dressing is opened, certain observations may be made which I had occasion to make in a case which I operated on in 1905.

CASE VI.—An Irish laborer of forty-five years, an alcoholic, had an extensive carcinoma of the rectum, which was operated on February 20 by the combined sacral and abdominal route, the abdominal incision being made along the outer edge of the rectus muscle. The abdominal wall was sutured with cat-gut in layers for peritoneum, fascia, and skin. The carcinoma had been broken into in the course of the operation. The hollow of the sacrum was therefore tamponed. Patient vomited a good deal after the operation, coughed, held himself hanging half-way out of the bed, got up and walked around, disregarding all orders to the contrary. On the day after the operation patient was restless, coughed some. He was taken to the dressing room and on opening the abdominal dressing a considerable bulging of the skin in the region of the incision was noticed. Patient was informed of his condition and advised to have a secondary suture, but refused to have anything done.

On the twenty-second the hernia was larger. Patient vomited three times. On the twenty-third, in order to demonstrate to the patient that his suture had given way, I introduced a probe between the clean skin edges, which dropped into the abdominal cavity without any resistance as far as I allowed it to enter. Patient still refused to have anything done. Patient vomited twice on this day. On the twenty-fourth the patient vomited once and the wound burst open. When I arrived at the hospital, an interne was busy trying to replace the prolapsed intestines, the patient lying on his bed, struggling and pressing. The young physician, shocked by the occurrence, had forgotten all discussions of the proper treatment of such cases and had handled the bowel very roughly. Under absolutely insufficient aseptic preparations he then sutured the abdominal wall. The patient was in poor condition after this treatment and died eight hours later. The postmortem showed diffuse fibrinous peritonitis and extensive infection of the wound cavity in the pelvis. The suture of the intestine had held in spite of all rough handling.

The bulging of the skin and the test with the probe gave excellent evidence of the separation of the deeper layers and might



on occasion be remembered with advantage. If the patient had been less unreasonable and independent, the secondary suture performed on the day after the operation would at least have prevented the postoperative prolapse, though it is doubtful whether he would have survived the infection of the pelvic connective tissue. The peritonitis may have been a continuation of this pelvic infection rather than a consequence of a lack of proper manipulation at the time of the prolapse.

If there is no reason for opening the dressing before it is time to remove the stitches in the skin, I pursue now the following plan: Before the skin sutures are removed, the patient is asked to raise himself from the recumbent position, while the physician places an aseptic hand either over the wound itself or over a thin layer of dressing placed over the wound. If the abdominal wall consists only of skin, it is possible to feel that. It might be urged that this very act might precipitate the postoperative prolapse. But as long as the stitches are not removed, there is very little danger of prolapse, and if the test should demonstrate the separation of the deeper layers, then it would be proper to prepare the patient for operation immediately and to remove the skin sutures with all preparations for secondary suture ready at hand. It may take some moral fortitude to tell a patient of the necessity of a secondary suture, when the patient is feeling perfectly well, but a secondary suture will be a lesser evil than a postoperative prolapse or a hernia.

In speaking of the accident under discussion the terms "postoperative prolapse," "rupture of the abdominal wound," "postoperative evisceration" are used rather promiscuously. They are none of them quite correct. Oftentimes the abdominal wound separates, but the intestines do not protrude at all, or at least not above the level of the skin, so that it is hardly proper to speak of prolapse or evisceration. Rupture of the abdominal wound conveys the impression, that the whole abdominal wound ruptures at one time, whereas in fact the separation of the deeper layers takes place at a time preceding the separation of the skin by varying intervals. Also it conveys the idea of a sudden action which is not always correct. "Separation of the wound" fits all of the various forms of this surgical accident better than any other term, and I have therefore placed it at the head of this paper.

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2