Midline Abdominal Incision

Richard Davis

Introduction:

The midline abdominal incision is by far the most commonly used incision in abdominal surgery. It allows rapid access to all the abdominal cavity. It is extensible if access is limited or if unexpected findings prompt a change in strategy. It does not require a muscle to be split and therefore it can be closed rapidly, in one layer.

An understanding of the midline incision and all of its variations is part of the foundation of abdominal surgery. The incision and closure proceed in the following general steps:

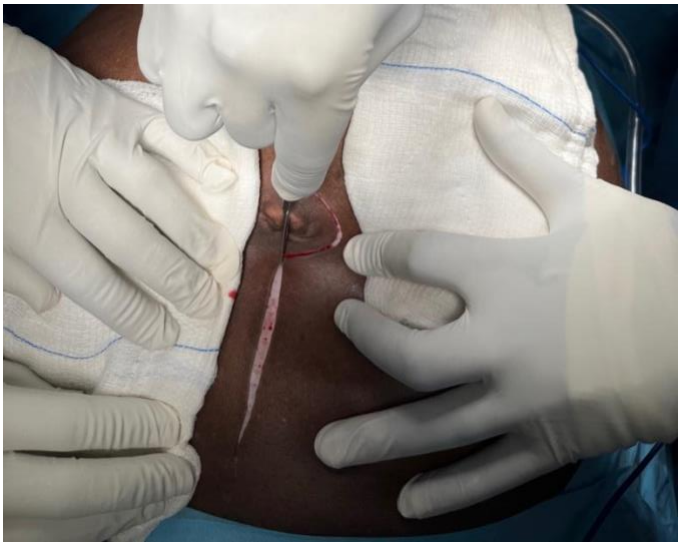
- Skin incision and division of the subcutaneous fat
- Division of the linea alba
- Dissection of the preperitoneal space
- Division of the peritoneum
- Intra-abdominal intervention
- Closure, beginning separately at each end of the incision and meeting in the middle
- Skin closure

Steps:

1. The surgeon generally stands opposite the side of expected pathology. For pelvic surgery, the surgeon stands on the side that will allow the dominant hand to have direct access to the pelvis.
2. The area of planned incision is marked, if desired. If there is any possibility of an ostomy, curve the incision to the opposite side of the umbilicus

The planned incision can be marked by gently scratching the skin with an instrument. This step is not mandatory.

3. Incise the skin with a scalpel, down to the level of the dermis or subcutaneous tissue.



Incision of the skin through the epidermis alone allows better hemostasis, as the dermis with its blood vessels can now be divided with diathermy.

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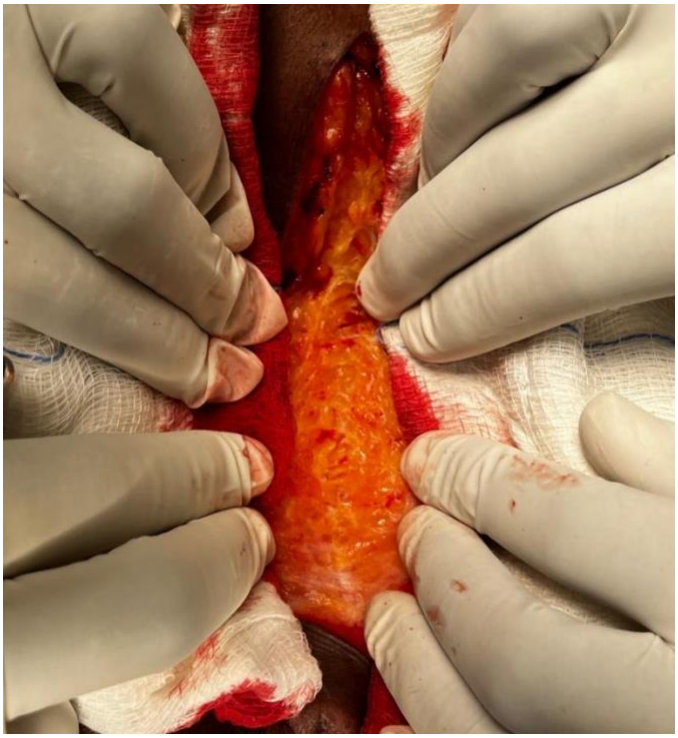
4. If the dermis has not been completely divided, divide it with the "Cut" setting on the diathermy.

Using the "Cut" setting on the diathermy at this point minimizes scarring but controls bleeding from the dermis better than cutting straight through with a scalpel blade.

5. Both surgeon and assistant apply direct pressure on the cut skin edges while dividing the subcutaneous fat, causing it to separate in an even manner.

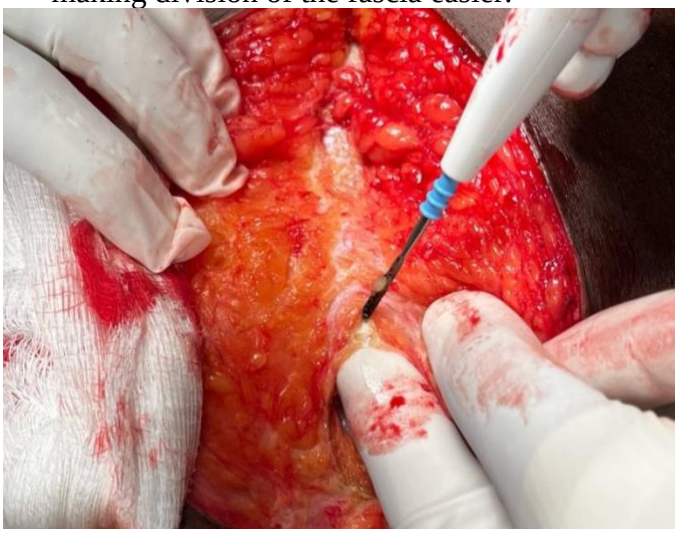


Pulling on both sides of the incision will cause the subcutaneous fat to separate more easily under diathermy, until the linea alba is reached.

6. The linea alba, the midline between the rectus muscles, is incised. If the incision is on the midline, the preperitoneal fat is seen. If the incision is off midline, one of the rectus muscles will appear instead. Try to judge which direction to cut in order to return to the midline.

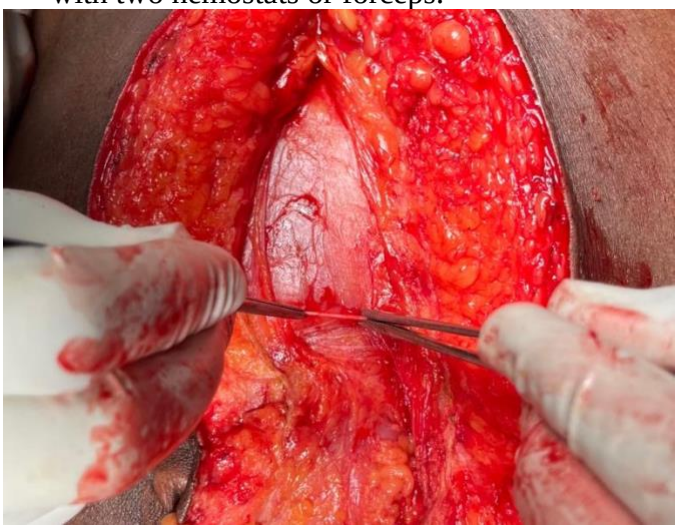
The linea alba has been divided and the preperitoneal fat is seen. The peritoneum itself is a variable depth beneath this, depending on the patient's body habitus.

7. Once the preperitoneal space is opened, the surgeon can insert a finger into it and bluntly dissect the fat posteriorly away from the fascia, making division of the fascia easier.



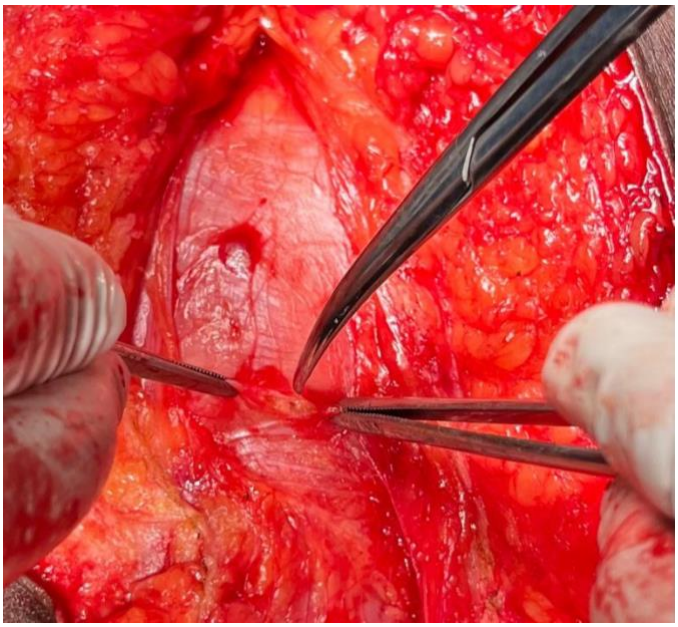
Finger dissection between the fascia and the preperitoneal space allows controlled division of the fascia.

8. In patients with scant preperitoneal fat, sometimes the peritoneum itself will be entered while dividing the linea alba. If this occurs, insert a finger into the peritoneum and continue to divide the linea alba, preperitoneal fat and peritoneum all at once.
9. In cases of abdominal distention, one must take care while entering the peritoneum to not damage the intestines underneath. Bluntly dissect through the preperitoneal fat until the peritoneum itself is seen. Grasp the peritoneum and pull it upwards with two hemostats or forceps.



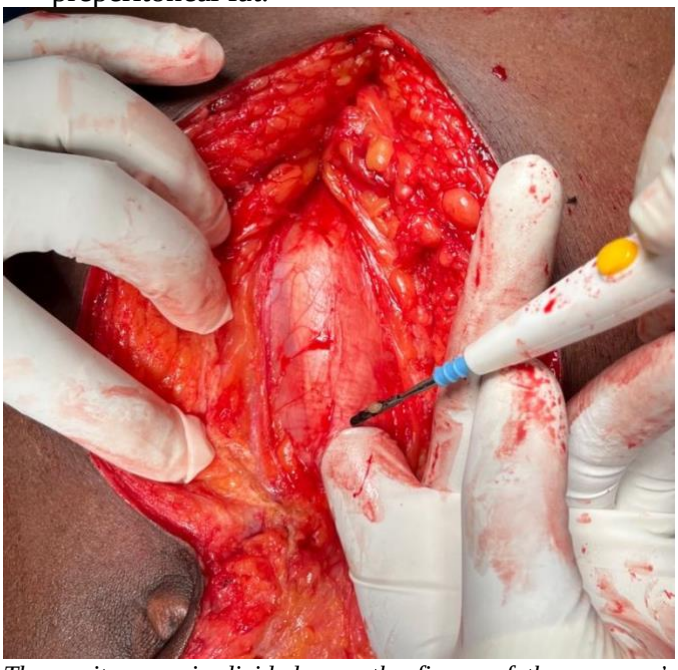
Beneath the preperitoneal fat, the peritoneum will be seen as a glistening white structure. Grasp it with two forceps, taking care not to grasp any intestines underneath, and elevate it.

10. Cut between the forceps and then widen the opening into the peritoneum carefully.



The peritoneum has been cut and the intraperitoneal fat is visible underneath.

11. Insert a finger into the peritoneum and use diathermy to divide the peritoneum and preperitoneal fat.



The peritoneum is divided over the finger of the surgeon's nondominant hand. This finger also feels for any adhesions, which can then be visualized and divided if necessary.

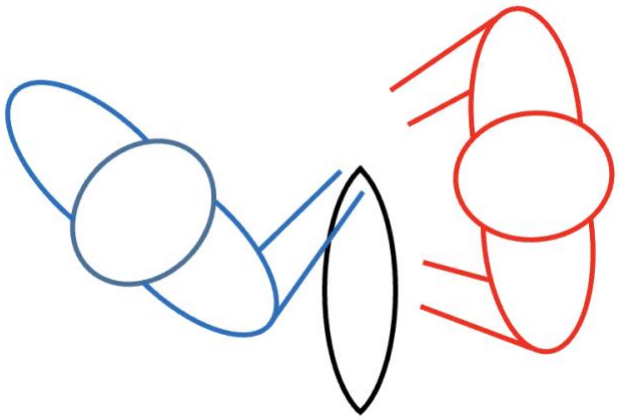
12. For maximum exposure in the pelvis, the division of the linea alba can extend all the way to the

pubic symphysis. Bluntly dissect with a finger in the prevesical space to be sure the bladder is not damaged during entry.

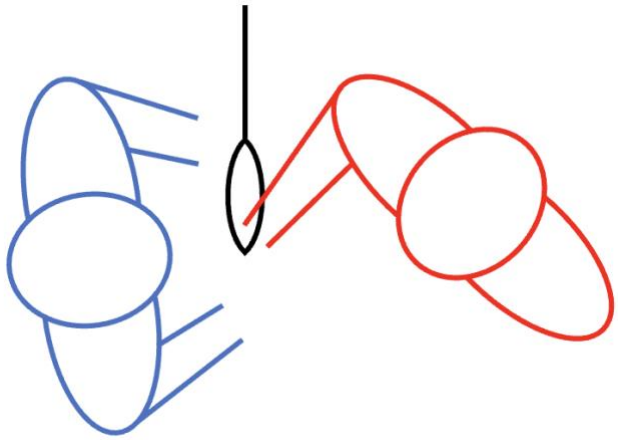
13. For maximum exposure in the upper abdomen, the division of the linea alba can be extended to one side of the xiphoid process. During subsequent closure, be sure the suture passes through the anterior rectus sheath fascia anterior to the xiphoid process, rather than encircling or piercing the bone itself.

Incise the fascia adjacent to the xiphoid process (Black dot) to extend the upper abdominal incision by 2cm. When closing, suture only the fascia anterior to the bone and avoid encircling or piercing it with the suture.

14. Once the surgery is complete, irrigate the abdominal cavity with warm saline. Adding antibiotics to the irrigation has not been shown to decrease the risk of intra-abdominal infection and may increase adhesion formation.
15. Close the fascia with a running, slowly absorbable or non-absorbable suture such as polydioxanone (PDS) or polypropylene (Prolene.) The surgeon will begin at the end of the wound that is most easily reached by their dominant hand. Then, the assistant will be positioned to begin sewing at the other end. Do not close a laparotomy incision by sewing straight from one end to the other, because it will be difficult to see the needle as the last few stitches are placed, placing the patient at risk for bowel injury.



The surgeon (Blue) begins sewing at the apex of the wound that their dominant forearm is most closely perpendicular to. The assistant is shown in Red.



The assistant (Red) then begins sewing from the other apex of the wound, so that the two sutures can meet in the middle. This avoids the unsafe practice of "sewing into a corner."

16. Begin sewing. Grasp the apex of the incision with a Kocher clamp. A wide malleable retractor is placed inside the abdomen to hold the intestines away from the closure. The assistant retracts the skin and subcutaneous tissue with a small handheld retractor.

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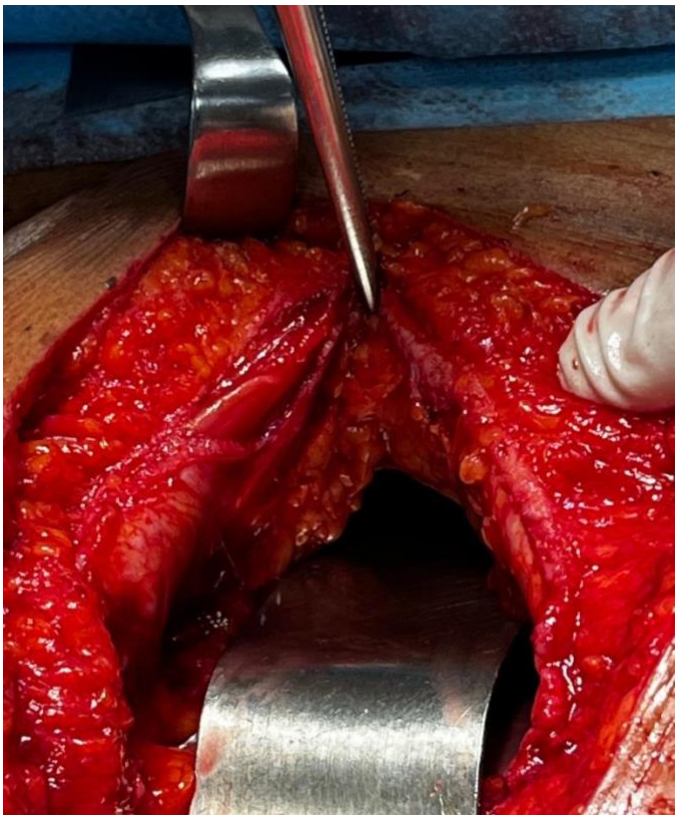
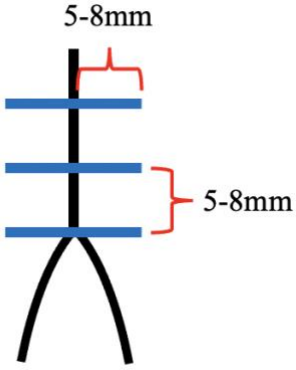
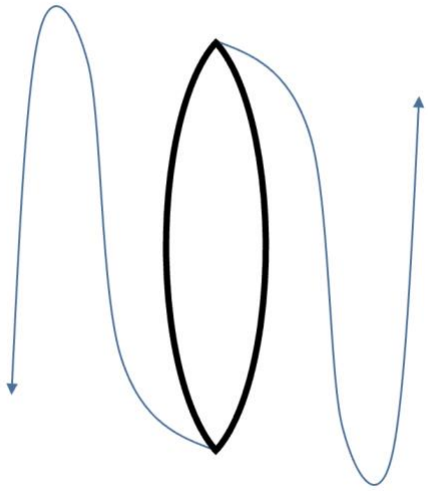


Grasp the apex of the fascial incision with a Kocher clamp. The surgeon will hold this in the non-dominant hand while placing the first stitch. Protect the viscera from the closure with a wide malleable clamp which is repositioned frequently during the closure. The assistant retracts the skin and subcutaneous tissue with a small retractor to expose the fascia.

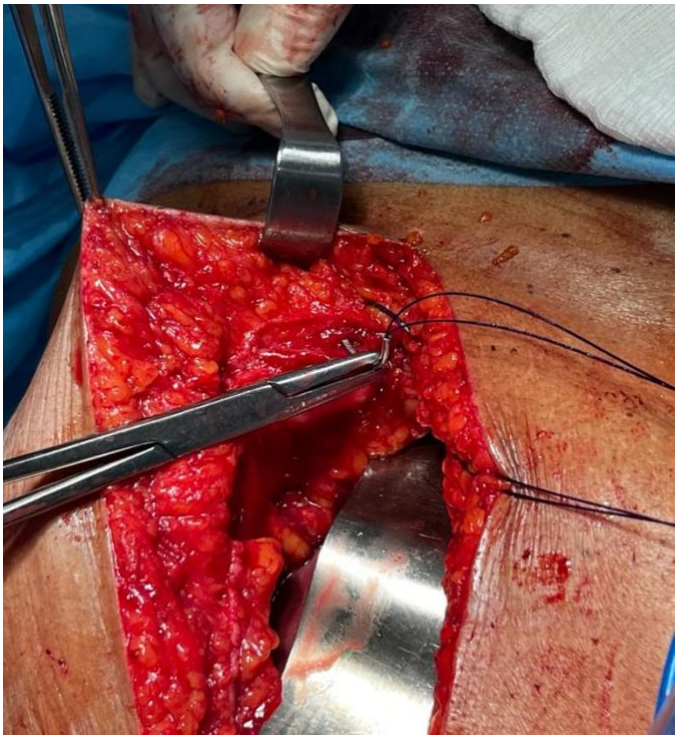
17. Stitches are placed every 5-8mm, with bites no deeper than 5-8mm. It is tempting to take "deeper" bites, which in fact may seem "stronger," but this approach actually leads to a higher chance of dehiscence and hernia. Overall, the ratio of suture length to wound length should be 4:1.



The sutures are placed taking bites of no deeper than 5-8mm, and advancing no more than 5-8mm.



The total length of each suture will be greater than twice the length of the wound to be closed, resulting in a ratio of 4:1 suture to wound closure length.



Bites are taken in the fascia only. Be sure you see the tip of the needle at all times. When the anterior and posterior rectus fascia have been divided separately, it is acceptable to take only the anterior fascia. Recall that below about 3cm caudal to the umbilicus, only the anterior rectus fascia should be sutured, as the posterior rectus sheath here is not a fascial layer.

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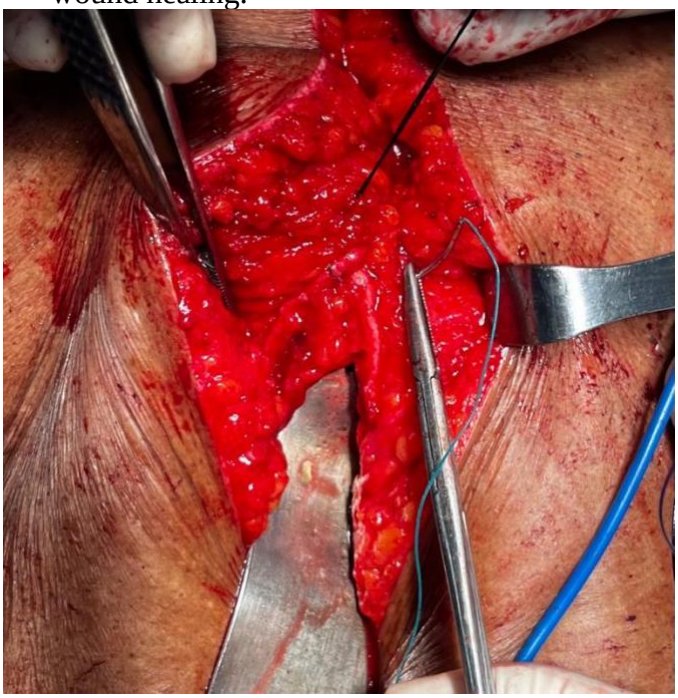
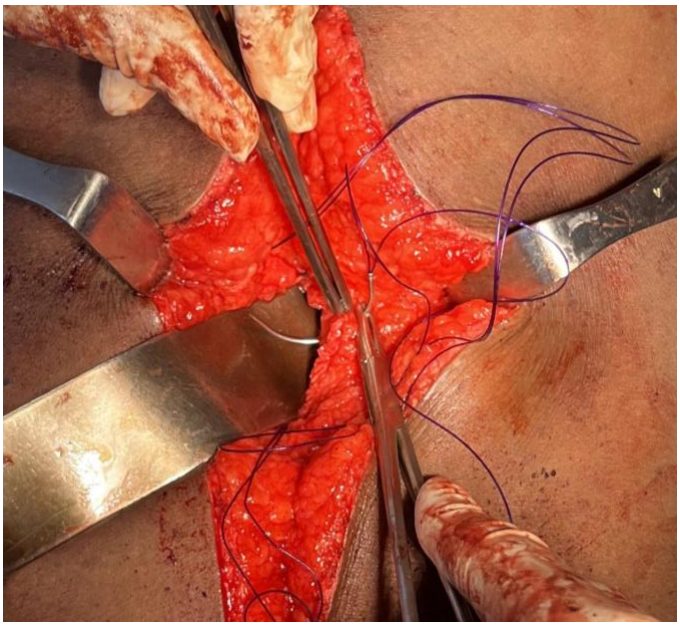
18. It is our practice to place nonabsorbable internal retention sutures in the fascia every 3-5cm, especially in patients who are obese, malnourished, or have other risk factors for poor wound healing.

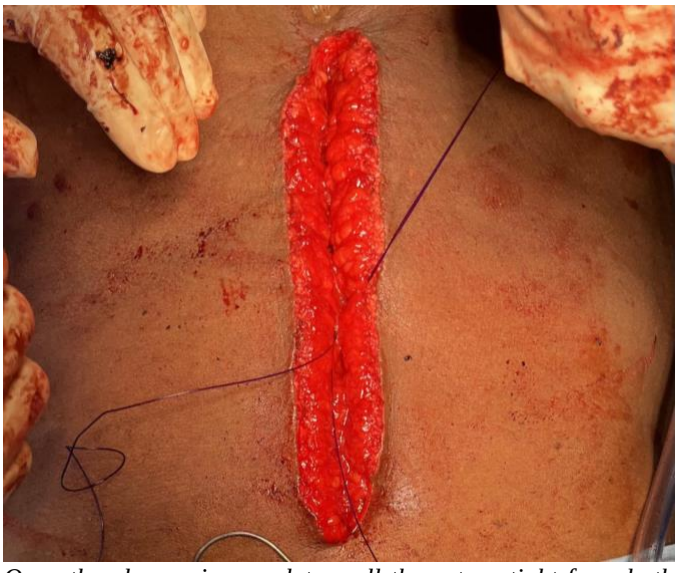


Interrupted internal retention sutures are placed every 3-5cm. Again, be sure you see the tip of the needle at all times while placing these sutures. The assistant maintains traction on the previously placed sutures.

19. The assistant begins a second suture at the opposite end of the incision. The two sutures will meet in the middle of the incision. This avoids placing the last few sutures of the abdominal closure at one end of the incision, where poor visualization increases the risk of damaging viscera with the needle.
20. The last 5cm of closure is done without traction on the sutures, so that the inside of the fascia can be seen during their placement. The narrow malleable retractor is used to protect the viscera during suture placement.



The final stitches, in the center of the incision, are placed without the assistant maintaining traction on the previously placed sutures. A narrow malleable retractor is inserted, perpendicular to the incision, underneath the space where the needle will be passing. Following these steps assures that the tip of the needle will be seen as every stitch is taken. These loose stitches will be pulled tight once the closure is complete.



Once the closure is complete, pull the suture tight from both ends and then tie the two sutures to each other.

21. Irrigate the subcutaneous space and assure hemostasis.

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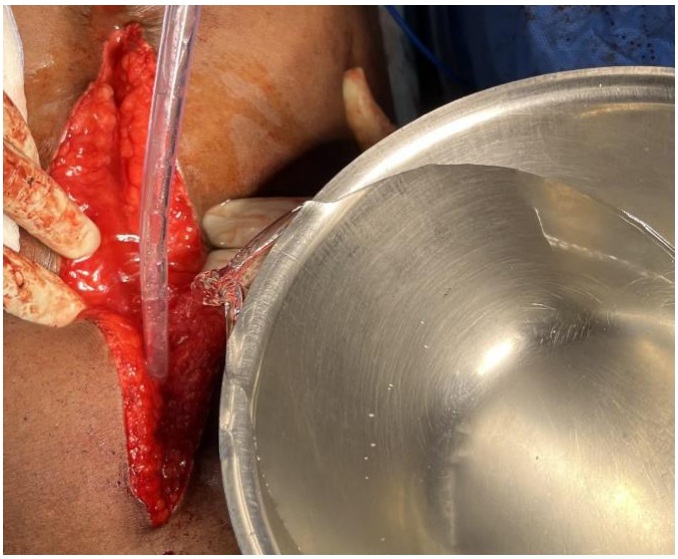

Irrigate the subcutaneous space until it returns clear.

Examine the subcutaneous space and cauterize any bleeding sites, to prevent blood from accumulating in the wound.

22. The subcutaneous fat is not closed under normal circumstances, but if a large space remains after resection of a tumor or closure of an incisional hernia, the fat in this space can be approximated with a few absorbable sutures.
23. The skin is closed with staples or interrupted sutures. Running suture is avoided, in case a part of the wound needs to be opened later to treat a wound infection.

Special Situations:

Previous laparotomy: Patients who have already had a laparotomy are prone to bowel injury during entry. The best way to avoid this situation is to open the abdomen in an area it has not already been opened before. Make the initial incision about 4cm above or below the previous scar and carry the incision through the subcutaneous tissue, fascia, preperitoneal fat and peritoneum as described above. Then extend the incision into the previously opened space, visualizing the inside of the peritoneum and dissecting any adhesions to the planned incision before making it.

It is almost always possible to find a part of the abdomen that has not been previously opened. But if the previous incision has truly gone from xiphoid to pubis, enter slowly and carefully, dissecting layer by layer, elevating each layer with a dissecting forceps before dividing it. When scar tissue becomes bowel, attempt to dissect along the surface of the bowel to find the plane interior to the peritoneum. See the Chapter, Lysis of Adhesions for more details.

When performing laparotomy on a patient who has a previous laparotomy, begin about 4cm above the scar, leaving enough room to open the abdomen in a previously undissected space and see inside the peritoneum while extending the incision.

Wound dehiscence: When this occurs, carefully consider what the reasons might be. If you are sure the cause is a technical error, it is reasonable to close again in the manner described above, including internal retention sutures.

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One common cause of dehiscence is intra-abdominal infection, usually accompanied by anastomotic leak. When this happens the dehiscence will be accompanied by purulent, bilious or feculent discharge. The best option in this case is to resuscitate, give antibiotics, and then reoperate and externalize the anastomosis as an ostomy. If the leak is in the stomach, duodenum, or proximal jejunum, it must be repaired with an omental patch or drained with a roux limb, options that are described elsewhere in this Manual. If you do not operate in this situation, it becomes an enter-cutaneous or entero-atmospheric fistula. Non-operative management of this problem includes total parenteral nutrition, bowel rest, and intensive nursing; these are scant resources in settings such as ours. The patient is better treated with a relaparotomy and attempt to close the fistula.

This patient presented to our facility after a laparotomy elsewhere and no history available. He was resuscitated, given antibiotics, and then explored. After a very difficult dissection, a small bowel injury was found and repaired with an omental patch.

If the dehiscence is due to patient factors such as malnutrition, infection, immunosuppression, or something else out of your control, you face a difficult decision. One option, if the dehiscence is small and there is no infection, is to do nothing. Make sure that the skin is completely open so no infection can accumulate, and pack the wound gently with gauze. A vacuum dressing may help the skin wound to contract over the dehiscence, which converts the problem to a hernia. Make sure that nutrition is optimized in this case. We would strongly consider a nasogastric tube and aggressive feeding, as the patient has already "failed" nutrition once.

This 80 year old woman with malignant small bowel obstruction underwent laparotomy and ileostomy placement. Postoperatively she had a wound dehiscence of about 4cm in length in the mid-portion of her wound. After assuring there was no infection, we used aggressive nutrition and vacuum-assisted closure to make the wound smaller and more manageable at home. She was discharged to home hospice. For more information on vacuum-assisted closure, see the Section on Wound Care.

If the dehiscence is large and due to patient factors, you must reoperate. If there is no intra-abdominal infection, do not endanger the patient by trying to dissect much intra-abdominally. Close the fascia with a running non-absorbable suture, using the principles above, supplemented with interrupted full-thickness retention sutures going through all layers of the abdominal wall including the skin. These will remain in place for 2-3 months at least. Aggressively treat this patient's malnutrition and any other factors that may have contributed to the wound dehiscence. If none is apparent consider tuberculosis or the Human Immunodeficiency Virus (or both in combination!)

Pitfalls

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- Visceral injury is possible during opening, especially if the bowels are distended. The surgeon should be very clear about the anatomical layers at the time of incision. For emergency surgery, it is important to be speedy, but causing a bowel injury will make the operation take longer overall.
- Incisional hernia formation: Risk factors for this complication include emergency surgery, obesity, steroid use, chronic cough, tobacco use, and connective tissue disorders. Patients with abdominal aortic aneurysm also have an increased risk of postoperative hernia formation. Meticulous closure using the principles described above will decrease the risk of this complication.
- Fascial dehiscence in the acute phase is a complication that usually requires repeat operation. Excessive amount of serous fluid drainage from the wound is one clue that this has occurred. If you suspect wound dehiscence, open a small part of the wound at the bedside and probe with your finger; most patients can tolerate this kind of examination if it is done gently. See Chapter, "Closure of Laparotomy Wound Dehiscence."
- Visceral injury is very possible during closure: make sure the tip of the needle is visualized at all times as it passes through the fascia.
- Wound infection after any laparotomy must be watched for. Remove the dressing after 48 hours and from then on only cover parts of the wound that are bleeding or leaking serous fluid. If there is any erythema, firmness, or cloudy discharge from the wound, remove a few sutures or staples and probe the space with a finger to rule out fascial dehiscence. The wound must be opened enough to allow any open space under it to drain. Pack the space with a gauze and change the dressing twice daily. It is not necessary to culture the wound or to start antibiotics for a small wound infection: opening the wound and packing it regularly will be enough.

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