Incision, Exposure, Closure

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Achieving Exposure

Many dangerous surgical mishaps occur because the operative exposure is inadequate. The *first step* toward obtaining good exposure is to make a well-planned incision of sufficient length. The *second step* during abdominal surgery is to pack the intestines away from the area of operation. If a dissection requires exposure of a large portion of the abdominal cavity, such as for left hemicolectomy or excision of an abdominal aortic aneurysm, it may be necessary to exteriorize the small intestine for the duration of the dissection. The *third step* is retraction of the wound edges.

Retraction of the wound edges may be accomplished by simple retractors, such as the handheld Richardson (see Chap. 11 for illustrations of various retractors and other instruments), or by fixed retractors, such as the simple Balfour or the more complex but adaptable Omni-track.

In the initial exploration phase of an operation, simple retractors are extremely useful because they can rapidly be moved as needed to explore various quadrants of the abdomen and identify the extent of the pathology. Richardson retractors are used to retract the skin, subcutaneous fat, and musculofascial layers of the abdominal wall. Harrington or heart-shaped retractors may be used to gently retract and expose deeper structures.

Once the extent of pathology has been determined, there are advantages to using a fixed retractor. For small abdominal incisions where simple retraction of the abdominal wall is all that is required, a Balfour retractor may suffice. Place moist laparotomy pads under the blades to help minimize tissue trauma and to avoid slippage of the blades. For thoracotomy and thoracoabdominal incisions, a Finochietto retractor is excellent for separating the ribs.

More complex fixed retractors are anchored in some way to the operating table and thus provide very constant exposure. These vary from the simple "chain" retractor to fancy systems such as the Omni. The "*chain*" *retractor* (Fig. 3.1) is an inexpensive improvisation that permits insertion of a retractor blade underneath the lower end of the sternum or underneath either costal margin. It may seem primitive in comparison with modern systems but can be adapted to the humblest operating room in the most difficult circumstances and remote locations. The retractor (the third blade of a Balfour-type system works well) is attached to an ordinary link chain, which can be purchased in a hardware store. The anesthesiologist attaches a curved steel post borrowed from the gynecologic lithotomy stirrup set to the side rail at the head of the operating table. When the post is adjusted to the proper height, the chain is fixed to a snap at the tip. By rotating the post in the proper direction, the lower end of the sternum and the thoracic cage can be retracted forcefully cephalad and anteriorly to elevate the sternum by as much as 8–10 cm.

This device is ideal for operations around the lower esophagus, such as hiatus hernia repair. It does not require purchase of new instruments other than 25–30 cm of chain. It may be installed when necessary without preparation, even during an operation. It is also helpful for liberating the splenic flexure of the colon. Here the device is placed on the left side of the operating table, and the retractor is positioned to draw the left costal margin to the left, cephalad, and anteriorly, significantly improving exposure. Whenever exposure for operations on the biliary tract is difficult, applying the "chain" retractor to the right costal margin can be of benefit.

A slightly more complex retractor that attaches to the operating table to improve upper abdominal exposure is the *upper hand retractor* (Fig. 3.2). This device is a steel bridge

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C.E.H. Scott-Conner (ed.), *Chassin's Operative Strategy in General Surgery*,
DOI 10.1007/978-1-4614-1393-6_3,

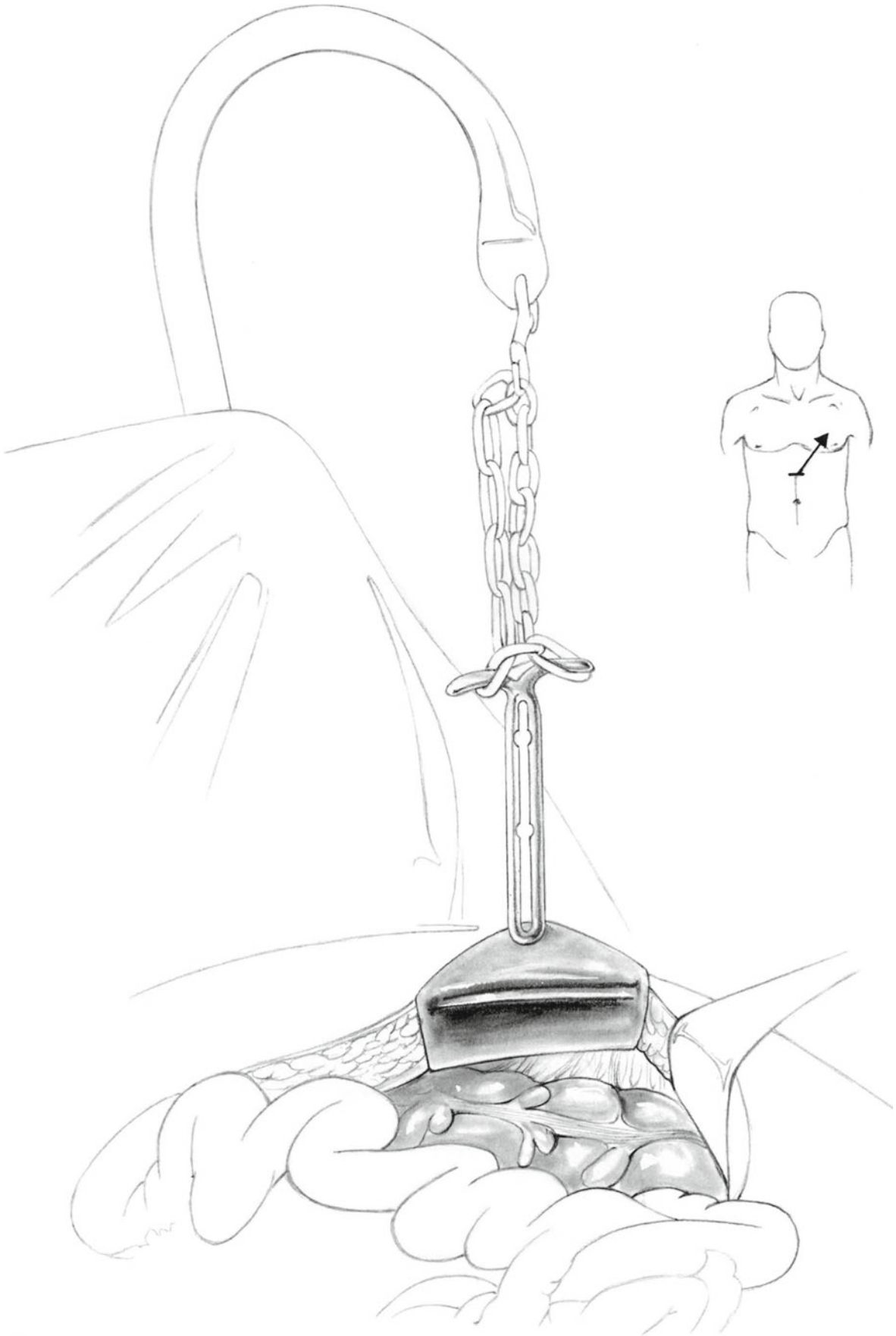

Fig. 3.1

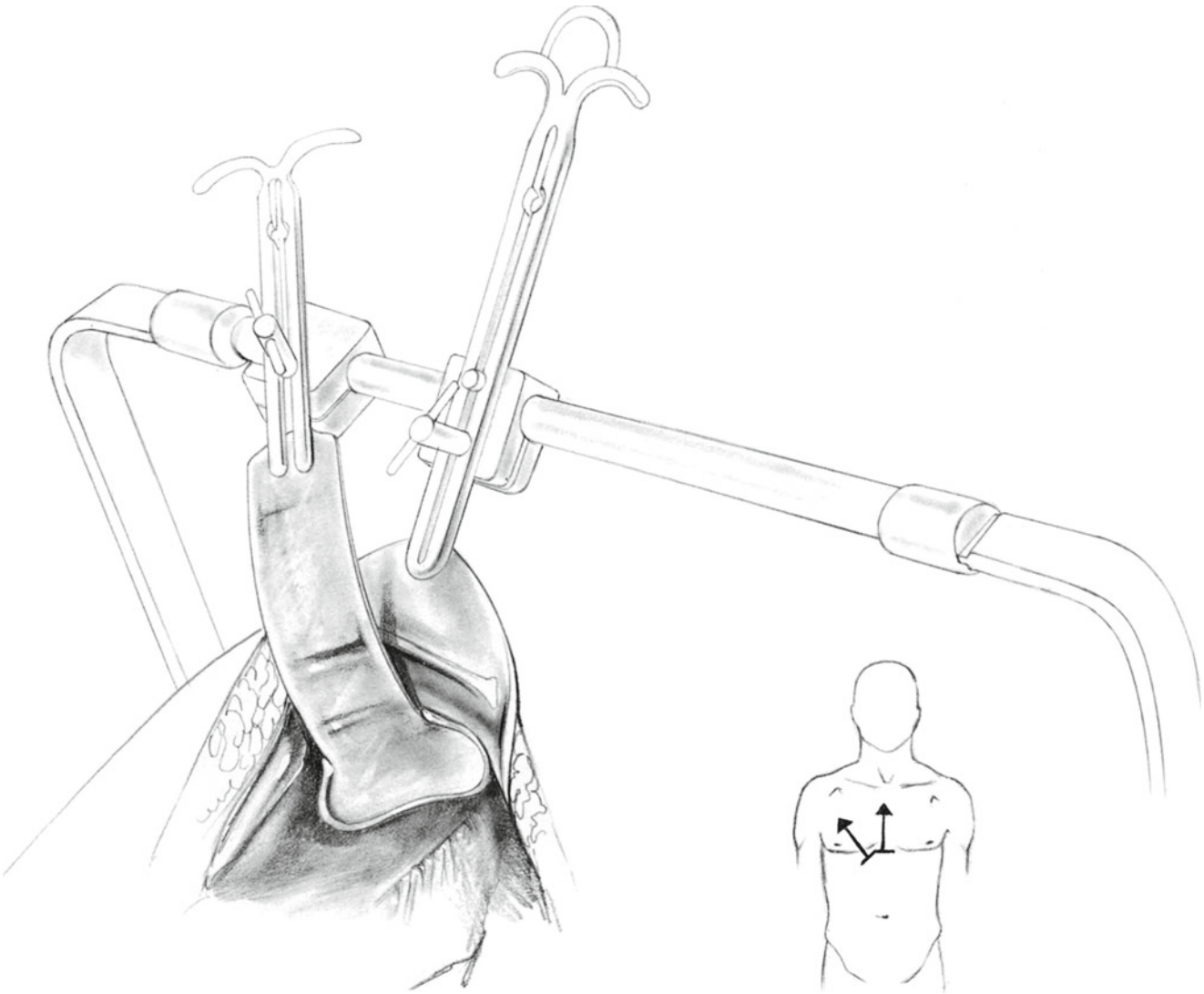

Fig. 3.2

that is attached to both sides of the operating table and passes across the patient at the midsternal level. Its height is set at 4–10 cm above the sternum, depending on the type of retraction desired. Two retractor blades can be attached to the steel bridge, one of which may be used to elevate the lower sternum in a manner similar to the "chain" retractor. A second blade may be attached to the bridge to retract the liver for biliary tract surgery; this method sometimes eliminates the need for a second assistant.

For most operations, a more complex system of self-retaining retractors such as the Thompson or Omni (see Chap. 11) is useful. This particular system chosen depends on personal preference and availability. These retractors attach to the operating table and have a large variety of components for retraction. These devices are more flexible during operation than is the upper hand retractor.

The primary aim of all fixed retractors is not to reduce the number of assistants in the operating room but to provide better and more stable exposure. One disadvantage of using a mechanical self-retaining retractor in the abdomen is that it may inflict trauma if intense pressure is exerted against the rectus muscles. This pressure can be lessened by using long incisions and padding the musculature with moist gauze pads. A second potential disadvantage when deep blades are used to retract intra-abdominal viscera is distortion of normal anatomy, which may make it difficult for the surgeon to identify vital structures. If the field is difficult to interpret, consider removing any fixed deep blades and reassessing the exposure.

Incisions for Abdominal Surgery

Although many surgeons have long believed that transverse incisions are stronger and have a lower incidence of dehiscence than midline incisions, this belief is false (see following

section). Some think that the upper transverse incision interferes less with respiration than does the upper midline incision. Clinically, this does not appear to be important. A long, vertical *midline incision* gives excellent exposure for all parts of the abdomen. It also provides flexibility, as extensions in either direction are simple to execute. Reoperation for other pathology is simpler if the previous operation was performed through a midline incision rather than a paramedian incision. Finally, the midline incision creates minimal inferences with abdominal wall blood supply, facilitating subsequent creation of TRAM (transverse rectus abdominis) flaps for reconstructive breast and other surgery. Creation of ostomies is simpler because the surgical incision is not in proximity to the stoma.

Splenectomy, splenic flexure resection, hiatus hernia repair, vagotomy, pancreatectomy, and biliary tract surgery are easily done with the aid of the "chain" or more sophisticated retractors. Whenever exposure in the upper abdomen by this technique is inadequate, it is a simple matter to extend the midline incision via median sternotomy or into a right or left *thoracoabdominal approach*. Yet another advantage of midline incisions is the speed with which they can be opened and closed.

Despite these advantages, we often use a *subcostal approach* for open cholecystectomy because a short incision provides direct exposure of the gallbladder bed. If the gallbladder has already been removed and a secondary common duct exploration is necessary or a pancreaticoduodenectomy is contemplated, a midline incision extending 6–8 cm below the umbilicus provides excellent exposure and may be preferred.

When considering whether an upper midline incision or subcostal might provide better exposure, study the angle of your patient's ribs. If the patient has a narrow chest with a high xiphoid process (a rib cage like the high arches of a gothic church), an upper midline may be better. The thickset individual with a wide costal angle may do better with a subcostal incision.

For the usual appendectomy, the traditional *McBurney incision* affords reasonable exposure, a strong abdominal wall, and a good cosmetic result. It heals extremely well and hernias are rare. Accomplishing the same exposure with a vertical incision would require either a long midline or a paramedian incision or an incision along the lateral border of the rectus muscle, which might transect two intercostal nerves and produce some degree of abdominal weakness.

Avoiding Wound Dehiscence and Hernia

Wound dehiscence spans a spectrum from catastrophic evisceration through occult dehiscence. Major wound disruption is associated with significant postoperative mortality; and even minor degrees of occult dehiscence may result in a postoperative incisional hernia.

The major causes of wound disruption are as follows:

- Inadequate strength of suture material, resulting in breakage
- Suture material that dissolves before adequate healing has occurred (e.g., catgut)
- Knots becoming untied, especially with some monofilaments (e.g., nylon and Prolene)
- Sutures tearing through tissue

All these causes except the last are self-explanatory; suture tears are poorly understood by most surgeons. A stitch tears tissue if it is tied too tightly or encompasses too little tissue. Although it is true that in some patients there appears to be diminution in the strength of the tissue and its resistance to tearing, especially in the aged and extremely depleted individuals, this does not explain the fact that many wound disruptions occur in healthy patients. The sutures must hold throughout the initial phase of wound healing, which lasts several weeks and involves softening of the collagen around the wound edges. Recent randomized trials with careful follow-up have shown that the actual incidence of wound infection and hernia is much higher than previously suspected and there is still much to be learned about the best method of incisional closure.

When the incision is disrupted following an uncomplicated cholecystectomy in a healthy, middle aged patient with good muscular development, there must be a mechanical explanation. Often the surgeon has closed the wound with multiple small stitches of fine suture material. Under these circumstances, a healthy sneeze by a muscular individual tears the sutures out of the fascia and peritoneum because the muscle pull exceeds the combined suture-tissue strength.

If the problem, then, is to maintain tissue approximation during a sneeze or abdominal distension for a period of time sufficient for even the depleted patient to heal, what is the best technique to use? Adequate bits of tissue must be included in each suture; the sutures must be placed neither too close nor too far apart; and they must be tied securely in a manner that approximates but does not strangulate the tissue.

Unfortunately, there is as yet no consensus as to the best technique. Several points appear to have emerged from recent trials. First, a running suture of a heavy slowly absorbable material (such as PDS) appears to have advantages. Second, suture length to incision length should approximate 4:1.

Many surgeons believe that a patient who is at increased risk of wound dehiscence by virtue of malnutrition, chronic steroid therapy, or chronic obstructive pulmonary disease should have an abdominal incision closed with "retention sutures" that go through the skin and the entire abdominal wall. If retention sutures are used, they should be considered an adjunct to good closure rather than a substitute for it.

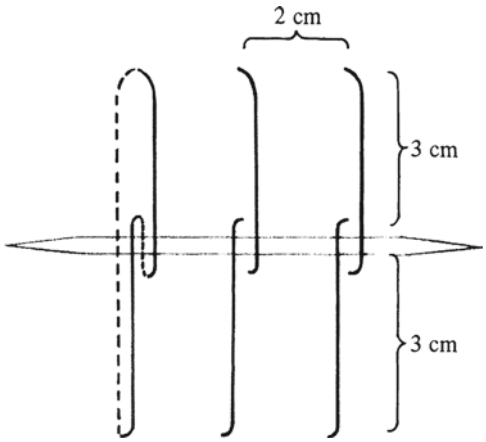

Fig. 3.3

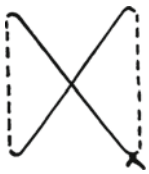

Fig. 3.4

Suture bridges protect the skin, and retention sutures tied loosely do not cut through the fascia. Retention sutures should be used only when delayed healing is anticipated and should be left in place until healing is complete, which often is signaled by the previously snug retention sutures becoming loose as the wound contracts.

The Smead-Jones suture, recently modified as a continuous rather than interrupted technique, creates a row of internal retention sutures by taking bites through the fascia and muscle layers but avoiding the skin (Figs. 3.3 and 3.4) and provides an alternative to external retentions that may be more palatable to the patient. Although this text describes the interrupted Smead-Jones technique, some have used a similar running suture technique with great success.

Operative Technique for a Midline Incision

Making the Incision

Hold a large gauze pad in the left hand and apply lateral traction on the skin; the first assistant does the same on the opposite side of the incision. Use the scalpel with a firm sweep along the course of the incision (Fig. 3.5). The initial stroke should go well into the subcutaneous fat. Then reapply the gauze pads to provide lateral traction against the subcutaneous fat; use the belly of the scalpel blade to carry the incision down to the linea alba, making as few knife strokes as

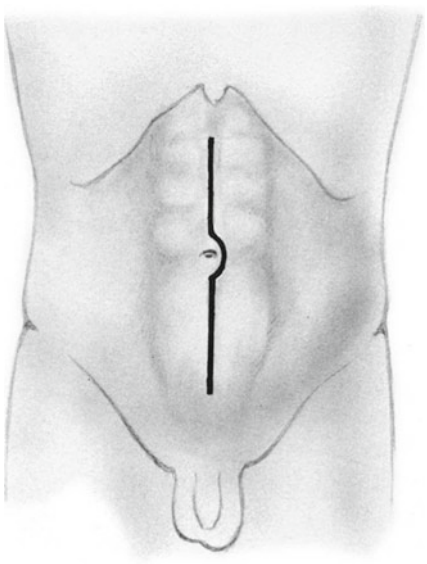

Fig. 3.5

possible. In morbidly obese individuals, a strong pull by surgeon and assistant will often "cleave" the fat along the bloodless midline to the linea alba. The linea alba can be identified in the upper abdomen by observing the decussation of fascial fibers. It can be confirmed by palpating the tip of the xiphoid, which indicates the midline.

The former custom of discarding the scalpel used for the skin incision (in the belief that it incurred bacterial contamination) is not supported by data or logic and is no longer observed. Because subcutaneous fat seems to be the body tissue most susceptible to infection, every effort should be made to minimize trauma to this layer. Use as few hemostats and ligatures as possible; most bleeding points stop spontaneously in a few minutes. Subcutaneous bleeders should be electrocoagulated accurately and with minimal trauma.

Continuing lateral traction with gauze pads, divide the linea alba with the scalpel. If the incision is to be continued around and below the umbilicus, leave a 5- to 8-mm patch of linea alba attached to the umbilicus to permit purchase by a suture during closure. Otherwise, a gap between sutures may appear at the umbilicus, leading to an incisional hernia.

Open the peritoneum to the left of the falciform ligament. Virtually no blood vessels are encountered when the peritoneum is opened close to its attachment to the undersurface of the left rectus muscle. Elevate the peritoneum between two forceps and incise it just above and to the left of the umbilicus. Using Metzenbaum scissors, continue this incision in a cephalad direction until the upper pole of the incision is reached. If bleeding points are encountered here, electrocoagulate them.

So as not to cut the bladder, be certain when opening the peritoneum in the lower abdomen to identify the prevesical fat and bladder. As the peritoneum approaches the prevesical region, the preperitoneal fat cannot be separated from the

peritoneum and becomes somewhat thickened and more vascular. If there is any question about the location of the upper margin of the bladder, note that the balloon of the indwelling Foley catheter can be milked in a cephalad direction. It is easy to identify the upper extremity of the bladder this way. It is not necessary to open the peritoneum into prevesical fat, as it does not improve exposure. Rather, simply retract this fat in a caudal direction. However, opening the fascial layer down to and beyond the pyramidalis muscles to the pubis does indeed improve exposure for low-lying pelvic pathology.

Closure of Midline Incision by Modified Smead-Jones Technique

In the upper abdomen, it is unnecessary to include the peritoneum or falciform ligament in the suture. Below the umbilicus there is no distinct linea alba, and the rectus muscle belly is exposed. In this region include the peritoneum in the stitch.

Apply Allis clamps to the linea alba at the midpoint of the incision, one clamp on each side. Below the umbilicus, the Allis clamps should include a bite of peritoneum and of anterior fascia. With no. 1 polydioxanone suture (PDS), encompass 3 cm of tissue on each side of the linea alba; then take a small bite of the linea alba, about 5 mm in width, on each side. This results in a small loop within a large loop (Fig. 3.6). The purpose of the small loop is simply to orient the linea alba so it remains in apposition rather than one side moving on top of the other. Place the small loop 5–10 mm below the main body of the suture to help eliminate the gap between adjacent sutures. Insert the next suture no more than 2 cm below the first. Large, curved Ferguson needles are used for this procedure.

For an interrupted closure, tie the sutures with at least four square throws. *Avoid excessive tension*. When half of the incision has been closed, start at the other end and approach the midpoint with successive sutures (Fig. 3.6). With a running stitch, it may be tempting to use a single

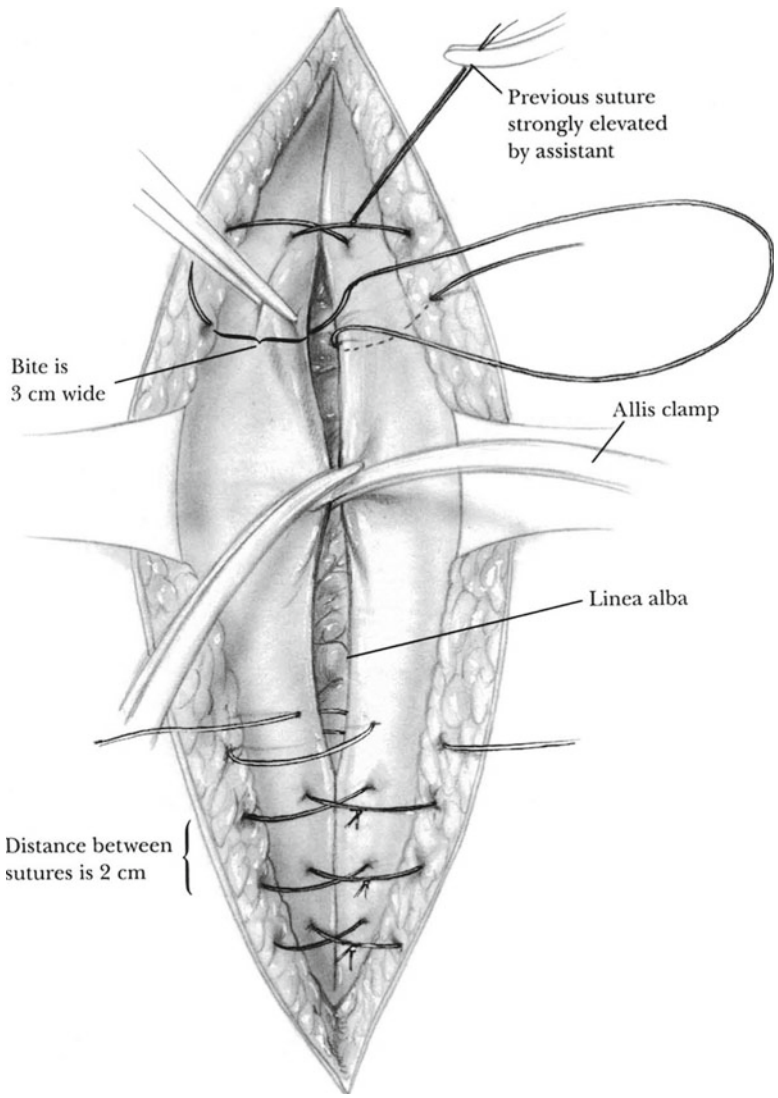

Fig. 3.6

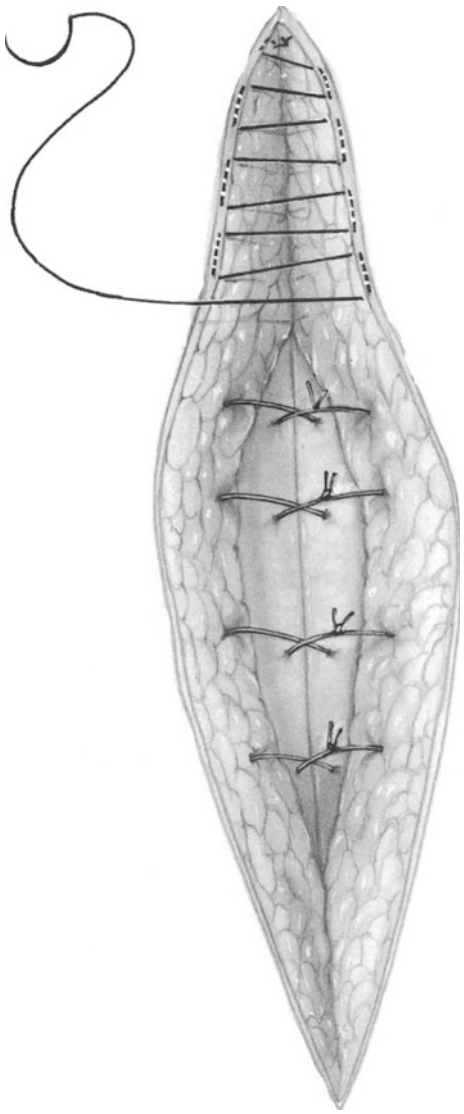

Fig. 3.7

length of suture for the entire incision, but it is far easier and safer to begin from the ends and finish in the middle. Do not tie the last few stitches, leaving enough space to insert the remaining stitch under direct vision. In no case should the surgeon insert a stitch without seeing the point of the needle at all times. Tie all the remaining sutures (Fig. 3.7). Close the skin with interrupted 4-0 nylon vertical mattress sutures, a continuous subcuticular suture of 4-0 polyglycolic (PG), or staples.

Other special incisions such as the *McBurney* (see Chap. 46), *subcostal* (see Chap. 77), and *Pfannenstiel* (see Chap. 66) incisions are found elsewhere in this volume where the operations most commonly performed through these exposures are introduced.

Further Reading

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