5 Suturing Techniques

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5.1 Endoscopic Suturing

The endoscopic knots presently practiced are basically a modification of knots used by seamen, fishermen, weavers, or hangmen.

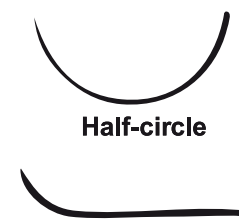
There are three stages of knot tying:

1. configuration (tying),
2. shaping (drawing), and
3. securing (locking or snuggling).

For a knot to be perfect, all the stages of knot tying should be accurate.

5.2 Parameters Influencing Intracorporeal Suturing

1. Angle of the instruments at the suture area.
2. Space around the suture site.
3. Length of the suture.
4. Constant and stable view and quality of the screen picture.
5. Angle of the needle in the needle holder.
6. Angle of the needle to be passed through the tissue.
7. Conflicts of the needle holder with other instruments.
8. Natural bias of the suture.
9. Tension of the tissue to be approximated.
10. Personal skill and technique.



5.3 Endoscopic Needle Shapes

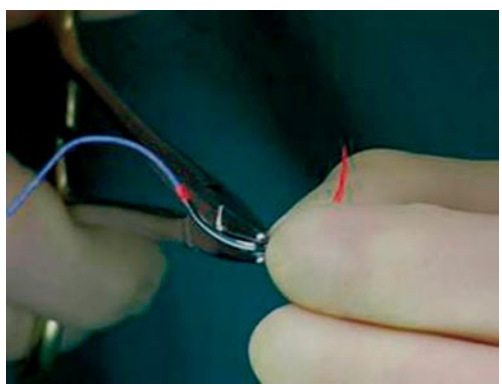
Half-circle needles are too large to pass through the ports. Flattened needle forms are preferred to overcome the shape and size disparity of half-circle needles. Ski-shaped needles are the most reliable ones for endoscopic suturing and combine the advantages of the curved and flattened designs.

5.4 Endoscopic Suture Materials

Sterile, packed, absorbable and nonabsorbable suture materials are available for endoscopic procedures:

1. Polydiaxone (PDS™ ‡) is a monofilament, absorbable, long-lasting, and strong suture material.
2. Polyglactin (Vicryl™ ‡) is a plaited, absorbable, medium-lasting, and strong suture material.
3. Polyester (Ethibond™ ‡) and silk. Polyester is a plaited, nonabsorbable, strong suture material for permanent organ fixation.
4. Polypropylene (Prolene™ ‡) is a monofilament, nonabsorbable suture that can also be used for permanent fixation.

(‡ Ethicon, Somerville, NJ, USA)

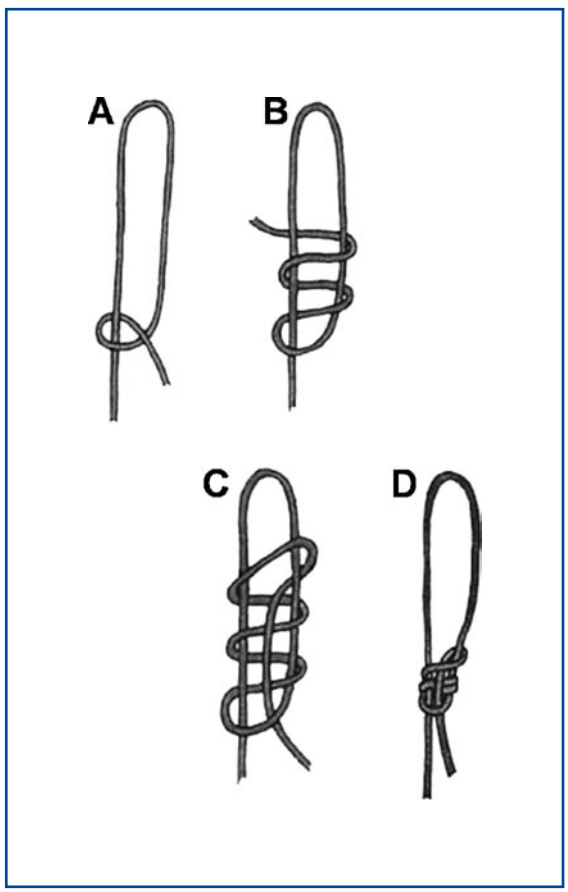


5.4.1 Ski Needle

Ski needles are available in different sizes and armed with different suture material. The surgeon can bend the proximal two-thirds of a normal circled needle and convert it into a ski needle.

5.4.2 Extracorporeal Knot Tying

Extracorporeal knot tying is a method of avoiding the difficult and time-consuming skill of intracorporeal knot tying, and is equally effective. The knot is tied outside the body and then slipped inside using a knot-pusher device. The suture has to be long enough (45–90 cm) to pass from outside the port to the target tissue and back out through the port. The only disadvantage is the wastage of suture material.



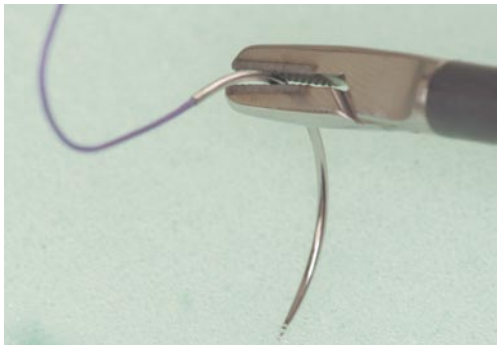
5.4.2.1 Types of Extracorporeal Knots

Extracorporeal knots are normal single- or double-hitch knots followed by one or two single-hitch knots, all of which are slid down separately, like in open surgery. However, extracoporeal tied slip knots can also be employed. The most commonly used extracorporeal tied slip knots are the Roeder knot (see figure for technique), Meltzer slip knot, and the Tayside knot.

5.4.2.2 Extracorporeal Knot-Tying Technique

Please see Figs. 1–6.

Figure 5.1

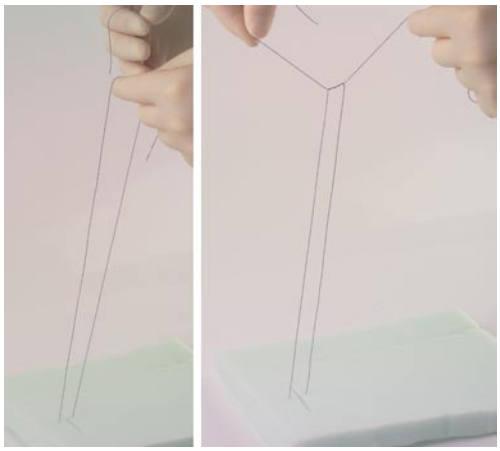


The full-length suture is introduced and the tissue is approximated with the suture

Figure 5.2

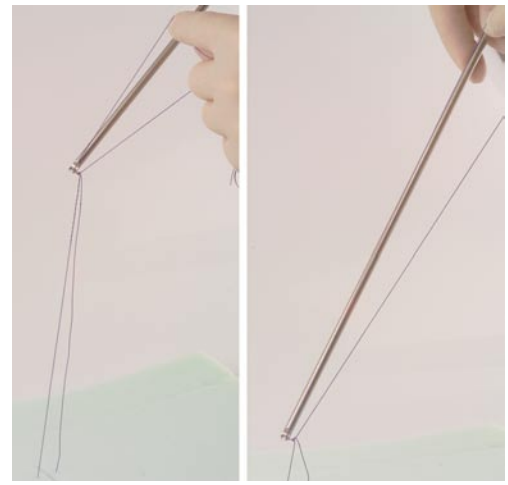
The suture is retrieved from the same port where it was introduced. The suture site should be observed on the monitor to avoid excessive tension and tears of the tissue

Figure 5.3



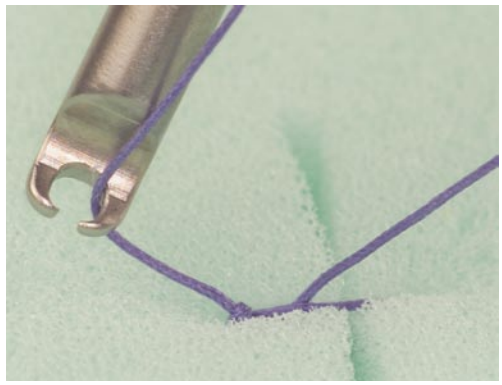
The suture ends are tied extracorporeally

Figure 5.4



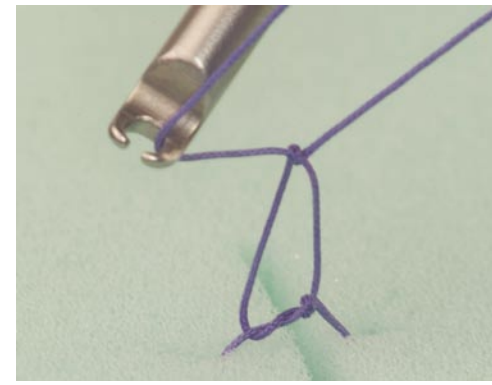
Holding both the sutures in one hand, the knot is then pushed using a knot-pusher

Figure 5.5



Care should be taken to direct the knot-pusher away from the wound edge

Figure 5.6



The second knot is tied and pushed holding one suture end under slight tension

5.4.3 Intracorporeal Knot Tying

Intracorporeal knots are tied with the help of a needle holder within the body cavity. The suture should have a minimum length of approx 10 cm and should not exceed 20 cm for comfortable tying.

There are five types of intracorporeal knots:

- square knot
- surgeon's knot
- tumble square knot
- Dundee jamming knot
- Aberdeen termination knot

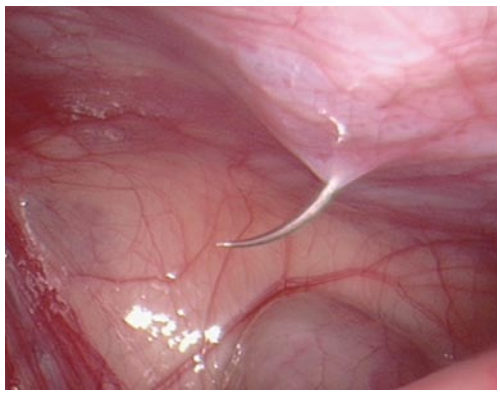
5.4.3.1 Tips for Intracorporeal Knot Tying

1. If the tissue is under tension and a double wrap is insufficient to hold the tension, two single wraps can be made to create a slip knot.
2. Never pull the needle in the needle holder when not sighted on the monitor. This can lead to tissue damage.
3. Do not pull the needle to tighten the suture. This can cause the suture to detach from the needle.
4. Tying intracorporeal knots is easiest when the instruments meet at an angle of 45–80° at the target tissue.

5.4.3.2 Intracorporeal Suturing with a Half-Circle Needle

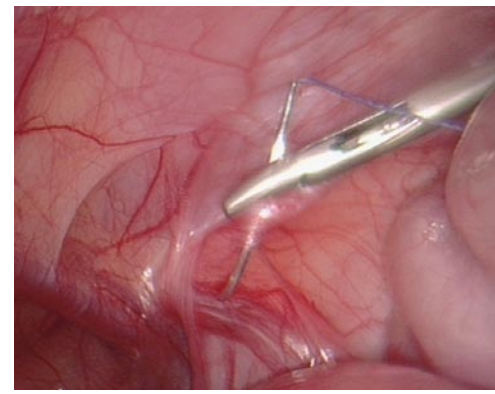
Please see Figs. 7 and 8.

Figure 5.7



Half-circle needles are too large to pass through the ports and can be introduced directly through the abdominal wall

Figure 5.8



The needle is grasped and the suture is tied intracorporeally. After this, the needle can be removed either (a) back through the abdominal wall or (b) through the port site along with the port as a single unit (with loss of insufflation in this case)

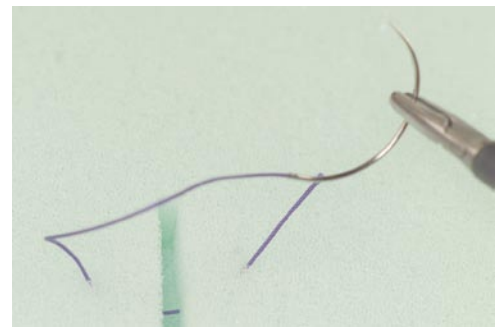
5.4.3.3 Intracorporeal Knot-Tying Technique

Please see Figs. 9–14.

Figure 5.9

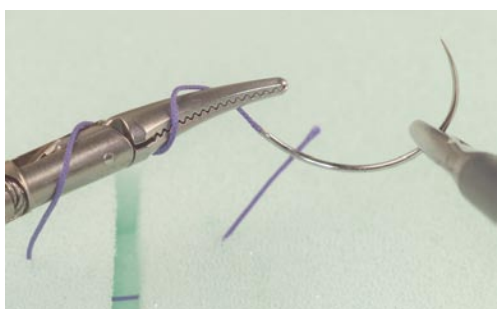
The needle is approximated. The suture is passed through the tissue with the needle held by the dominant needle holder

Figure 5.10



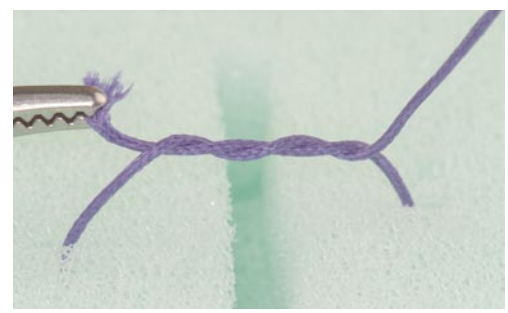
The needle is received by the nondominant needle holder and pulled so that it can be grasped by the dominant needle holder. The suture is pulled and laid in the form of a tension-free C-loop

Figure 5.11



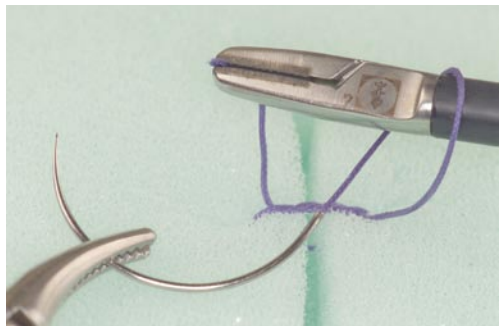
With the needle held in the dominant needle holder, the suture is then wrapped twice over the nondominant needle holder

Figure 5.12



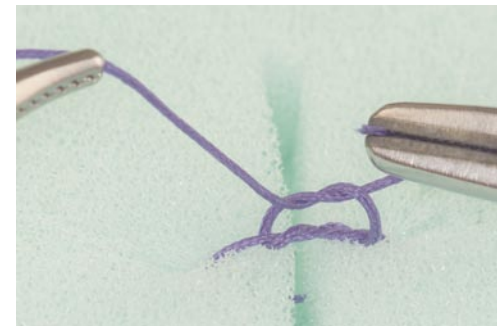
The nondominant needle holder is used to grasp the tail of the suture and pull to cinch down the knot

Figure 5.13



The second wrap is a single reverse wrap to secure the first knot

Figure 5.14



The second wrap is completed by wrapping the suture on the dominant needle holder and pulling the free end to tie the first knot. The third single wrap is made to place a second knot on the first one

Recommended Literature

1. Brown SI, White G, Witpat K, Frank TG, Cuschieri A (2004) Improving the retention of suturing needles in surgical graspers. Surg Endosc 18:1605–1607
2. Croce E, Olmi S (2000) Intracorporeal knot-tying and suturing techniques in laparoscopic surgery: technical details. JSLS 4:17–22
3. Joice P, Hanna GB, Cuschieri A (1998) Ergonomic evaluation of laparoscopic bowel suturing. Am J Surg 176:373–378