Surgical Stapling
Principles and Precautions

TO STAPLE OR TO SEW?

Surgical staplers facilitate gastrointestinal surgery by rapidly closing or anastomosing bowel. Some anastomoses (e.g., choledochojejunostomy) are best done by hand. For other purposes, such as joining colon to a rectal remnant after a low anterior resection, stapling is easier and faster, or it creates a more consistent anastomosis in an inaccessible location. For most procedures, however, the choice is up to the surgeon. The advantages and disadvantages of various techniques are pointed out throughout this volume in the appropriate chapters.

Stapled anastomoses, when constructed with proper technique, are no better and no worse than those done with sutures. Stapling has the disadvantage of increased expense but the advantage of speed: A stapled anastomosis can generally be completed within 2–5 minutes, which is a significant benefit in the poor-risk patient who is critically ill and who may be undergoing an emergency operation. Even with the availability of skilled anesthesiologists expert in the physiologic support of desperately ill patients, there is indubitably an advantage to completing the operation speedily.

Stapled anastomoses cannot be expected to succeed under conditions that would make construction of a sutured anastomosis dangerous. There is no evidence that staples are safer than sutures, for instance, in the presence of advanced peritonitis or poor tissue perfusion.

Whereas sutures can be inserted and tied to appropriate tension to approximate but not strangulate a wide range of tissue thicknesses, staplers are much less tolerant. The stapler must be matched to the task and the tissue thickness (see below). In some situations (e.g., stricturoplasty for Crohn disease) the bowel may be too thick and diseased to staple accurately.

There are occasional, though rare, instances in which the exposure does not allow enough room to insert a stapling instrument into a body cavity. If this is the case, do not apply traction to the tissues to bring them within stapler range.

CHARACTERISTICS OF STAPLES

Modern gastrointestinal staplers are designed to preserve the viability of the tissues distal to the staple line. This is analogous to the “approximate but do not strangulate” principle used when a bowel anastomosis is hand-sewn. Figure 5–1a and Figure 5–1b shows how two common staples sizes are designed to enter the tissue straight and then bend into a B configuration. This allows blood to flow through the staple line. If staple size and tissue thickness are appropriately matched, one sees blood oozing through the staple line. Occasionally a figure-of-eight suture of fine PDS must be inserted to stop a small bleeder, particularly when the stomach is being stapled. This technique is contraindicated if the tissues are so thick compression by the stapling device is likely to produce necrosis. On the other hand, if the tissues are so thin the staples cannot provide a firm approximation, bleeding and anastomotic leakage may occur.

There is some leeway when approximating tissues of varying thickness. Two standard staple sizes are available for the standard linear stapler. The 3.5 mm staple is 3.5 mm in leg length and 4.0 mm wide across the base. The 4.8 mm staple also is 4.0 mm wide across the base, but its leg length is 4.8 mm. The 3.5 mm stapler achieves a closed size of 1.5 mm, and the 4.8 mm stapler closes to 2 mm. For some staplers the smaller (3.5 mm) cartridge is blue and the larger (4.8 mm) cartridge is green; hence the mnemonic “little boy blue and the jolly green giant.” As a general rule, the 3.5 mm cartridge is appropriate for most tasks. The 4.8 mm cartridge is used for thicker tissues, such as stomach. Some stapling devices are continuously variable within this range, and the thickness may be tested with a gauge and then dialed in. Become
STAPLING IN INVERSION

The circular stapler and the linear cutting stapler create inverted staple lines that mimic the equivalent hand-sutured anastomosis. In many situations, both inverted and everted staple lines are created, as illustrated by the completed functional end-to-end anastomosis shown in Figure 5-2. Here a linear cutting stapler was used to create the first (inverting) staple line, which brought the two segments of colon into side-to-side alignment. A single stitch at the apex of this suture line helps provide mechanical stability. Three applications of a linear stapler have been used to close the open ends of bowel in an everting fashion.

STAPLING IN EVERSION

Everted staple lines are commonly created when the linear stapler is used to complete an anastomosis or to close the end of a piece of bowel. Even when tissues are stapled in eversion, with mucosa facing mucosa, satisfactory healing takes place. This is in contrast to sutured evert ing anastomoses, which are generally weaker than inverting anastomoses.

STAPLING DEVICES USED FOR GASTROINTESTINAL TRACT ANASTOMOSIS

Linear Stapling Devices

The 55 mm linear stapler applies a doubled staggered row of staples approximately 55 mm long; similarly, the 90 mm linear stapler applies a doubled staggered row about 90 mm long. There is also a 30 mm stapler that is occasionally useful for extremely short suture lines.

Each device may be used with 3.5- or 4.8-mm staples, according to the principles described above. These devices are used to approximate the walls of the stomach or intestine in an eversion fashion. They find application in closure of the duodenal stump, the gastric pouch during gastrectomy, and the end of the colon when a side-to-end coloproctostomy is performed.

Linear staplers use an aligning pin to ensure that the stapler cartridge meets the anvil accurately. This limits the length of bowel that can be stapled to a length that can be contained between the closed end of the device and the pin. For this reason it is