

Hand Sewn GI Anastomosis

I. OBJECTIVES:

By the end of this module the resident should be able to.....:

- Understand the principles underlying the construction of an intestinal anastomosis.
- Understand the various techniques and technical options of performing an intestinal anastomosis.
- Understand the signs and symptoms, consequences and management of an anastomotic leak.
- Perform a simulated end-to-end hand sewn two-layered bowel anastomosis.
- Perform an anatomic end-to-end hand sewn two-layered bowel anastomosis.

II. ASSUMPTIONS:

- Familiarity with the basic skills of tying and suturing
- Familiarity with the anatomic layers of the gastrointestinal tract.
- Familiarity with the surgical instruments and the two common suturing techniques: (1) continuous over-and-over and (2) the interrupted Lembert suture required to perform an intestinal anastomosis.

III. SUGGESTED READING:

ACS surgery: Principles and practice. Chapter 24. Intestinal anastomosis. Page 644-655.

IV: DESCRIPTION OF THE LABORATORY MODULE:

After a 15 minute overview, participants will rotate through the following:

Station 1. Continuous (over-and-over) stitch.

Interrupted Lembert stitch.

Station 2. Simulated hand sewn two-layered end-to-end anastomosis.

V. DESCRIPTION OF ANATMOIC ANASTOMOSIS:

- An intestinal anastomosis becomes necessary when a segment on the gastrointestinal tract is resected for benign or malignant indications and gastrointestinal continuity needs to be restored.
- The resected segment can be anywhere between the pharynx and the anus. As a result an anastomoses can be performed between the esophagus and stomach (*esophago-gastric*), small bowel and small bowel (*entero-enteric*), small bowel and colon (*entero-colostomy*), colon and colon (*colo-colic*), colon and rectum (*colorectal*), colon and anus (*coloanal*) and small bowel and the anus (*ileaoanal*).
- The anastomoses are usually between the ends of intestinal segments and thus are called *end-to-end* anastomoses. However the anastomoses can also be between the end of one segment and the side of the other (*end to side* anastomosis) or between the sides of two segments (*side-to-side* anastomosis).
- Intestinal anastomoses can be preformed in a variety of ways. The specific technique is usually a function of surgeon preference, which at times can be based more on “*dogma*” than “*scientific rationale*”.

Although there are specific considerations to each of these types of anastomoses there are certain fundamental principles that are generalizable to all of them.

PRINCIPLES OF SUCCESSFUL INTESTINAL ANASTOMOSIS:

1. Well nourished patient with no systemic illness.
2. No fecal or purulent contamination, either within the gut or in the surrounding peritoneal cavity.
3. Adequate exposure and access.
4. Gentle tissue handling.
5. Well-vascularized tissues and adequate hemostasis.
6. Absence of tension and distal obstruction
7. Approximation of well vascularized cut ends of the bowel.

8. METICULOUS SURGICAL TECHNIQUE.

INTESTINAL ANASTOMOTIC HEALING:

- The tensile strength of the bowel wall is due to the submucosa.
- The submucosa's strength is a result of the collagen which is the single most important molecule for determining intestinal anastomotic strength.
- The process of intestinal anastomotic healing is similar to wound healing elsewhere in the body and can be arbitrarily divided into
 - (A) Acute inflammatory (lag) phase
 - (B) Proliferative phase,
 - (C) Remodeling or maturation phase.
- The bursting pressure of an anastomosis is often used to gauge the strength of the healing process. This pressure has been found to increase rapidly in the early postoperative period, reaching 60% of the strength of the surrounding bowel by 3 to 4 days and 100% by one week.
- For the purpose of a bowel anastomosis, it is important to keep in mind that the serosa (i.e. the visceral peritoneum) holds suture better than either the longitudinal or the circular muscle layer.
- The absence of a peritoneal layer makes anastomosis of the thoracic esophagus and the rectum below the peritoneal reflection technically more difficult than anastomosis of the intraperitoneal segments of the intestine. In addition, the stomach and the small bowel are more vascularized than the esophagus and the large bowel and consequently tend to heal more readily.

TECHNIQUES OF INTESTINAL ANASTOMOSES:

The two most commonly used anastomotic techniques are:

(1) Hand-sewn sutured anastomosis

(2) Stapled Anastomosis

Prospective, randomized trials have not demonstrated any differences between stapled and hand-sewn anastomoses in terms of in clinical and sub-clinical leakage rates, length of hospital stay, or overall morbidity.

TECHNICAL OPTIONS FOR PERFORMING A HAND-SEWN SUTURED ANASTOMOSIS:

Suture material:

Intestinal segments can be sewn together with various suture materials. The ideal suture material – one that causes minimal inflammation and tissue reaction, while providing maximum strength during the lag phase of wound healing is yet to be discovered.

Popular choices include:

- Absorbable (vicryl, PDS) vs. non absorbable (silk).
- Monofilament (PDS, Maxon) vs. braided (vicryl)

Continuous versus Interrupted sutures:

Continuous and interrupted sutures can be used in performing an intestinal anastomosis. No randomized trials have addressed the question of whether interrupted sutures have a significant advantage over continuous sutures; however, retrospective reviews have not demonstrated any advantage of one method over the other.

Single layer versus Double layer anastomosis:

- Double layered anastomoses typically consist of an inner layer of *continuous* or *interrupted* absorbable sutures and an outer layer of *interrupted* absorbable or non-absorbable sutures.
- Single layered anastomoses consist of one layer of *interrupted* or *continuous* absorbable sutures.

Although single layered anastomoses have been shown to have theoretic advantages over double layered anastomoses, in clinical practice, both are equally efficacious.

TECHNIQUE OF DOUBLE LAYERED INTESTINAL ANASTOMOSES:

1. The two bowel ends that are to be anastomosed are aligned next to each other by aligning the non-crushing bowel clamps.
2. Two corner sutures are placed through the serosa and underlying muscularis; each is then tied and tagged with a straight clamp. The needle and suture is transected distal to the clamps.
3. *Posterior interrupted layer:*
 - Five to seven interrupted (seromuscular) Lembert stitches are placed between the corner sutures.
 - The sutures are then tied (three knots) so that the knots will be “outside” the anastomosis.
 - All but the two corner sutures are then cut, leaving the tied corner sutures tagged with straight clamps.
4. *Inner posterior layer:*
 - Starting in the middle, two continuous sutures are started to form the inner layer of the anastomosis.
 - Each suture goes towards each corner, in an over-and-over manner, incorporating the mucosal and submucosal layers of each lumen.
5. *Inner anterior layer:*
 - The continuous suture is continued around the corners, one after the other, coming together in the middle and tying the two ends after cutting the needles of each (4-5 knots).
 - After the inner layer of the anastomosis has been completed, the non crushing bowel clamps are removed.
6. *Anterior interrupted layer:*
 - Five to seven anterior (seromuscular) Lembert sutures are placed,
 - Sutures are tied at the end (3 knots) and cut 5 mm. distal to the knots.

After any anastomosis a close visual inspection of the entire circumference of the anastomosis should be performed. As a rule, if the divided ends appear well apposed, then the anastomosis is probably sound.

One of the most important determinants of outcome after procedures that include intestinal anastomosis is surgical technique. The central importance of meticulous technique means that constant practice and careful attention to detail are essential.

ANASTOMOTIC FAILURE:

Failure of an anastomosis with leakage of intestinal contents is one of the most significant surgical complications. Reported failure rates range from 1.5 to 2.2%, depending on what type of anastomosis was performed and whether the operation was an elective or an emergency procedure. An anastomotic leak increases the morbidity and mortality associated with the operation: it can double the length of the hospital stay and increase the mortality as much as 10-fold.

Signs and symptoms suggestive of an anastomotic leak include postoperative (usually between days 4 to 7) abdominal pain or peritonitis, fever and a leukocytosis. An abdominal X-ray showing free air or a CT scan with pneumoperitoneum and significant free fluid or inflammatory changes around the anastomosis suggestive of an anastomotic leak.

A localized anastomotic leak that is not associated with peritonitis or significant systemic sepsis can be managed with percutaneous or open drainage of the abscess, however anastomotic leaks associated with peritonitis or systemic manifestation of sepsis require a laparotomy and either revision of the anastomosis if feasible or fecal diversion proximally or at the site of the anastomosis.

Factors contributing to anastomotic failure;

Type and location:

As a rule, for any given technique the location of the anastomosis does not influence the overall leakage rate. There are two exceptions to this general rule. First, low anterior rectal anastomosis are associated with leakage rates ranging from 4.5% to 70%, however an acceptable leak rate is around 8-10%. Second esophageal anastomoses are associated with leakage rates of about 5%.

Bowel preparation:

For elective anastomoses of the colon and rectum, it is traditional to cleanse the large bowel prior to surgery. The rationale being that decreasing the bacterial load in the large bowel facilitates anastomotic healing and decreases the incidence and consequences of anastomotic leakage. Recent studies have questioned this approach and there is

increasing evidence that a bowel preparation may not be essential and that it may actually have some disadvantages.

Anastomoses in the esophagus, stomach and small bowel do not require a bowel preparation.

Associated diseases and systemic factors:

Anemia, diabetes mellitus, previous irradiation or chemotherapy, malnutrition with hypo albuminemia, vitamin deficiencies, steroid use, and certain disease conditions like Crohn's disease are associated with poor anastomotic healing and increased anastomotic leak rates.

VII. EQUIPMENT NEEDED:

- Kocher clamps
- Non crushing intestinal clamps
- Needle drivers
- DeBakey tissue forceps
- Snaps (Kelly)
- Scalpel and blade
- Suture material: 3.0 Silks and 3.0 vicryl
- Metz scissors
- Gloves.

VIII. REFERENCES.