INTRODUCTION

Intestinal anastomosis is one of the most commonly performed surgical procedures, especially in the emergency setting ***(Kaidar-Person et al., 2008).***

Leakage from an anastomosis in the gastrointestinal tract is often associated with increased morbidity, mortality rate and adversely affect length of hospital stay and cost. The frequency and consequences of anastomotic failure vary according to the site within the gastrointestinal tract ***(Bruce et al., 2001).***

The cause of the leakage may be multifactorial, including contribution from faulty technique, ischemia of the intestine at the suture line, excessive tension across anastomosis and mesentery, presence of distal obstruction. The old patients, anemia, malnourished with several coexisting diseases, receiving high doses steroids, after chemoradio-therapy is more prone to develop the anastomotic leakage ***(Bieleki and Gajda, 1999).***

Surgeons are all familiar with potentially devastating consequences of an anastomotic leak. Patients classically develop agonizing abdominal pain, tachycardia, high fever and a rigid abdomen, often accompanied by hemodynamic instability. In these cases, urgent return to the operating room for peritoneal washout and diversion is generally required ***(Hyman et al., 2007).***

The mortality rate for an anastomotic leak in the 6 to 39% range with a 10- 100% rise of permanent stoma ***(Brisinda et al., 2009).***

However, many patients ultimately found to have an anastomotic leak develop a more insidious presentation, often low-grade fever, prolonged ileus, or failure to thrive ***(Pickleman et al., 1999).***

In these patients making the diagnosis may be much more difficult as the clinical course is often similar to other postoperative infectious complications. These patients are often discharged from the hospital without the correct diagnosis in the present environment of cost containment as their nonspecific symptoms (i.e. poor appetite, failure to thrive) are not enough to (justify) continued hospitalization. Radiological imaging is usually required even then, the diagnosis may be elusive or at least uncertain ***(Hyman et al., 2007).***

The benefits of identifying patients at high risk of anastomotic leakage include the opportunity for more informed preoperative patient counselling and the potential for treatments to be altered, such as by the formation of a de-functioning stoma in high-risk patients ***(Lipska et al., 2006).***

Also, the incidence of anastomotic leakage has been proposed as a measure of performance following colorectal surgery ***(Platell et al., 2006).***

Several studies had identified risk factors for anastomotic leakage; however, there is no universal agreement on which risk factors consistently feature.

AIM OF THE WORK

This study aims at defining the incidence & risk factors of anastomotic leakage in Al Matariya Teaching Hospital as an example of tertiary care centres in Egypt.

It was also designed to provide statical data that helps in prediction of such serious complication, allowing high risk patients to get sufficient care & attention.

REVIEW OF LITERATURE

Intestinal Anastomosis

Intestinal anastomosis is one of the most commonly performed surgical procedures, especially in the emergency setting, and is also commonly performed in the elective setting when resections are carried out for benign or malignant lesions of the gastrointestinal tract.

Comprehensive understanding of the mechanism of healing anastomosis and different associated complications is beneficial for improving the applied methods to achieve more successful gastrointestinal anastomosis and to reduce the incidence of complications.

A. History

The art of bowel anastomosis dates back into the 19th century. Nicholas Senn's review performed in 1893 detected approximately 60 different techniques for intestinal suture, which he attributed to the "ancient and modern methods," followed by an additional 33 "recent methods" of suturing bowel ***(Senn, 1893).***

Within the past 200 years, gastrointestinal anastomosis has been transformed from a life-threatening venture into a safe

and routinely performed procedure. Among these advances was the transition to scientifically based medicine, chiefly the knowledge of the importance of serosa apposition introduced by ***Antoine Lembert*** in 1826 and the concept of asepsis proposed by ***Lord Joseph Lister*** in 1867 ***(Chen, 2012).***

Various materials have been proposed for suturing and stapling and have been used for creating the anastomosis such as catgut, stainless still, absorbable sutures and stapling devices. The idea of using stapling devices increased since 1908 that Humer Hültl introduced the first stapling device ***(Mortensen et al., 2008).***

In 1882, drawing attention to the idea that the collagen content in the submucosal layer was the main factor responsible for the resistance of anastomosis was already done by Halsted ***(Halsted, 1887).***

Since 19th century, the concept of creating a successful anastomosis has been under research. Investigators were interested to design a method that excluded the possibility of leakage following anastomosis. The idea of compression anastomosis has been proposed by ***Felix-Nicholas Denans***, in 1928 ***(Kaidar-Person et al., 2008).*** Compression anastomosis was based on two opposing rings that trap the ends of transect

bowel. ***Denans*** has suggested the compression anastomosis concept by applying silver or zinc rings in canine models for constructing end to end anastomosis. Bonnier, in 1885, and Murphy, in 1892, designed the first devices for performing anastomosis, which consisted of 2 metallic rings, which was not effective enough regarding its clinical usage ***(Gordon, 2006)***.

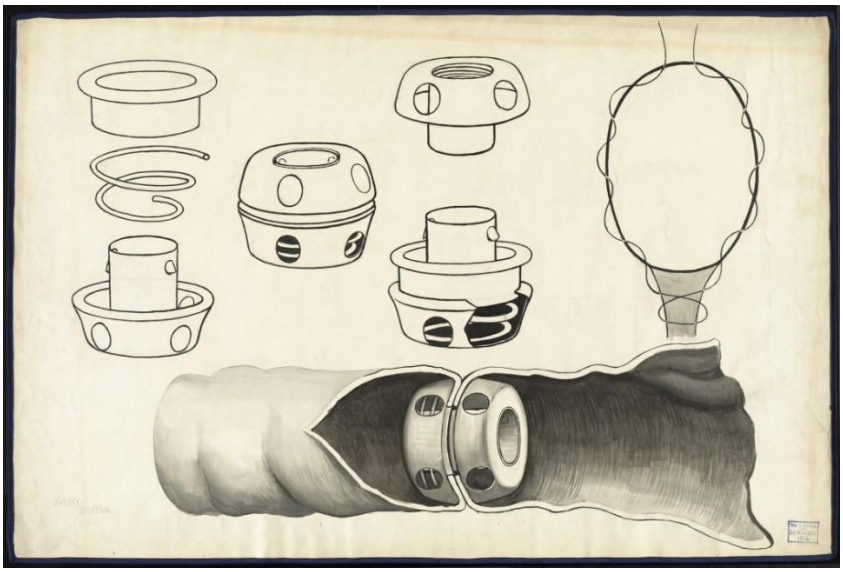

Figure 1: Components and final placement of Murphy's button for intestinal surgical anastomosis ***(Kaula, 1896).***

Although the Murphy Button described in 1892 was the first popular stapling prototype, further progress was not remarkable until the early 1960's when the Institute for Experimental Apparatus and Instruments in Moscow developed a group of instruments capable of performing gastrointestinal tract anastomosis ***(Forde et al., 1993)***. However, these

instruments were difficult to use and required individual staples be inserted by hand prior to each use. Several further engineering feats, including Ravitch's introduction of a modified form of the Russian stapling device and advent of bio-fragmentable anastomosis rings in 1985 led to the resurgence of suture-less anastomosis around the world ***(Chen, 2012).***

AKA-2 is a non-absorbable device, which was designed for colorectal anastomosis by Kanschin in 1984, to be expelled from the body after 6 days ***(Kanshin et al., 1984).*** Valtrac bio-fragmentable anastomotic ring (BAR) is another device developed by Hardy in 1985, almost one century after Bonnier ***(Hardy et al., 1985).***

Another device, nickel-titanium with shape memory alloy (SMA), was invented later for compression anastomosis, which is used in clip or ring forms and was expelled from the body almost after seven days ***(Nudelman et al., 2000).*** Also, endoluminal compression anastomotic ring (Endo-CAR) is another type of nickel-titanium device, which acts through simultaneous necrosis-healing process and it will be expelled from the body in one week by finishing the healing process ***(D'Hoore et al., 2008).***

Magnomosis is another method, which constructs a magnetically mediated intestinally anastomosis through an impermanent device with compression necrosis effect. Even despite various types of anastomosis devices designed since almost previous century, these devices did not obtain the importance and reputation of approaches such as stapling, which has a great efficacy in providing intestinal anastomosis ***(Jamshidi et al., 2009).***

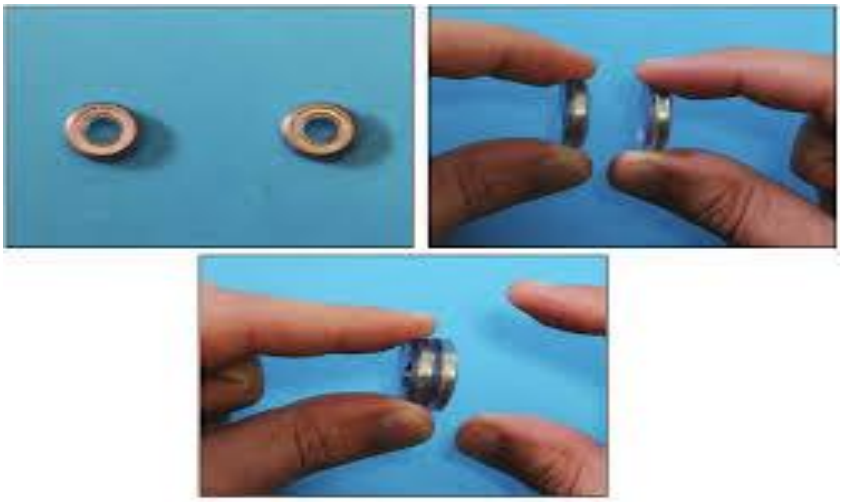

Figure 2: MAGNAMOSIS: magnetic anastomotic device ***(Joël et al., 2012).***

B. Indications

Basically, 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 ***(Chen, 2012).***

For more certainty, indications for intestinal anastomosis can be broadly divided into two categories: restoration of bowel continuity following resection of diseased bowel and bypass of unresectable diseased bowel ***(Vikram, 2018).***

- **Resection of diseased bowel as in**:

- Bowel gangrene due to mesenteric vascular disease, prolonged intestinal obstruction, intussusceptions, ... etc.
- Malignancy. - Complicated radiation enteritis.
- Benign conditions (e.g., intestinal polyps, intussusception, roundworm infestation with intestinal obstruction).
- Infections complicated with stricture or perforation (e.g., tuberculosis).
- Traumatic perforations not amenable to primary closure.
- Inflammatory bowel disease, ulcerative colitis, or Crohn disease that is refractory to medical therapy or associated with complications.
- Chronic constipation or Hirschsprung disease when the disease is refractory to medical therapy.

- **Bypass of unresectable diseased bowel as in:**

  - Locally advanced tumor causing luminal obstruction.
  - Metastatic disease, causing intestinal obstruction.
  - Poor general condition or condition that prevents major resection.

- **Certain pediatric conditions, as following, may also require intestinal anastomosis:**

  - Congenital anomalies (e.g., Meckel diverticulum, intestinal atresia, malrotation with volvulus leading to gangrene, meconium ileus, duplication cysts, Hirschsprung disease)
  - Inflammatory conditions (e.g., necrotizing enterocolitis)
  - Other conditions (e.g., intussusception, angiodysplasia, polypoid disease, ascariasis)
  - As a part of other surgical procedures (e.g., Kasai portoenterostomy, choledochal cyst, urinary diversions, pancreatic neoplasms)

C. Contraindications

Contraindications to intestinal anastomosis include conditions in which there is high risk of anastomotic leak, ***(Vikram, 2018)*** such as the following:

- Severe sepsis.
- Poor nutritional status (e.g., severe hypoalbuminemia)
- Disseminated malignancy (peritoneal and serosal deposits, ascites).
- Doubted bowel viability.
- Fecal contamination or frank peritonitis.

D. Operative Techniques:

The two most commonly used anastomotic techniques are: **handsewn sutured** anastomosis and **stapled** anastomosis (fiure3). Important advantages of the stapled technique are the shorter operating time and the greater ease of performing the procedure, especially in low pelvic anastomoses.

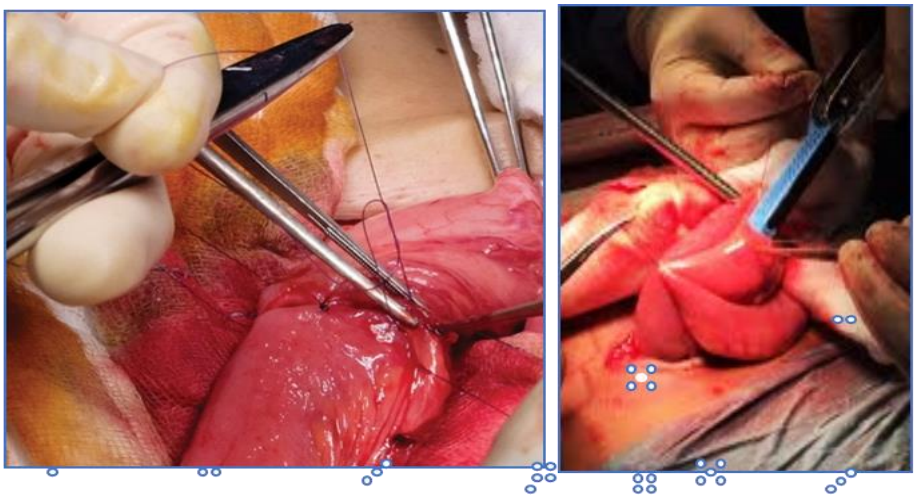

Figure 3: Handsewn sutured anastomosis(left) vs. Stapled anastomosis (right).

Prospective, randomized trials have not demonstrated any differences between stapled and hand-sewn anastomosis as regard leakage rates, length of hospital stay, or overall morbidity ***(Docherty et al., 1995)***. On the other side, animal studies have found that a stapled anastomosis heals by secondary intention, whereas a sutured anastomosis heals by primary intention; this may account for the high rate of stricture ***(Vikram, 2018).***

So, we believe in that controversy remains about which of the two methods yields better clinical outcomes.

Intestinal segments can be sewn together with various suture materials. The ideal suture material is one that causes minimal inflammation and tissue reaction, while providing maximum strength during the lag phase of wound healing ***(Chen, 2012).*** Regarding to material AR Ross et al. recommend polypropylene, a non-absorbable, monofilament suture that elicits minimal tissue reaction and handles well for tying. They also believe this suture material minimizes the 'drag' experienced as it passes through tissue ***(Ross et al., 2016).*** It is also likely that the minimal tissue reaction generated by this material results in minimal scarring and rapid healing ***(Ballantyne, 1984).***

Figure 4: Interrupted anastomosis for the anterior layer (Small intestine).

Both continuous and interrupted sutures can be used in performing an intestinal anastomosis (fig. 4). Double layered anastomosis typically consists of an inner layer of continuous or interrupted absorbable sutures and an outer layer of interrupted **absorbable** or **nonabsorbable** sutures. Single layered anastomosis consists of one layer of interrupted or continuous absorbable sutures. Potential advantages of the single-layer technique are that it takes less time to perform and that it costs less, though safety may be a concern ***(Garude et al., 2013).***

In 2006 a meta-analysis analyzing 670 patients concluded that there was no evidence that two-layer anastomosis yielded a lower rate of postoperative leakage than single-layer anastomosis ***(Shikata et al., 2006).*** Still, the incidence of perioperative complications, mortality, or the length of hospital stay with the single-layer technique ***(Sajid et al., 2012).***

When it comes to size discrepancy in anastomotic ends there have been only a few methods devised to solve this problem ***(Gunduz, 2016).*** There is still no concluding evidence about the efficiency of any of these techniques. Also all the methods should be performed according to the surgeon's experience and skills.

Whichever the technique to be used, its success depends on many peri-operative considerations, which can be summarized as following…

E. Peri-operative Considerations:

- **Preoperative**

- **Intestinal preparation:** Mechanical Bowel Preps (MBP) was initially given before elective colorectal procedures to decrease the bacterial load of the colon and, therefore,