The American Journal of Surgery 213 (2017) 590–595

Contents lists available at ScienceDirect

The American Journal of Surgery

journal homepage: www.americanjournalofsurgery.com

Common side closure type, but not stapler brand or oversewing, influences side-to-side anastomotic leak rates

V.A. Fleetwood*, K.N. Gross, G.C. Alex, C.S. Cortina, J.B. Smolevitz, S. Sarvepalli, S.R. Bakhsh, J. Poirier, J.A. Myers, M.A. Singer, B.A. Orkin

Department of General Surgery, Rush University Medical Center, Chicago, IL, United States

ARTICLE INFO

Article history:
Received 15 July 2015
Received in revised form
24 February 2016
Accepted 10 October 2016

Keywords:
Anastomotic leak
Side to side anastomosis
Stapler
Device
Brand
Oversewing

ABSTRACT

Background: Anastomotic leak (AL) increases costs and cancer recurrence. Studies show decreased AL with side-to-side stapled anastomosis (SSA), but none identify risk factors within SSAs. We hypothesized that stapler characteristics and closure technique of the common enterotomy affect AL rates.
Methods: Retrospective review of bowel SSAs was performed. Data included stapler brand, staple line oversewing, and closure method (handsewn, HC; linear stapler [Barcelona technique], BT; transverse stapler, TX). Primary endpoint was AL. Statistical analysis included Fisher's test and logistic regression.
Results: 463 patients were identified, 58.5% BT, 21.2% HC, and 20.3% TX. Covidien staplers comprised 74.9%, Ethicon 18.1%. There were no differences between stapler types (Covidien 5.8%, Ethicon 6.0%). However, AL rates varied by common side closure (BT 3.7% vs. TX 10.6%, $p = 0.017$), remaining significant on multivariate analysis.
Conclusion: Closure method of the common side impacts AL rates. Barcelona technique has fewer leaks than transverse stapled closure. Further prospective evaluation is recommended.

1. Introduction

The most dreaded complication of the intestinal anastomosis is leakage, occurring in 3–19% of patients.[1] Anastomotic leak is a potentially life-threatening complication, requiring at best antibiotics and at worst, re-operation; even small leaks significantly increase costs and length of stay.[2] If the patient survives the immediate postoperative period despite the leak, recurrence rates are higher in operations indicated by malignancy.[3] Constructing a secure anastomosis has a vast effect on the outcome of the patient and the financial burden on the healthcare system.

However, formation of the secure intestinal anastomosis is a skill less often learned from textbooks than it is passed down from surgeon to surgeon, and technique is therefore subject to a high degree of variability. Although multiple factors related to the surgeon, the patient, the indication, and even the anesthesia type have been studied and validated, little consensus has been reached on technical variations as risk factors for leakage.[1] One technical aspect that has been studied extensively is the use of staplers as compared to suturing for creation of the anastomosis. The safety of the stapled anastomosis was examined in a recent meta-analysis[1] and found to have mixed results in different studies. The overall conclusion was equivalent outcomes in terms of anastomotic leak, although an included subgroup analysis[4] indicated that the stapled anastomosis is superior in the hands of residents and less-experienced surgeons.

Although a plethora of studies have examined differences between stapled and handsewn anastomoses,[1,5–7] these have all focused on the technique used to join the bowel segments without addressing the closure of the common enterotomy (Fig. 1). Anastomoses have been considered handsewn if completely sutured, stapled if a stapler is used at all. Although meta-analysis has found a higher rate of stricture with stapled than sutured common enterotomy closure in gastrojejunostomy,[8] no studies have examined rates of anastomotic leak.

Similarly, differences in outcomes caused by type of stapler have not been addressed. The common enterotomy created in the anastomosis can be closed by linear stapler (Barcelona technique) or by transverse stapler (Fig. 1). Despite the differences in staple characteristics within these two types, the question of how the choice of stapler affects leak rates has not been raised. Furthermore, within staplers there are multiple different brands and lengths

* Corresponding author. Department of General Surgery, 1653 W Congress Pkwy, 878 Jelke, Chicago, IL 60612, United States.
E-mail address: vidyaratna_a_fleetwood@rush.edu (V.A. Fleetwood).

http://dx.doi.org/10.1016/j.amjsurg.2016.10.038
0002-9610/

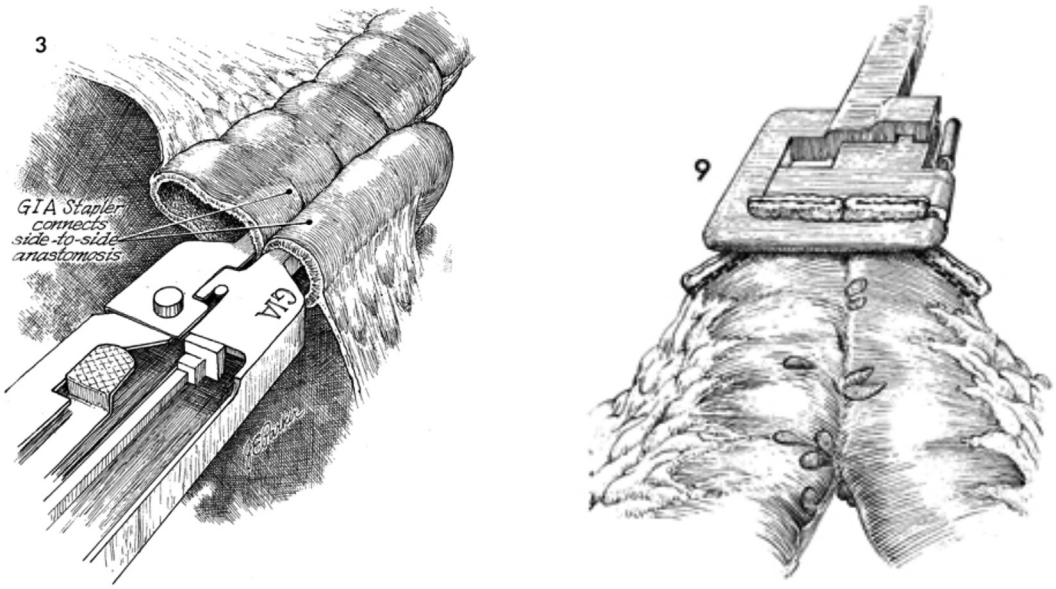

Fig. 1. a) Discontinuous bowel and formation of the common channel. b) Step a is followed by closure of the common enterotomy with a transverse stapler to create a transverse closure. A single application of the linear stapler across the common enterotomy, in place of the transverse stapler, creates a Barcelona closure. Illustrated by John Parker, medical illustrator. Reprinted from the Atlas of Pelvic Surgery by Wheeless and Roenneberg, On-line Edition under Fair Use Doctrine.

which can be used to create a given anastomosis; perhaps due to a lack of data detailing which staplers were used, there is no information on how these specific stapler characteristics affect complications.

Given the dearth of literature on a topic made increasingly relevant by the increased popularity of the quicker, more resident-friendly stapler technique, we created a comprehensive database detailing stapler factors and enterotomy closure technique. We hypothesized that stapler characteristics and technique of common enterotomy closure affect anastomotic leak rates.

2. Methods

We conducted a single-center retrospective review of the electronic medical record between January 2009 and December 2012. Charts were identified by Current Procedural Therapy (CPT) codes for specific intestinal surgeries and operative reports were used to confirm presence of intestinal anastomosis.

Both large and small intestinal anastomoses were included in our database. We examined only intestinal anastomoses created in a side-to-side fashion. The operations examined therefore included small bowel resection, ileocolic resection, and total colectomies.

Data was collected on multiple factors. Preoperative demographics included age and sex; operative variables included were operative time, surgical indication, and individual surgeon. Technical variables collected were method of enterotomy closure, oversewing of staple line, and number of stapler firings required for low anterior resection; stapler factors were brand, length, and type. Stapler lengths used in fewer than five anastomoses were not considered in our analysis due to insufficient power to correctly evaluate significance. Our endpoint was anastomotic leak, detected either radiographically or clinically.

Operative reports were closely reviewed to determine method of enterotomy closure, which was classified as either handsewn closure (HC), Barcelona technique (BT) closure, or transverse stapler closure (TX). Our HC classification included both stapled and handsewn anastomoses with a handsewn closure of the common enterotomy. Barcelona technique closure involved closing the common enterotomy with a linear (GIA) stapler. Transverse stapler closure (Fig. 1) required enterotomy closure with a transverse (TA) stapler. For GIA and TA stapling, limbs of bowel were brought together to provide an equal length of staple line. Method of oversewing was also collected and was described as absent if none was performed, partial for intermittent Lembert sutures or oversewing of only part of the common enterotomy, and complete for a two-layer closure.

Technique was not standardized in this study; the choice of enterotomy closure type was left to the individual surgeon. This was done in order to study the effects of closure type without the confounder of surgeon inexperience with a given technique.

Descriptive analysis compared demographics between groups, leak and non-leak, using Fisher's exact test for binary variables and chi-square analysis for categorical variables. Fisher's exact test and chi-square testing were also used in univariate analysis. Univariate analysis was performed on each of the factors listed above, including preoperative demographics, operative variables, technical factors, and closure type. Additionally, we evaluated the univariate effects of comorbidities, including diabetes and anemia; steroid use; and tobacco use. Nutrition was evaluated using preoperative albumin, which was evaluated as a continuous variable with t testing.

Multivariate logistic regression with Wald forward selection was utilized to evaluate the association between closure type and our primary endpoint after adjusting for age, gender, urgency, indication for surgery, and duration of surgery.

Analysis was conducted in R (3.1.1) under the purview of a statistician. Our study obtained full approval from the Institutional Review Board prior to any data collection.

3. Results

3.1. Demographics

Of the charts reviewed, 952 patients were operated on with a