

Single Layer Versus Double Layers Technique in Hand Sewn Intestinal Anastomosis: A Comparative Study

MOHAMMAD A. ELIAN, M.D.*; MOATASEM A. ERFAN, M.D.**; MOHAMED A. ABDEL ZAHER, M.D.* and ASAAD A. ABDELAZIZ, M.D.*

The Department of General Surgery, Faculty of Medicine, Minia University* and Misr University for Science & Technology**

Abstract

Background: Gastrointestinal anastomosis is considered a step in the surgeons' daily practice that has a lot of debates. There are several techniques used, but hand sewn remains the gold standard for anastomosis. It has been a controversy regarding the outcomes of single layer or double layers anastomosis.

Aim of Study: The aim of this study is to compare outcomes regarding the efficiency, safety and the cost effectiveness associated with each technique.

Patients and Methods: The study included 100 patients indicated for intestinal anastomosis at El-Minia University Hospital and Suad Kafafi University Hospital between June 2022 and June 2023. The patients were randomized into two equal groups; group A for single layer intestinal anastomosis (SLIA) and group B for double layers intestinal anastomosis (DLIA). Patients aged ≥ 18 years indicated for elective or emergency intestinal anastomosis for different causes were included. Post-operatively, all the patients were assessed for anastomotic leak. Also, duration required to perform the intestinal anastomosis, hospital stay, morbidity and mortality were assessed. Rate of anastomotic leak was the primary outcome while length of hospital stay and other complications were considered the secondary outcome measures.

Results: Enteroenteric anastomosis was the commonest. Eighty patients underwent elective surgery and 20 patients underwent emergency surgery. The duration of anastomosis was significantly shorter in group A ($p=0.00$). There were 3 anastomotic leaks; one in group A (2%) and 2 in group B (4%) ($p=0.55$). Seroma and SSI were recorded postoperatively in the initial 3 months. There was 1 death in each group due to septic shock after leak. Hospital stay in group A was comparable to that of group B ($p=0.92$).

Conclusion: SLIA has proved safety and feasibility with significant reduction in duration of anastomosis and was comparable to the DLIS in postoperative outcome.

Key Words: Intestinal anastomosis – Single layer – Double layer – Bowel resection.

Introduction

HAND sewn suturing technique is popular because most surgeons are familiar with the procedure and the suture materials are affordable and available [1]. The reported rate of failure of intestinal anastomosis ranges from 1.5% to 2.2%, depending on the type of anastomosis, whether the operation was elective or emergency, general factors like age, nutrition, comorbidity and local factors like vascularity, suture technique and sepsis. Anastomotic leak increases the length of hospital stay, the cost of the treatment and mortality rate [2]. It has been a controversy regarding the outcomes of single layer or double layers anastomosis. Double layers anastomosis is time consuming, defective in serosal apposition and carries the risk of anastomotic stricture [3]. Single layer intestinal anastomosis causes less tissue ischemia or stricture with less time and cost without adding to the risk of leak, so, it is currently popular [4]. The main goal of this study is to add further insight on the choosing of either single layer or double layers anastomosis by comparing outcomes associated with each technique.

Patients and Methods

The study included 100 patients indicated for intestinal anastomosis at El-Minia University Hospital and Suad Kafafi University Hospital between June 2022 and June 2023. The study was approved by the Institutional Ethics Committee of Minia College of Medicine. Written informed consent was obtained from all included patients. The patients were randomized into two groups by chit and box method, each group included 50 patients. Group A was assigned for single layer intestinal anastomosis (SLIA) and group B for double layers intestinal anastomosis (DLIA). Patients aged ≥ 18 years indi-

Correspondence to: Dr. Moatasem A. Erfan,
E-Mail: moatasem.erfan@must.edu.eg

cated for elective or emergency intestinal anastomosis for different causes were included regardless of the type of anastomosis (end-to-end, end-to-side, side to side). Patients requiring rectal, duodenal, or gastric anastomosis, patients who were inoperable or refusing to give a consent, patients with preoperative comorbidities (like hypertension, diabetes mellitus, immunodeficiency, bleeding disorders, sepsis and septic shock, cachexia, ICU admission and TPN), patients whose anastomosis ended with stoma, patients with postoperative complications related to anesthesia, renal, pulmonary, and cardiac conditions were excluded.

All patients were operated by a consultantsurgeon or senior registrar. Postoperatively, all the patients were assessed for anastomotic leak which was defined as clinical or radiological signs of leak together with fever above 38°C or septicemia, symptoms and signs of peritonitis (e.g. fever, persistent abdominal pain, tachycardia. Leukocytosis) or presence of intraperitoneal abscess and confirmed by abdominal ultrasound or established enterocutaneous fistula [5]. Also, duration required to perform the intestinal anastomosis, hospital stay, morbidity (i.e. complications like seroma, surgical site infections) and mortality were assessed. After discharge, patients were followed-up every month for 3 months and were evaluated for complications like anastomotic leak, surgical site infections and bleeding. Rate of anastomotic leak was the primary outcome while length of hospital stay and other complications were considered the secondary outcome measures.

Surgical technique:

The diseased intestinal segment was resected according to standard resection technique. The intestinal cut ends were cleaned with 5% povidone iodine (Betadine) swab. SLIA was carried out using a continuous 3/0 polyglycolic acid (Vicryl) sutures with round needle involving all layers except the mucosa. Stitch bites were applied 4-6mm away from the cut edge with 5mm distance from each other with larger bites at the mesenteric border to ensure adequate sealing [6] (Fig. 1).

DLIA was constructed using a continuous 3/0 polyglactin sutures with round needle for the first layer and interrupted 3/0 polyglycolic acid (Vicryl) sutures for the outer seromuscular layer inverting the first layer [7] (Fig. 2).

The mesenteric window was closed to prevent internal herniation. To confirm the patency, the anastomotic segment was palpated gently between fingers. Abdominal tube drains were placed whenever necessary.

Statistical analysis:

Values are given as medians \pm SD (Standard Deviation) or percentage. To compare parametric

data, independent samples *t*-test was used, whereas comparing nonparametric data was done using Chi-square tests. *p*-value less than 0.05 was considered statistically significant.



Fig. (1): Group A Hand sewn single layer intestinal anastomosis (SLIA).



Fig. (2): Group B for double layers intestinal anastomosis (DLIA) interrupted suture after continues suture.

Results

A hundred patients were included, 50 in SLIA and 50 in DLIA. The age and gender in both groups were comparable ($p=0.11$, 0.51 ; respectively). Enterointestinal anastomosis was the commonest with no statistically significant difference between the 2 groups ($p=0.90$). Eighty patients underwent elective surgery and 20 patients underwent emergency surgery with no statistically significant difference between the 2 groups ($p=0.61$). Closure of stoma following emergency intestinal resections was the most common cause of intestinal anastomosis in both groups. Other common causes included malignancy (like colonic cancer), bowel obstruction, strangulated hernia, bowel ischemia and bowel perforation (Table 1).

The duration of anastomosis was significantly shorter in group A ($p=0.00$). There were 3 anastomotic leaks; one in group A (2%) and 2 in group B

(4%) with no statistically significant difference between the 2 groups ($p=0.55$). Seroma and SSI were recorded postoperatively in the initial 3 months, but the difference between the 2 groups was not statistically significant ($p=0.64, 0.50$; respectively). There was 1 death in each group. Mortality was due to septic shock after leak in a patient who underwent an enterocolic anastomosis for malignancy in group A and another patient who underwent enteroenteric anastomosis for bowel perforation in group B. Hospital stay in group A was comparable to that of group B ($p=0.92$) (Table 2).

Table (1): Patient's general characteristics.

	Group A (No., %)	Group B (No., %)	<i>p</i> - value
Age (mean ± SD)	44.90±9.38	47.84±9.28	0.11
<i>Gender:</i>			
- Male	33 (66)	36 (72)	0.51
- Female	17 (34)	14 (28)	
<i>Type of anastomosis:</i>			
- Entero-enteric	37 (74)	35 (70)	0.90
- Entero-colic	5 (10)	6 (12)	
- Colo-colic	8 (16)	9 (18)	
Emergency	11 (22)	9 (18)	0.61
Elective	39 (78)	41 (82)	
<i>Indication for bowel anastomosis:</i>			
- Closure of stoma	26 (52)	24 (48)	0.96
- Malignancy	8 (16)	11 (22)	
- Bowel obstruction	6 (12)	4 (8)	
- Strangulated hernia	3 (6)	4 (8)	
- Bowel ischemia	2 (4)	3 (6)	
- Bowel perforation	2 (4)	2 (4)	
- Fistula	3 (6)	2 (4)	

Table (2) Outcome and hospital stay.

	Group A (No., %)	Group B (No., %)	<i>p</i> - value
Operative time (mean ± SD, minutes)	19.00±1.42	30.34±1.68	0.00
<i>Complications:</i>			
- Leak	1 (5)	2 (10)	0.55
- Seroma	2 (10)	3 (15)	0.64
- SSI	4 (20)	6 (30)	0.50
Mortality	1 (5)	1 (5)	1.00
Hospital stays	7.84±2.01	7.88±1.93	0.92

Discussion

Intestinal anastomosis has become a routine procedure over the last 200 years due to advances in technique, better management of sepsis, use of antibiotics and aseptic precautions. Although stapled

method shown to be superior, handsewn anastomosis is still widely adopted in many institutions [8,9]. Accurate union of two viable bowel ends without tension with good blood supply is the key to a successful anastomosis. The double layers anastomosis technique is technically demanding especially in deep areas like pelvis [10,11]. But Halsted demonstrated that bowel anastomosis can be safely done using a single layer of sutures. There is still debate concerning the best type of handsewn anastomosis with respect to appropriateness, ease of accomplishment, duration required to create the anastomosis, outcomes and cost effectiveness. Reduced time duration and lower cost of suture materials are the main benefits of single layer anastomosis over double layers [12].

The mean duration of anastomosis was significantly shorter in SLIA group (19.00±1.42 and 30.34±1.68 minutes for SLIA and DLIA groups, respectively) ($p=0.00$). This is comparable to results obtained by other studies [4,5,13]. In the present study, the incidence of anastomotic leak, seroma and SSI was comparable between both groups. There were 3 cases of postoperative leak in 3 months follow-up period; 1 in SLIA group (2%) and 2 in DLIA (4%) which was comparable to the incidence reported in recent studies with no significant differences between the 2 groups. A comparative study by Singh et al., on 60 patients showed a similar leak rate of 6.7% in both groups [13]. Also, Burch et al., documented a similar leak rate in both groups [5]. Herrle et al., reported a leak rate of 3.1% and 4.9% in SLIA and DLIA; respectively [14]. It should be mentioned that anastomotic leak depends on many factors other than the technique (like diabetes mellitus, malnutrition, anemia, sepsis, Crohn's disease, steroid use, previous chemotherapy and irradiation [15,16]. A total of 2 deaths (one in each group 2%) were recorded in our study during the follow-up period due to anastomotic leak superadded by septic shock.

Mortality rate in the present study was comparable to a study by Aniruthan et al. [12] who reported a mortality rate of 1.92% and 3.7% in SLIA and DLIA; respectively and Herrle et al., who reported a mortality rate of 1.5% in SLIA group [14]. The mean hospital stay in our study was 7.84 days in SLIA and 7.88 days in DLIA, which was comparable to 8.33 days in SLIA and 8.89 days in DLIA by Aniruthan et al., [12] 7.9 days in SLIA and 9.9 days in DLIA by Burch et al., [5] and 8.97 days in SLIA and 8.93 days in DLIA by Singh et al. [13] with no significant difference between the two groups. Further studies may be needed to compare other long-term outcomes like anastomotic site stricture etc.

Conclusion:

Apart from significant reduction in duration of anastomosis, the SLIA was comparable to the DLIA reference to leak rate, morbidity, mortality and

hospital stay. SLIA can be considered safe and feasible in elective and emergency context. We advocate the use of the single layer method for bowel anastomosis.

Disclosure:

The authors report no proprietary or commercial interest in any product mentioned or concept discussed in this article.

Funding:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

- 1- KAR S., MOHAPATRA V., SINGH S., et al.: Single Layered Versus Double Layered Intestinal Anastomosis: A Randomized Controlled Trial. *J. Clin. Diagn. Res.*, Jun.11(6): PC01-PC04, 2017.
- 2- BOSCHUNG U.: Milestones in the history of intestinal anastomosis (Article in German). *Swiss Surg.*, 9: 99-104, 2003.
- 3- GARUDE K., TANDEL C., RAO S. and SHAH N.J.: Single layered intestinal anastomosis: A safe and economic technique. *Indian J. Surg.*, Aug. 75 (4): 290-293, 2013.
- 4- KUMAR A. and KUMAR V.: Single layer versus double layer intestinal anastomoses: A comparative study. *Int. Surg. J.*, Sep. 7 (9): 2991-2998, 2020.
- 5- BURCH J.M., FRANCIOSE R.J., MOORE E.E., et al.: Single-layer continuous versus two-layer interrupted intestinal anastomosis: A prospective randomized trial. *Ann. Surg.*, Jun. 231 (6): 832-7, 2000.
- 6- BAILEY H.R., LAVOO J.W., MAX E., et al.: Single layer polypropylene colorectal anastomosis. Experience with 100 cases. *Dis. Colon. Rectum.*, Jan. 27 (1): 19-23, 1984.
- 7- SLIEKER J.C., DAAMS F., MULDER I.M., et al.: Systematic review of the technique of colorectal anastomosis. *JAMA Surg.*, Feb. 148 (2): 190-201, 2013.
- 8- LUSTOSA S.S., MATOS D., ATALLAH A.N. and CASTRO A.A.: Stapled versus handsewn methods for colorectal anastomosis surgery: A systematic review of randomized controlled trials. *Sao Paulo Med. J.*, Sep. 2; 120 (5): 132-6, 2002.
- 9- CERALDI C.M., RYPINS E.B., MONAHAN M., et al.: Comparison of continuous single layer polypropylene anastomosis with double layer and stapled anastomoses in elective colon resections. *Am. Surg.*, Mar. 59 (3): 168-71, 1993.
- 10- GOLIGHER J.C., LEE P.W.G., SIMPKINS K.C. and LINTOTT D.J.: A controlled comparison of one- and two-layer techniques of suture for high and low colorectal anastomoses. *Br. J. Surg.*, Sep. 64 (9): 609-14, 1977.
- 11- TUSON J.R. and EVERETT W.G.: A retrospective study of colostomies, leaks and strictures after colorectal anastomosis. *Int. J. Colorectal Dis.*, Feb. 5 (1): 44-8, 1990.
- 12- ANIRUTHAN D., PRANAVI A.R., SREENATH G.S. and KATE V.: Efficacy of single layered intestinal anastomosis over double layered intestinal anastomosis-an open labelled, randomized controlled trial. *Int. J. Surg.*, Jun. 78: 173-178, 2020.
- 13- SINGH R, NAJMI HI, CHAHAL RK. and NIKHIL D.: A Comparative Study of Single-Layered Versus Double-Layered Intestinal Anastomosis. *Cureus*, Mar. 12; 14 (3): e23088, 2022.
- 14- HERRLE F., DIENER M.K., FREUDENBERG S., et al.: Single-layer continuous versus double-layer continuous suture in colonic anastomoses a randomized multicentre trial (ANATECH trial). *J. Gastrointest Surg.*, Feb. 20 (2): 421-30, 2016.
- 15- JUNG S.H., YU C.S., CHOI P.W., et al.: Risk factors and oncologic impact of anastomotic leakage after rectal cancer surgery. *Dis. Colon Rectum.* Jun. 51 (6): 902-8, 2008.
- 16- VOLK A., KERSTING S., HELD H.C. and SAEGER H.D.: Risk factors for morbidity and mortality after single-layer continuous suture for ileocolonic anastomosis. *Int. J. Colorectal Dis.*, Mar. 26 (3): 321-7, 2011.

تقنية الطبقة الواحدة مقابل تقنية الطبقات المزدوجة فى توصيل الأمعاء المخيطة يدوياً: دراسة مقارنة

الخلفية: يعتبر توصيل الجهاز الهضمى جراحياً خطوة فى الممارسات اليومية للجراحين والتي تثير الكثير من الجدل. وهناك العديد من التقنيات المستخدمة، ولكن الخياطة اليدوية تظل هى المعيار الذهبى لتوصيل الامعاء. ولقد كان هناك جدل حول نتائج توصيل الامعاء جراحياً باستخدام الطبقة الواحدة أو الطبقات المزدوجة. وان الهدف من هذه الدراسة هو مقارنة النتائج المتعلقة بالكفاءة والسلامة وفعالية التكلفة المرتبطة بكل تقنية منهم.

المرضى وطرق العمل: شملت الدراسة ١٠٠ مريض محدد للتوصل الجراحى للأمعاء فى مستشفى المنيا الجامعى ومستشفى سعاد كفافى الجامعى فى الفترة ما بين يونيو ٢٠٢٢ ويونيو ٢٠٢٣. فقد تم اختيار المرضى عشوائياً إلى مجموعتين متساويتين؛ المجموعة (أ) للتوصل المعوى الجراحى ذات الطبقة الواحدة (SLIA) والمجموعة (ب) للتوصيل المعوى الجراحى ذو الطبقة المزدوجة (DLIA). وقد تم تضمين المرضى الذين تتراوح أعمارهم بين ١٨ سنة والمشار إليهم بتوصيل الامعاء جراحياً فى حالات اختيارية أو حالات طارئة لأسباب مختلفة. وبعد العملية الجراحية، تم تقييم جميع المرضى للتسرب بعد التوصيل المعوى جراحياً. أيضاً، تم تقييم المدة اللازمة لإجراء توصيل الأمعاء جراحياً، والإقامة فى المستشفى، المضاعفات والوفيات. وكان معدل التسرب لتوصيل الامعاء جراحياً هو النتيجة الأولية فى حين اعتبرت مدة الإقامة فى المستشفى والمضاعفات الأخرى مقياس النتائج الثانوية.

النتائج: كان خياطة الامعاء الدقيقة للأمعاء الدقيقة جراحياً هى الأكثر شيوعاً. خضع ثمانين مريضاً لعملية جراحية اختيارية وخضع ٢٠ مريضاً لعملية جراحية طارئة. وكانت مدة التوصيل الجراحى للأمعاء أقصر بكثير فى المجموعة (أ) ($p=0.00$). وقد كان هناك ٣ تسربات فى توصيل الامعاء؛ واحدة فى المجموعة أ (٢٪) واثنان فى المجموعة ب (٤٪) ($p=0.05$). وقد تم تسجيل تجمع سائل سيرومى والتهاب فى مكان الجروح الخارجية للبطن بعد العمل الجراحى فى الأشهر الثلاثة الأولى. وكانت هناك حالة وفاة واحدة فى كل مجموعة بسبب الصدمة التسممية بعد التسريب. وكانت الإقامة فى المستشفى فى المجموعة (أ) مماثلة لتلك الموجودة فى المجموعة (ب) ($p=0.92$).

الخلاصة: أثبت توصيل الامعاء جراحياً باستخدام طبقة واحدة جراحية سلامتها وجدواها مع انخفاض كبير فى المدة الزمنية للتوصيل الجراحى للأمعاء، وكانت مماثلة لـ توصيل الامعاء جراحياً باستخدام الطبقة المزدوجة فى نتائج ما بعد الجراحة.