International Surgery Journal
Kumar A et al. Int Surg J. 2020 Sep;7(9):2991-2998
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20203782

Original Research Article

Single layer versus double layer intestinal anastomoses: a comparative study

Ajit Kumar*, Vinod Kumar

Department of Surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India

Received: 09 June 2020
Revised: 17 July 2020
Accepted: 30 July 2020

***Correspondence:**
Dr. Ajit Kumar,
E-mail: ajitkumar02.rims@gmail.com

ABSTRACT

Background: There are still conflicting views regarding suitability of single layer and double layer anastomotic technique. This prospective single blinded randomized comparative study conducted at Rajendra Institute of Medical Sciences to assess various aspects viz. safety, efficacy, duration of hospital stays and chances of perforation in single- and double-layer anastomotic surgery.
Methods: 26 patients each in single layer and double layer anastomosis group were included in the study. Single layer intestinal anastomosis was carried using extramucosal technique with 2-0 vicryl suture (round body). Double layer anastomosis was carried out using interrupted 3-0 silk lembert sutures for the outer layer and a continuous 2-0 vicryl for the inner layer. End to end colocolic, end to end ileocolic, end to side ileocolic, end to end ileoileal, side to side ileoileal, end to end jejunoileal and end to end jejunojejunal anastomosis were performed. Each group was compared for anastomotic leak, time required to construct the anastomosis, cost incurred, and length of hospital stay.
Results: Findings of the study indicated that single layer is economical in comparison to double layer anastomosis and took significant less time to operate. There was no significant difference in hospital stay of the patients in two groups. There was no anastomotic leak in group-S (single layer) while one (3.8%) patient in group-D (double layer) suffered from anastomotic leak.
Conclusions: It was concluded that single layer anastomosis method is beneficial and safe as it required less operative time, suturing material and no leak took place after surgery.

Keywords: Anastomosis, Single layer, Double layer, Anastomotic leak

INTRODUCTION

Origin of intestinal surgery date back to antiquity as a method of treating life threatening injuries to the intestinal tract caused by wild animals or injuries received during war. The surgical procedures performed were directed to restore intestinal continuity either by re-approximating the severed bowel or creating an external fistula. Hippocrates (460 BC) has mentioned intestinal suturing in his writings. Celsus (30 BC - 30 AD) has described the methods of suturing of large intestine.[1]

Now a day's anastomosis is one of the most common surgical procedures. Over a million anastomoses are performed in the United States each year for visceral indication such as gastrointestinal, urological, and gynaecological surgeries.[2] Out of these surgeries intestinal anastomosis is most common one. Intestinal anastomosis is required in the patients suffering with intestinal malignancy, inflammation, infection like TB with stricture, obstruction, congenital conditions like intestinal atresia, hirschsprung syndrome or injuries leading to malfunctioning of area affected.[3,4]. Most common purpose of anastomosis is to restore the continuity of affected

intestinal portion. With the advent of modern surgical tools, suturing materials and medications, anastomosis is becoming more effective and safer surgery with lesser incidences of associated complexities. Intestinal anastomoses are common procedures in both elective and emergency general surgery and the technique selected is determined by the site of anastomosis, bowel caliber and quality and underlying disease process.[5]

The basic principles of intestinal suture were established more than 100 years ago by Travers, Lembert and Halsted.[6] Development of stapling instruments added new dimension to intestinal surgery with advantage of short learning curve.

Based on technique used, anastomosis is categorized as hand sewn, stapled and laparoscopic anastomosis.[7] Based on involvement of intestinal layer, anastomosis has been categorized into following two types- single layer anastomosis and double layer anastomosis. Various comparative studies have been performed to assess the efficacy and safety aspects of single layer and double layer anastomosis. The surgeon should conduct single layer or double layer anastomosis, is most discussed issue. Many studies have been conducted to test the efficacy of the two procedures considering the patient compliance, safety and operation time. In one such study comprising 553 anastomoses, Leslie and Steele concluded that single layer of interrupted sero submucosal sutures as the gold standard for anastomoses involving the large or small bowel. Burch et al conducted a prospective randomized trial on single-layer continuous versus two-layer interrupted intestinal anastomosis. On the basis of results, authors hypothesized that the single-layer continuous anastomosis could be safely introduced into a surgical training program and that it could be performed in less time and at a lower cost than the two-layer interrupted anastomosis. Shikata et al performed a meta-analysis of outcomes of anastomoses published from 1966-2004. There was no evidence found that two-layer intestinal anastomosis leads to fewer post-operative leaks than single layer.[8] Also comparing the duration of the anastomosis procedure and medical expenses, the single-layer intestinal anastomosis appears to represent the optimal choice for most surgical situations. In order to achieve successful anastomosis pre-operative, trans-operative and post-operative considerations must be followed.

Use of mechanical bowel preparation and oral non absorbable antibiotics are highly effective in decreasing the microbial load and reducing the chances of infection post-surgery. Further it has been also observed that using oral non absorbable antibiotics with parenteral antibiotics reduced the surgical site infection by 43%.[9] Nutritional status of individual is another key factor for successful anastomosis. Many studies show that prolonged and short-term malnutrition decreases anastomotic healing. Poor nutrition affects anastomotic healing may be due to lack of essential amino acids for collagen synthesis or deterioration in the patient's immune competence.

Trans-operative measure include selection of appropriate technique for desirable outcome. The creation of appropriate apposition and alignment, maintenance of well vascularized bowel and tension-free, equally spaced stitches are all considered essential. Accessibility and incision should be made in such a way to allow adequate exposure to operating field. The lateral aspects and peripheral areas of surgical field can be controlled by using a suitable retractor.

Feeding is one of the foremost post-operative considerations. Late feeding is justified by the perception that the fasting would protect the anastomosis from any complication such as abdominal distention, vomiting, ileus, anastomotic dehiscence or leaks, wound infection and would allow a hermetic closure of the anastomosis before the beginning of enteral feeding.[10]

Anastomosis like other surgeries, do have linked morbidity and sometime mortality. The morbidity and mortality in anastomose are determined by variety of factors that may be controlled. Anastomotic leak, bleeding, wound infection and anastomotic stricture are important complications associated with intestinal anastomosis. Despite of availability of literature and research work on the single layer and double layer anastomosis, there are no definite concluding findings that determine the suitability of either technique. This research work aims to add further insight on the adoption of either single layer or double layer anastomosis by comparing various aspects associated with it.

METHODS

Study was conducted during November 2018 to October 2019, at Rajendra Institute of Medical Sciences, Ranchi. Prospective single blinded randomized study model was adopted to complete the study. 52 patients, 26 in each group- single layer anastomosis and double layer anastomoses, were taken.

Patients between 18 years and 60 years age, visiting OPD at RIMS and suggested for resection and anastomosis of small bowel and large bowel for causes like intestinal obstruction due to bowel ischemia, strangulated hernia, traumatic bowel injury, bowel tumors etc., presenting to our institution RIMS, Ranchi from Jharkhand and adjoining states were included in the study. Patients below 18 years and over 60 years age, were excluded from the study. Those patients requiring esophageal and gastric anastomosis were also excluded. The included patients were randomly divided in to two groups- single layer anastomosis and double layer anastomoses each group comprising 26 patients.

The affected segments of bowel were resected as per the standard technique described as allocated for the patient.[11] The bowel ends were cleaned with 5% povidone iodine swab and approximated. The time considered for anastomosis begun with the placement of the first stitch

and ended with the cutting of the last stitch. Single layer intestinal anastomosis was carried out in extramucosal technique with 2-0 vicryl suture (round body). Double layer anastomosis was carried out using interrupted 3-0 silk lembert sutures for the outer layer and a continuous 2-0 vicryl (round body) for the inner layer (Burch et al). End to end colocolic anastomosis, end to end ileocolic anastomosis, end to side ileocolic anastomosis, end to end ileoileal anastomosis, side to side ileoileal anastomosis, end to end jejunoileal anastomosis and end to end jejunojejunal anastomosis were performed in different patients included for the study. Each group was compared for anastomotic leak, time required to construct the anastomosis, cost incurred, and length of hospital stay.

The data was analyzed by paired t-test and chi square test accordingly with a p-value<0.05 considered as significant. SPSS version 20 was used for statistical analysis. The study protocol was approved by Institute Ethics Committee (Memo Number 126IEC RIMS, dated 06/11/2018).

RESULTS

The mean ± SD of the participants in our study was 36.52±12.665 years. Age range was 18 years to 60 years. Approximately half 20 (38.4%) of the participants were between the ages of 18-30 years (Figure 1).

In our study, maximum number of patients in group S were in the age group of 18-30 years i.e. 08 (31%) followed by 31-40 years 07 (27%) while in group D also, maximum number of patients were in the age group of 18-30 years i.e. 12 (46%) followed by 31-40 years 07 (27%). The mean age in group S was 38.69 years and in group D was 34.35 years (Figure 2).

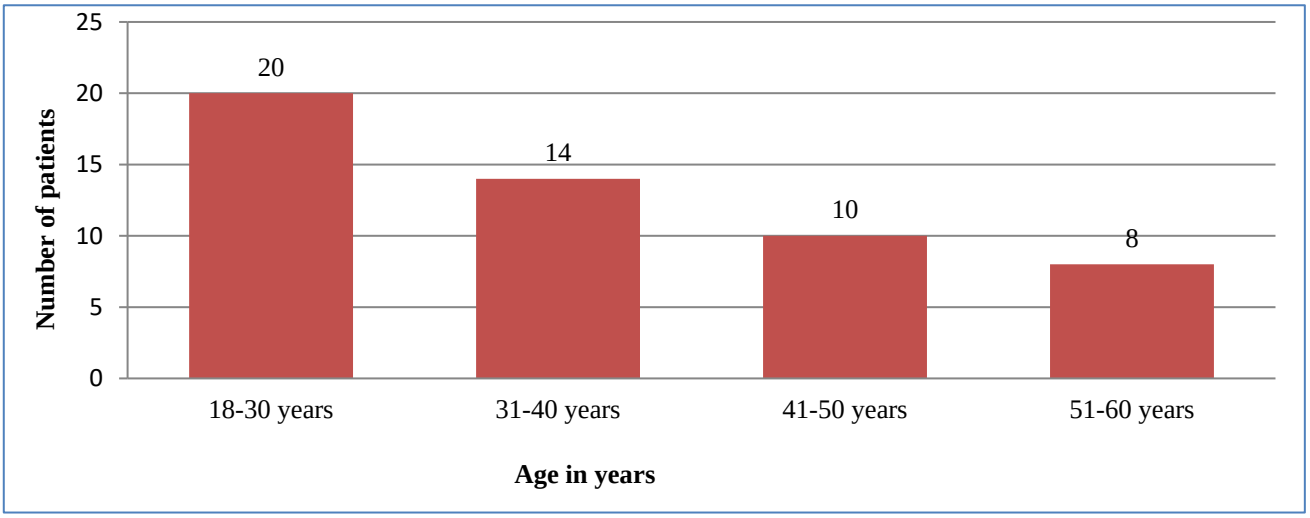

Figure 1: Age distribution of study subjects (n=52).

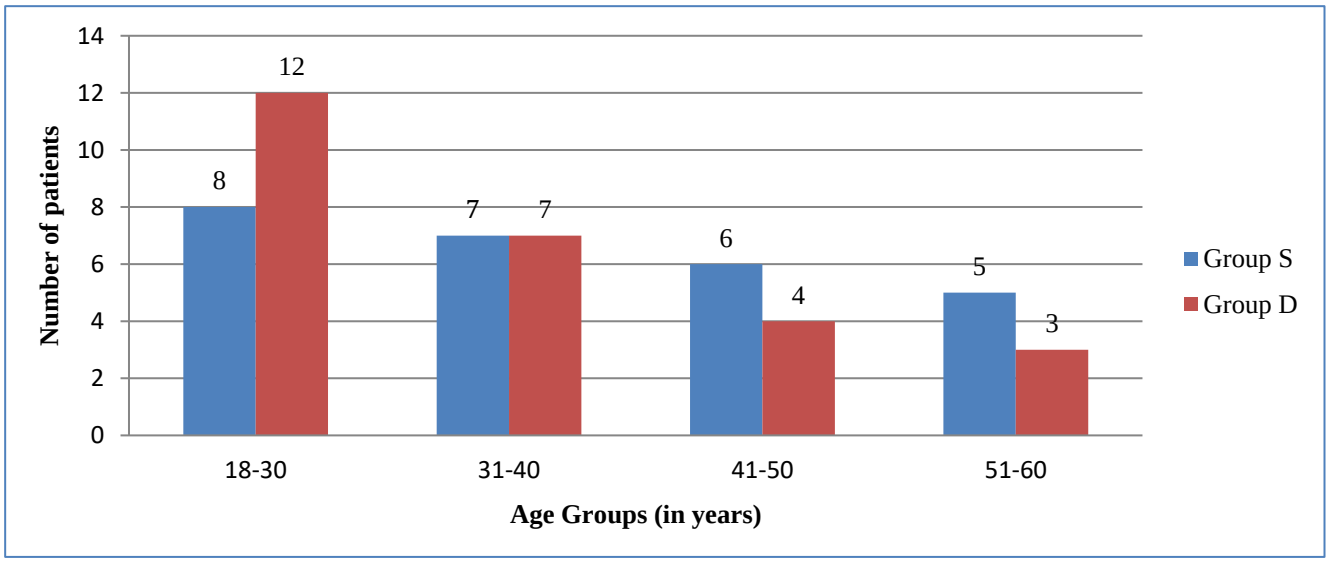

Figure 2: Age distribution of study subjects according to anastomotic procedure (n=52).

Most of the study participants in our study were males 37 (71%). In group S there were 20 (76%) males and 06 (24%) females and in group D there were 17 (66%) males and 09 (34%) females (Figure 3).

In our study, among the fifty-two cases, traumatic intestinal perforation 17 (33%) was diagnosed in maximum number of patients followed by sigmoid volvulus 12 (23%) cases.

Maximum numbers of participants in group S were diagnosed traumatic intestinal perforation 8 (30.9%) whereas in group D also most of the participants were diagnosed to be traumatic intestinal perforation 9 (34.6%). The second most common diagnosis in group S was sigmoid volvulus 5 (19.2%) and intestinal perforation due to enteric fever 5 (19.2%) while in group D the second most common diagnosis was sigmoid vovulus 7 (26.9%) only (Figure 4).

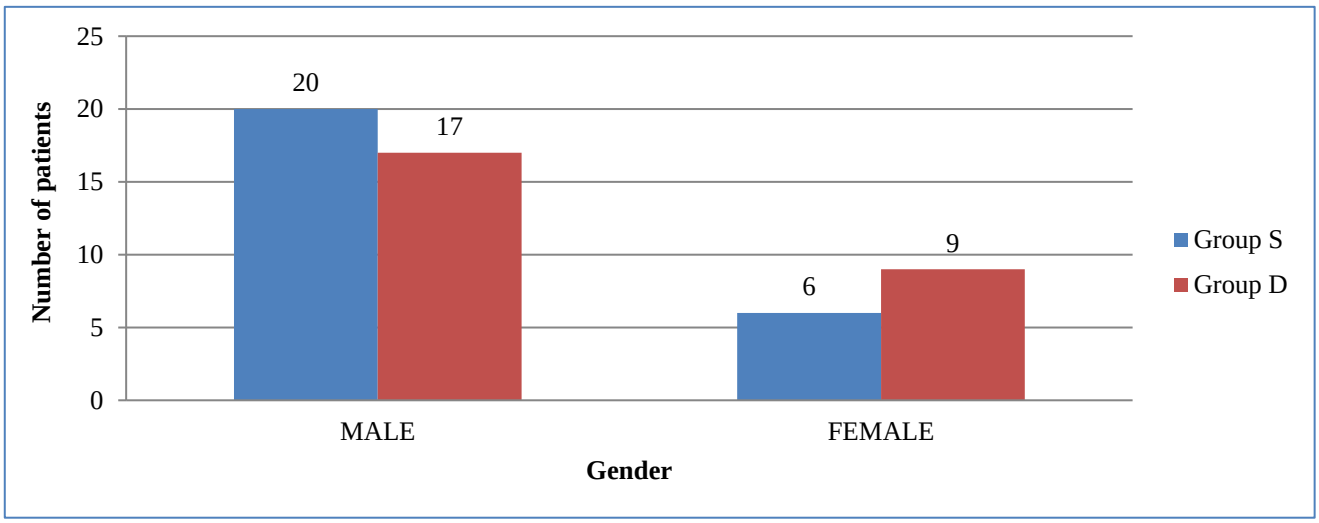

Figure 3: Gender distribution of study subjects according to anastomotic procedure (n=52).

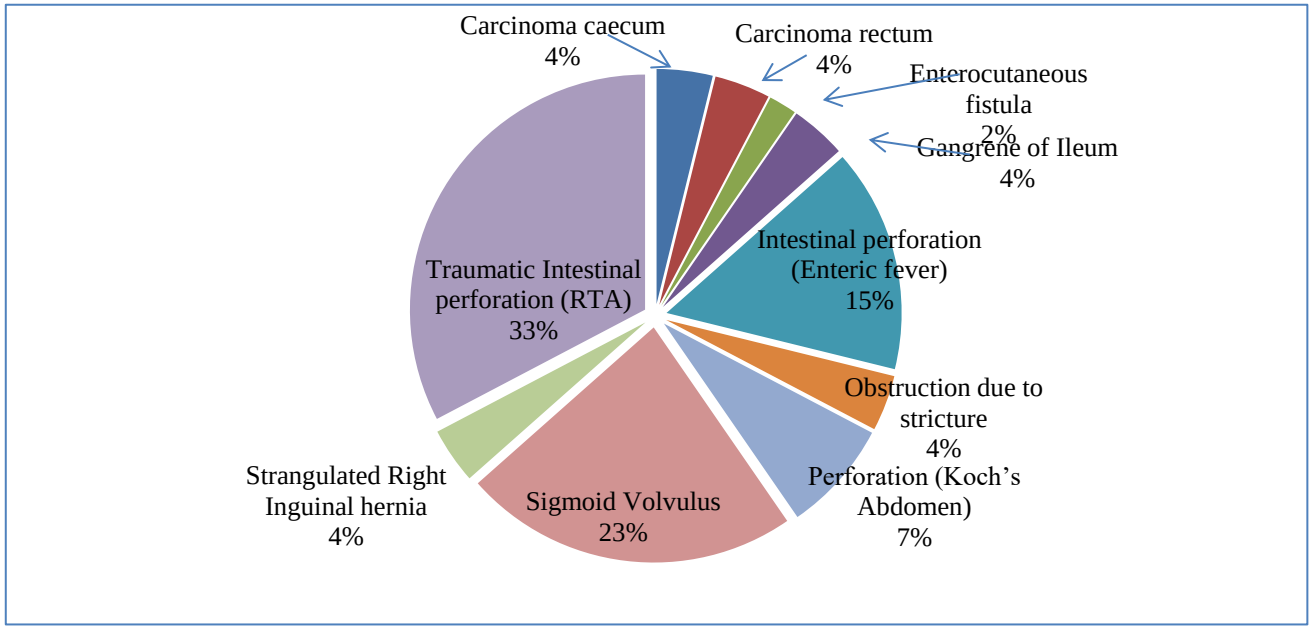

Figure 4: Disease distribution among study subjects (n=52).

In our study, ileoileal anastomosis was performed in maximum number of patients i.e. 24 (46.2%) cases followed by end to end colo-colic anastomosis 16 (30.8%) (Figure 5).

This study included a total of fifty two anastomosis, at different levels of small intestine and large intestine. The maximum number of anastomosis in group S were performed at entero-enteric level in 14 (54%) patients, next at colo-colic site in 7 (27%) patients and followed by entero-colic 5 (19%). In group D, out of 26 anastomosis, equal number of anastomosis were performed at colo-colic level in 11 (42%) patients and at entero-enteric site in 11 (42%) patients (Figure 6).

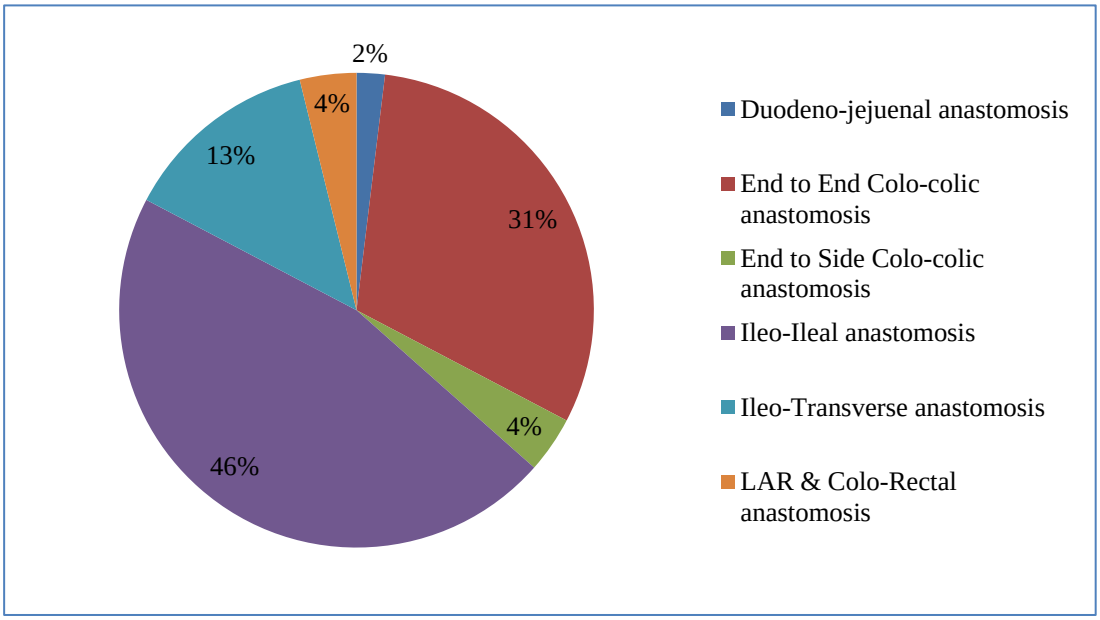

Figure 5: Type of procedures performed among study subjects (n=52).

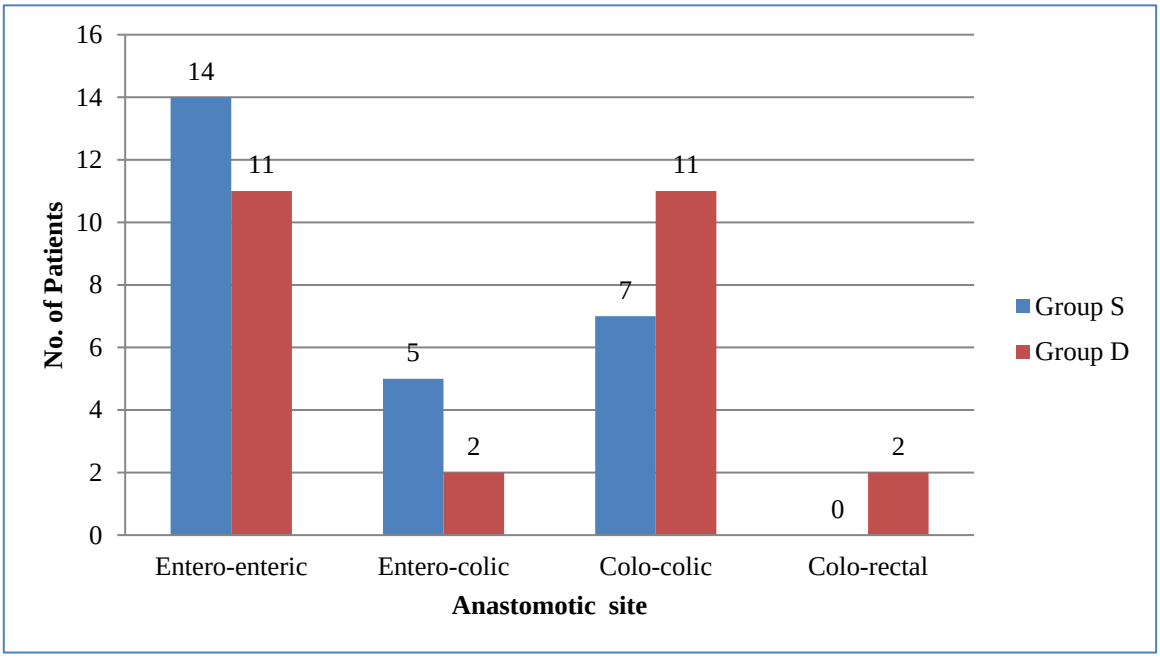

Figure 6: Type and number of procedures performed among study subjects according to anastomotic site (n=52).

The study included two different types of anastomosis in both groups depending up on the position of the viscera. In both the groups, end to end type of anastomosis was done more commonly with 21 (80.7%) and 22 (84.6%) in group S and group D respectively (Figure 7).

In this study, in group S number of anastomosis done in 15-20 minute range is 20 (77%). Rest 6 (23%) took time in between 21-25 minutes range. In group D no. of anastomosis done in 26-30 minutes range is 24 (92%). Rest 2 (8%) took time in between 31-35 minutes range. No anastomosis took time to complete beyond 35 minutes (Figure 8).

An independent sample t test reported a significant difference in time taken to complete anastomosis between Group S and Group D, t (50)=18.674, p<0.001, 95% C.I. [7.654 – 9.499]. Time taken to complete anastomosis was on average higher in group D (M=28.12, SD=1.68) as compared to group S (M=19.54, SD=1.63). Mean difference of duration between the two groups was found to be 8.57 (Figure 9).

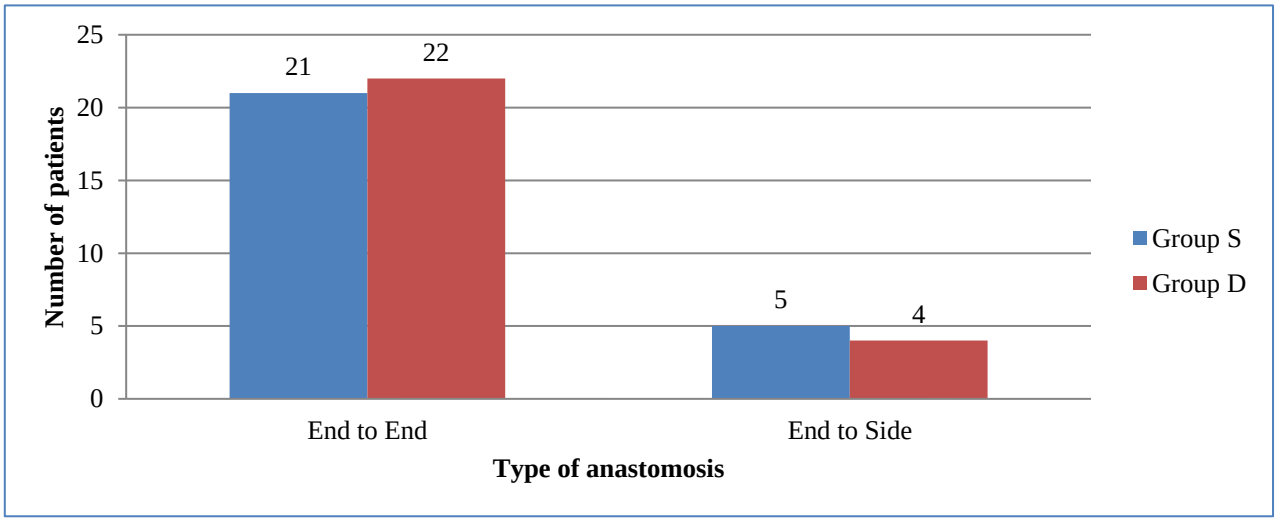

Figure 7: Type of anastomosis performed among study subjects (n=52).

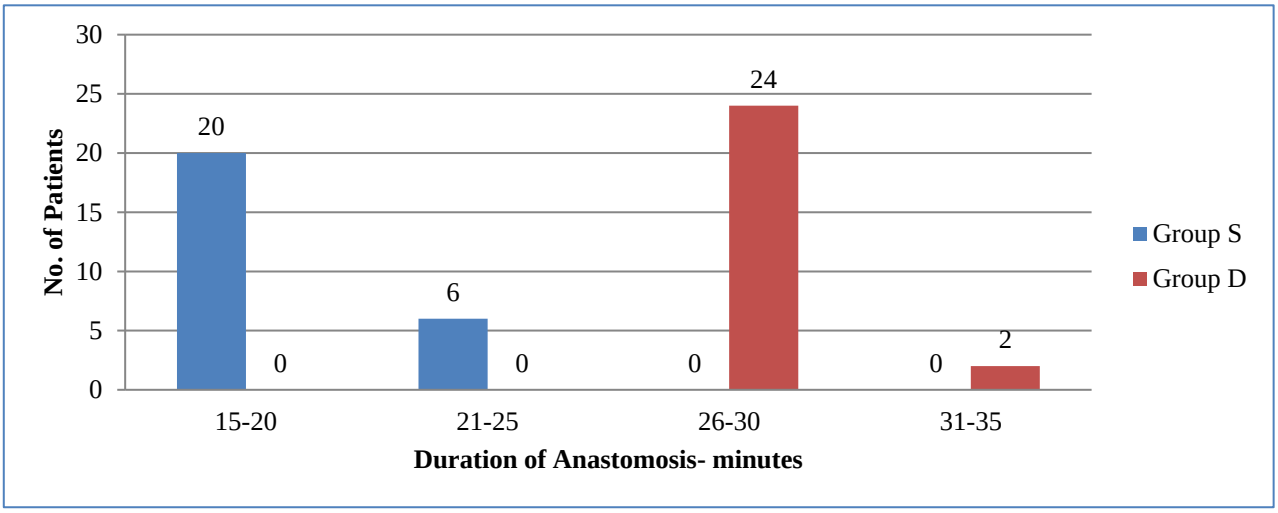

Figure 8: Time taken for completion of anastomosis among study subjects (n=52).

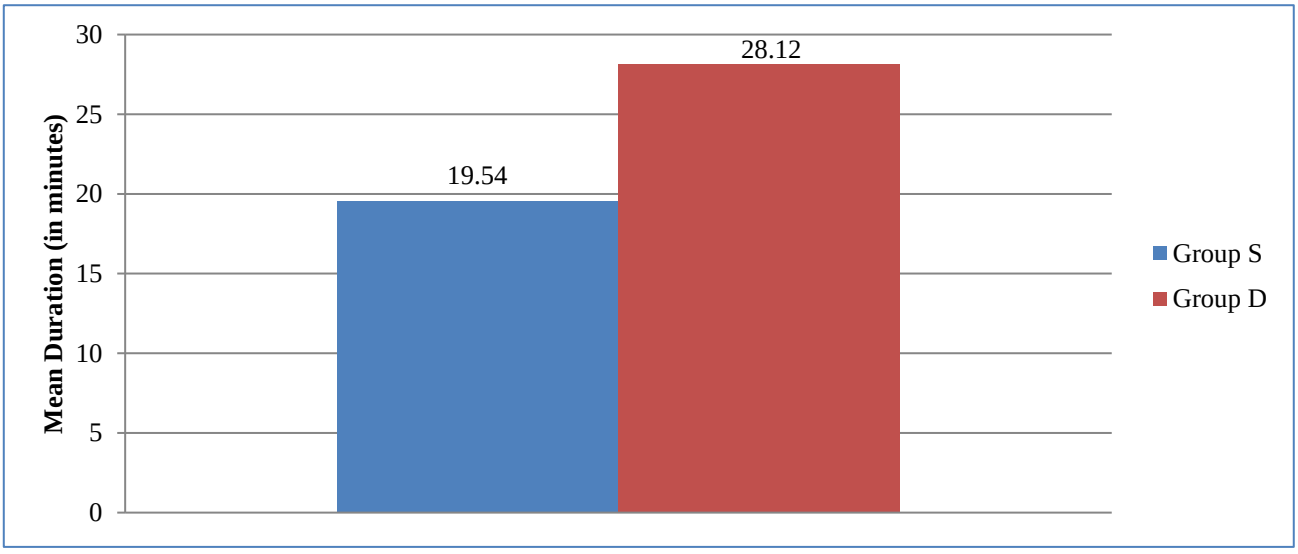

Figure 9: Mean difference for time taken for completion of anastomosis among study subjects (n=52).

An independent sample t test reported no significant difference in duration of hospital stay between group S and group D, t (50) =1.373, p=0.176, 95% C.I. [-0.231– 1.231]. Duration of stay was slightly higher in group D (M=11.58, SD=1.528) as compared to group S (M=11.08, SD=1.055). Mean difference of duration between the two groups was found to be 0.50. In our comparative study, overall complication in the form of anastomotic leak was noted in 1 (2%) patient. No anastomotic leak was observed in group S while 1 (3.8%) anastomotic leak was noted in group D.

In this study one patient who had developed anastomotic leak in group B, responded well to conservative management and recovered while rest 25 patients (92%) were asymptomatic. In group A none of the patients developed anastomotic leak.

DISCUSSION

The basic principles of intestinal suture were established more than 100 years ago by Travers, Lembert and Halsted. Anastomotic integrity is an important determinant of immediate outcome in gastrointestinal surgery and anastomotic technique is an important factor in healing. The most important factors in the creation of a bowel anastomosis are meticulous technique, gentle tissue handling, and adequate apposition of bowel ends, good blood supply and absence of tension. Healing of anastomosis also depends on general factors like age, nutritional status, blood loss, steroids, other co-morbidities like malignancy, renal failure, diabetes, jaundice, radiation exposure, etc. This study assessed the efficacy and safety of single layered anastomosis in comparison with double layered anastomosis after intestinal resection. Study included 52 patients who underwent resection-anastomosis at R.I.M.S, Ranchi from November, 2018 to October, 2019. This study included two groups, group-S and group-D, comprising of 26 cases in each group. Both groups compared in terms of, duration required to perform single- and double-layer intestinal anastomosis, post-operative complications, and duration of hospital stay in either of them. Cases requiring anastomosis for various clinical conditions of small and large bowel were allotted to either group. In present study mean age in group-S was 38.69 years and in group-D was 34.35 years. In Bhargava study mean age in group-S was 32.7 years and in group-D was 32.4 years. In both studies patients were of middle age group and mean age of present study was more than Bhargava study[12].

In this study the number of male patients outnumbered female patients in both the, groups, group-S and group-D, which may be because males are more prone to traumatic injury due to more outdoor activities.We found that single layered is economical in comparison to double layer anastomosis, as the total number of sutures pack required in double layer anastomosis was 2 or 3, whereas in single layer anastomosis only 1 pack was used. So, in comparison to single layer technique, double layer require a greater number of suture packs. So single layer is comparatively cost-effective.

In many studies it has been observed that mean time required for anastomosis in double layer is more than that in single layer. In present study meantime required for anastomosis was nearly 8 minutes less in single layer anastomosis as compared to double layer which is statistically significant. In present comparative study the mean duration of hospital stays in group-S was 11.08 days and in group-D was 11.58 days. So, all the above studies show that duration of hospital stay in both type of anastomosis group-S and in group-D is almost same. There is no significant difference in terms of duration of hospital stay.

In present study there was no anastomotic leak in group-S and 1 (3.8%) patient in group-D suffered from anastomotic leak. In a study by Khan et al, 1 (6%) anastomotic leak was present in group-S and 2 (12%) in group-D, while in a study by Ahmed et al, 1 (4%) anastomotic leak was present in group-S and 2 (8%) in group-D.[13,14]

Besides studying influence of single layer and double layer technique on leakage, attempts have been also made to correlate the leakage with gender. Lipska et al in a study having 541 consecutive operations involving anastomoses of the colon and rectum concluded that male gender, previous abdominal surgery and low rectal cancer are associated with increased anastomotic leak.[15] Irvin and Goligher had studied the risk of leakage and dehiscence in aged patients. They observed that more than 50% of the patients were over 60 years of age and the incidence of anastomotic break down in such cases was significantly higher than that encountered in patients below the age of 60 years.[16] Above studies shows that though anastomotic leak occurs more in double layer anastomosis but is not statistically significant. Finally, complication rates put all together shows; group-D anastomosis had more complication in terms of anastomotic leak. In the double layer technique sub-mucosal vascular plexus may be compromised and there may be more inflammation and inversion leading to narrowing of lumen.

Single layer anastomosis causes least damage to sub-mucosal vascular plexus, least chance of luminal narrowing, incorporates strongest submucosal layer and more accurate tissue apposition.

In present study anastomotic leak rate was less compared to other studies as large numbers of procedures were performed on selective basis and also patient in present study were of younger age group. In government hospitals like ours (RIMS, Ranchi) where emergency procedures were performed frequently and many patients belong to economically weaker sections, single layer anastomosis method is beneficial as it reduces operative time, anesthesia duration and less suture material needed. So is economical and equally safe.

CONCLUSION

On the basis of findings, it may be concluded that single layer anastomosis can be done in significantly less time as compared to double layer anastomosis. Number of sutures pack required for single layer anastomosis is significantly less than double layer anastomosis, i.e., this shows single layer anastomosis is more cost-effective. There is no significant difference between two groups in terms of duration of hospital stay and anastomotic leak.

Considering the different parameters associated with these two surgical procedures, it may be concluded that the single layer extra mucosal technique is equally safe and efficacious as classical double layer technique. Thus the findings of study affirms that single layer anastomosis can be trusted to be performed in the patients particularly economically poor one. Like other observational studies, certain limitations are associated with this study like limited number of patients, however more patients must be included in such study with some interventional approach to control incidences of leakage.

ACKNOWLEDGEMENT

Authors acknowledge the support of Dr. Gireesh Kumar Singh and Dr. Anjani Kumar, research scientist, multidisciplinary research unit, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand- 834009, India, in drafting and editing of the manuscript.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Ethical approval was taken from ethics committee of the Institute (Memo Number 126IEC RIMS, dated 06/11/2018) before commencement of the study

REFERENCES

1. Senn N. Enterorrhaphy: its history, technic, and present status. JAMA. 1893;21:215.
2. Cha J, Shademan A, Le HN, Decker R, Kim PCW, Kang JU, Krieger A. Multispectral tissue characterization for intestinal anastomosis optimization. J Biomed Opt. 2015;20(10).
3. Saha H, Ghosh D, Ghosh T, Burman S, Saha K. Demographic study and management of colonic atresia: single-centre experience with review of literature. J Ind Ass Ped Surg. 2018;23(4):206-11.
4. Hiranyakas A, Da Silva G, Denoya P, Shawki S, Wexner SD. Colorectal anastomotic stricture: is it associated with inadequate colonic mobilization?. Tech Coloproctol. 2013;17(4):371-5.
5. Goulder F. Bowel anastomoses: the theory, the practice and the evidence base. World J Gastrointest Surg. 2012;4(9):208-13.
6. Zinner MJ, Schwartz SI, Ellis H. Surgery of the small and large bowel. Maingot's abdominal operations. Stamford: appleton and lange. 1997:1309-10.
7. Kosuge M, Eto K, Hashizume R, Takeda M, Tomori K, Neki K, Mitsumori N, Yanaga K. Which is the safer anastomotic method for colon surgery? - Ten-year Results. In Vivo. 2017;31(4):683-7.
8. Shikata S, Yamagishi H, Taji Y, Shimada T, Noguchi Y. Single versus two- layer intestinal anastomosis: a meta-analysis. BMC Surgery. 2006;6:2.
9. Vargus MG, Sardaneta MLM, Reyes DP, Justo-Janeiro JM. Intestinal anastomosis. Clin Surg. 2018,3:1854-6.
10. Stewart BT, Woods RJ, Collopy BT, Fink RJ, Mackay JR, Keck JO. Early feeding after elective open colorectal resections: a prospective randomized trial. Aust N Z J Surg. 1998;68(2):125-8.
11. Burch JM, Franciose RJ, Moore EE, Biffl WL, Offner PJ: Single layer continuous versus two-layer interrupted intestinal anastomosis: a prospective randomized trial. Ann Surg. 2000;231(6):832.
12. Bhargava GS, Singh H, Singh J. Single or double layer intestinal anastomosis? Int Surg J. 2016;3(4):2173-6.
13. Khan HF, Ahmed B, Dilawaiz M, Akram M. Intestinal anastomosis; comparative evaluation of safety, cost effectiveness, morbidity and complication of single versus double layer. Professional Med J. 2010;17(2):232-4.
14. Ahmed N. Comparative study between single layers versus double layered bowel anastomosis in tertiary care hospital. Dissertation to Rajiv Gandhi University Medical Science, Bengaluru, Karnataka. 2014;82-95.
15. Lipska MA, Bissett IP, Parry BR. Merrie AEH. Anastomotic leakage after lower gastrointestinal anastomosis: men are at a higher risk. ANZ J Surg. 2006;76:579–85.
16. Irvin TT, Goligher JC. Aetiology of disruption of intestinal anastomoses. Br J Surg. 1973;60(6):461-4.

Cite this article as: Kumar A, Kumar V. Single layer versus double layer intestinal anastomoses: a comparative study. Int Surg J. 2020;7(9):2991-8.