Original Research Article

Single or double layer intestinal anastomosis?

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ABSTRACT

Background: Intestinal anastomosis after resection or following a palliative stoma formation is a very common procedure in India, being a tropical country and hence a large incidence of intestinal perforations as well as rising incidence of malignancies. Volume of procedure being performed all over India suggested us to try some better method of anastomosis as only a few studies have been conducted till now in this part of the world.

Methods: The study was conducted among 84 patients [Double layer (group “A”) and single layer extra mucosal anastomosis (group “B”) groups of 42 patients each] over a period of 2 years. Patients were assigned to either of the groups in a prospective and randomized fashion. Groups were evenly matched by age, sex, diagnosis and location of anastomosis. Patients below 18 and above 60 years age, location of anastomosis other than small bowel and gut wall with oedema, inflammation, ulcers, ischemia, scarring, etc. were excluded from the study.

Results: Outcomes as time taken for anastomosis, material cost, anastomotic leak, intra-abdominal abscesses and length of hospital stay were recorded in each group. Time taken and material cost for anastomosis was significantly low in group B as compared to group A. Postoperative anastomosis leak, intra-abdominal abscess formation and hospital stay, in both the groups, were comparable without significant difference.

Conclusions: Single layer extramucosal anastomosis is cost effective and time saving procedure as compared to double layer method without significant difference in postoperative complications.

Keywords: Double layer anastomosis, Postoperative leak, Single layer continuous anastomosis

INTRODUCTION

As India is a tropical country, intestinal perforations due to infectious diseases leading to resection-anastomosis of gastrointestinal tract (GIT) or formation and closure of a temporary intestinal stoma are very common procedures here. Incidence of GIT malignancies is also on the rise in our country for which a lot of resection - anastomotic surgeries are done. Intestinal anastomosis is being practiced all over the world for more than 150 years successfully.

The anastomotic techniques used in different situations and at different locations of GIT differ considerably. Out of these different techniques the most reliable technique is double layer anastomosis where first trans mural running suture layer is applied with some absorbable 3-0 suture material like polyglycolic acid followed by an inverted interrupted, seromuscular suture layer with a non-absorbable 3-0 silk suture. So due to its reliability, wherever possible, this is the most widely used method of anastomosis. A significant shortcoming of this technique is that it is a time consuming, cumbersome and costly technique. Hautefeuille P, first of all, tried extra mucosal

single layer anastomotic technique to overcome shortcomings of double layer method.¹ For many years, surgeons in different parts of the world kept on trying an extra mucosal, continuous, single layer anastomosis with a non-absorbable, monofilament, plastic, 3-0 polypropylene suture.^{2,3} Irwin ST and others tried single layer technique in gastro duodenal anastomosis with only 1.2% leak incidence.⁴ In nineties, different studies were conducted to find the fact that single layer extra mucosal anastomosis is comparable to double layer anastomosis as far as outcome is concerned and costs less time and money.⁵⁻¹⁰ Same were the findings of Law WL et al in colorectal anastomoses.¹¹ Lower incidence of leak was supposed to be due to less amount of foreign body (suture material), introduced at the site of surgery, and better vascularity of cut ends of bowel. Considering these potential advantages and little work done on the subject in our country, this study has been conducted.

METHODS

The study was conducted in Sri Guru Ram Das institute of medical sciences and research, Sri Amritsar among 84 patients from May 2014 to April 2016. Patients below 18 and above 60 years of age or having life threatening associated diseases were excluded from the study. Only small bowel anastomosis was included to avoid discrepancy of time consumed in anastomosis due to difference in the lumen size of bowel. Small gut requiring anastomosis and having oedema, inflammation, ulcers, some possibility of postoperative ischemia or scarring were not included to avoid influence of these factors on the outcome.

It was a prospective and randomized study where any patient requiring small bowel anastomosis if fulfills the inclusion criteria was assigned to the double layer (group A) or single layer (group B) technique randomly using a table of random numbers to avoid bias in case selection.

All two layer anastomosis were constructed with 3-0 polyglycolic acid, round body needle, suture for first running trans mural layer and 3-0 silk, round body needle, suture for inverting, interrupted, seromuscular second layer. Each single layer anastomosis was performed using a continuous 3-0 polypropylene, round body needle, suture starting at the mesenteric border. All layers of the gut wall except for mucosa were taken up in the suture. Each bite was taken at least 6 mm or more from the margin of the bowel wall (larger bite at the mesenteric border to avoid leak). Each stitch advanced by 5 mm only. It was ensured that gut wall ischemia does not occur due to tightening of suture and the pull was just enough to make the closure water tight. Time recording of anastomosis began with the start of first suture application and ended with cutting of the excess suture material of the last stitch.

Anastomotic leak (visible radio-graphically or as fistula or disruption of suture line on re-exploration) and intra-

abdominal abscess formation were defined as anastomotic failures.

Total number of patients in each group was used as denominator to calculate time taken for anastomosis construction, length of hospital stay, leak and abscess formation. Calculation of suture cost was based on standardized utilization of suture material by the surgeon and its purchase cost. In one single layer anastomosis one strip of 3-0 polypropylene suture was used which costs Rs. 385/-(ethicon) while in one double layer anastomosis one 3-0 polyglycolic acid suture, which costs Rs. 400/-(ethicon), and three strips of 3-0 silk suture (ethicon) costing Rs. 312/- (Rs. 104/- each strip) were consumed.

Continuous data was analyzed using student t-test while categorical data's were analyzed using Fisher exact test or Pearson chi-square test. "p" value <0.05 was considered as of statistical significance.

RESULTS

Eighty four patients (42 patients in each group) were included in study over the period of two years. All the patients were taken up randomly. The groups were evenly matched by age, sex, diagnosis and location of anastomosis as shown in Table 1.

Table 1: Comparable variables of two groups.

Variable	Group A	Group B
No. of anastomosis	42	42
Age (years)	32.7	32.4
Sex (M/F)	29/13	30/12
Diagnosis		
Ileostomy closure	20	19
Perforations	14	16
Bowel ischemia	2	2
Trauma	3	2
Others	3	3

Table 2: Comparison of results between two groups.

	Two layered (group A)	One layered (group B)	p value
No. of anastomosis	42	42	
Leaks	2 (4.7%)	1 (2.38%)	0.64*
Abscess	0	0	0.0*
Time (min.)	19.4	29.3	0.000 ⁺
Length of stay (days)	9.7	11.8	0.084 ⁺
Cost (Rs)	385	712	

*- Fisher exact test; + - Student t - test.

The results obtained in both groups with respect to time taken for anastomosis construction, cost incurred on anastomosis material, length of hospital stay, anastomosis leak and intra-abdominal abscess formation are shown

and compared in Table 2. Most of the patients in study were in third and fourth decade of life. Mean age was 32.7 years in group A and 32.4 years in group B, ranging from 15-56 years. Majority of patients were males with ratio 2.5:1. To match the cases evenly, location of anastomosis was kept same i.e. small bowel. Mean time taken for anastomosis construction in single layer method was 19.4 minutes while it was 29.3 minutes in double layer method which is statistically significant difference. Anastomosis material cost for single layer technique (Rs. 385/-) was nearly half of that (Rs. 712/-) for double layer technique.

Mean hospital stay in single layer group was 9.7 days as compared to 11.8 days in double layer group. Most common complication in both the groups has been wound infection where anastomosis was performed to treat intestinal perforation. In group A it was 19.7% while it was 16.6% in group B followed by leak (2.38% in group A and 4.7% in group B). Incidence of leak in both the groups was comparable statistically. No intra-abdominal abscess formation was noted in either of the groups.

Table 3: Studies on single layer continuous anastomosis.

Author	Year	Suture	No. of patients	Fistula
Hautefeuille ¹	1976	Polypropylene, nylon	570	2.8%
Harder ²	1988	Polydioxanone	143	0
Sarin ³	1989	Polyglycolic acid	131	5.3%
Max ⁵	1991	Polypropylene	1000	1.2%
Ceraldi ⁶	1993	Polypropylene	44	6.8%
Steele ⁷	1993	Polydioxanone	100	0
Thomson ⁸	1993	Polydioxanone	200	2%
Ahchong ⁹	1996	Polydioxanone	254	1.6%
Brodsky ¹⁰	1997	Polyglyconate	27	0
Law ¹¹	1999	Polyglyconate	500	1.4%
Burch ¹⁶	2000	Polypropylene	59	3.1%
Total			3028	1.7%

DISCUSSION

Anastomosis healing depends on general factors like age, nutritional status, blood loss, steroids, co-existing diseases like jaundice, diabetes, malignancy, renal failure as well as local factors like vascularity, sepsis, foreign body, etc.¹² Apart from these there are some factors which have direct bearing on the outcome of the procedure and are directly under the control of surgeon like ischemia, tension on the anastomosis and anastomotic technique. Studies show that leakage rates vary from surgeon to surgeon and are lower in hands of more experienced surgeon.^{13,14} Studies are available in the literature which have compared hand sewn versus stapled and end to end versus end to side anastomosis but none could prove superiority over the other.¹⁵ For a new technique to be acceptable it should prove safe in hands of different surgeons in large number of cases. Table 3 shows studies done by different surgeons among 3028 patients and collective leakage rate is calculated to be around 1.7% fulfills this criterion.

Suitability of an intestinal anastomotic technique is decided by its ability to heal without leakage as this is a dangerous complication of the procedure and can raise hospital stay and treatment cost by manifolds apart from

risking the life of patient sometimes. Above shown results of the study indicate that single layer method of anastomosis is as safe as double layer method in terms of leak and intra-abdominal abscess formation, but it can be performed in significantly less time and at a lower cost. The results also depict that this technique can be easily incorporated in teaching programme as well as practice without having a learning curve.

Mean time required for anastomosis construction was 10 minutes less in single layer group which is statistically significant. The time difference can be more if we count the time required for gut surface preparation for two layer anastomosis. Greater length of gut wall (1 cm) is required to apply two layers of sutures as compared to single layer. Other surprising finding was mean hospital stay of patient was two days less in single layer group which is probably attributed to less constriction of bowel lumen as compared to double layer technique and hence early resumption of function by GIT. Though this is a speculation and further studies are required to confirm the same. Cost difference of sutures used in two methods was considerable and it is dramatic if compared with staplers. In today's cost conscious environment it is an important finding in favor of single layer technique.

The success of single layer anastomotic technique over double layer technique can be attributed to (a) only one layer of stitches to be applied so consumes less time, less suture and less foreign body at anastomosis site (b) shorter length of bowel surface is to be prepared for one layer of suture so vascularity of cut ends is better which leads to better healing (c) lumen constriction is less (d) suture material used for single layer is plastic which can contract and expand at the time of passage of food (e) if traction to the thread is optimal in single layer application then there is no point of ischemia due to suture in single layer method while gut wall is completely devoid of its vascularity at the point of application of interrupted silk sutures in double layer method.¹ Single weakness of this study is that the sample size of patients is small so exact outcome of complication like leakage cannot be defined. Hence, a multi institutional trial is a must. However, our results are consistent with those available in the literature and reassuring as well.

CONCLUSION

Double layer anastomosis of intestine offers no definite advantages over single layer anastomosis as far as postoperative complications like leakage, intra-abdominal abscesses and others are concerned. Single layer anastomosis is as safe as two layer method, at the same time it is easy to perform and simple to teach. Taking into account the duration of anastomosis construction and cost incurred over it, single layer technique may prove the procedure of choice for most of the surgeons.

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Ethical approval: The study was approved by the institutional ethics committee

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