

**International Journal of Biomedical and Advance Research**

ISSN: 2229-3809 (Online); 2455-0558 (Print)

Journal DOI: [10.7439/ijbar](https://doi.org/10.7439/ijbar)

CODEN: IJBABN

**Original Research Article****A comparative study of single layer continuous sutures versus double layer interrupted sutures in intestinal anastomosis****Rahul Saboo, S.D. Deshmukh, Rajiv Sonarkar, Vijay P Agrawal\* and Prateek Shah***Department of General surgery, NKPSIMS, Nagpur, India***\*Correspondence Info:**

Dr. Vijay P Agrawal,

Assistant professor,

Department of General Surgery,

NKPSIMS, Nagpur, India

E-mail: [vijugunnu@gmail.com](mailto:vijugunnu@gmail.com)**Abstract****Objectives:** The objective of the study was to compare single layer continuous intestinal anastomosis and double layer interrupted intestinal anastomosis in terms of time taken for the anastomosis and safety.**Material & Methods:** A prospective comparative study was carried out in the Department of Surgery NKPSIMS and RC, Nagpur from August 2011 to October 2013. All patients who underwent elective intestinal surgeries and bowel anastomosis and consented for the study were included in the study. Patients requiring gastric, duodenal and rectal anastomosis and patients in whom staplers were used were excluded from the study. 30 single layered continuous and 30 double layered interrupted intestinal anastomosis were performed. Data was analyzed using Student t test for continuous variables and Chi square test for categorical variables. Comparison was made in terms of time taken for anastomosis, anastomotic leak and other complications.**Results:** The mean duration of intestinal anastomosis for the double layer group was 33.06 minutes whereas for the single layer group, it was 23.6 minutes, which was found to be statistically significant. Anastomotic leak was reported in 2 patients in the double layer group and in 3 patients in the single layer group was found to be statistically insignificant. The other complications that included surgical site infection, re intervention and mortality were similar in both the groups. Single layered intestinal anastomosis does not carry any increased risk of anastomotic leak and other complications when compared to double layered intestinal anastomosis and can be constructed in a shorter time.**Conclusion:** Single layered intestinal anastomosis technique takes less time for construction and does not carry any increased risk of complications**Keywords:** Single layered continuous intestinal anastomosis, double layered interrupted intestinal anastomosis, anastomotic leak.**1. Introduction**

Intestinal anastomosis dates back to 1000 B.C., the era of Sushruta “The Great Indian Surgeon” where he described the use of black ants for intestinal anastomosis.[1] Intestinal anastomosis has been successfully performed for more than 150 years using a variety of techniques, materials and devices. Hand sewn intestinal anastomosis is the most commonly used technique worldwide because of the availability and affordability of suture materials and familiarity with the procedure. Anastomosis may be performed by a double layered suturing technique or by a single layer technique. The potential shortcoming of the double layer intestinal technique is the risk of anastomotic stricture formation. Currently the single

layer extra mucosal anastomosis is popular, as advocated by Matheson of Aberdeen[2]. Single layer continuous intestinal anastomosis requires less time to fashion and has no increased risk of complications. This study is an attempt to compare the efficacy of single layer continuous sutures in intestinal anastomosis.

**2. Materials and methods**

The present study was carried out in the Department of Surgery from August 2011 to October 2013. A total of 60 cases who met the criteria were included in this hospital based prospective comparative study. All patients who underwent

elective intestinal surgeries and bowel anastomosis and consented for the study were included in the study. Patients requiring gastric, duodenal and rectal anastomosis and patients in whom staplers were used were excluded from the study.

**Technique**

All the anastomosis was performed by the senior operating surgeon. All the anastomosis constructed were end to end type of anastomosis

**Double Layered Anastomosis**

The inner transmural layer was constructed using 3-0 polyglactin Connell sutures. The outer seromuscular Lembert sutures were taken in an interrupted manner, using 3-0 silk sutures inverting the inner layer.

**Single Layered Anastomosis**

It was performed using continuous 3-0 silk sutures which incorporated all the layers except the mucosa.

**2.1. Outcome factors**

**Anastomotic Integrity**

Based on the presence or absence of anastomotic leak, two types of anastomotic leak were defined (Clinical and Radiological).

**Duration of anastomosis (in minutes)**

Duration of anastomosis counted from the time of taking the first stitch till the anastomosis was completed.

**Surgical Site Infection**

Defined as a purulent discharge in, or exuding from, the wound, or a painful, spreading erythema indicative of cellulitis irrespective of the bacteriological assessment.

**Return of gastrointestinal function**

Assessed by the day of return of bowel sounds and the day on which oral intake exceeded one liter over 24 hours.

**Day of removal of drain**

Removed on the day when drain output was less than 25 ml over 24 hours.

**Re-exploration**

Re-exploration defined as an invasive intervention for anastomotic leak.

**Hospital Stay (in days)**

Counted from the day of operation as there were a number of patient and hospital related factors which lead to a delay in the operation from the date of admission.

**Mortality**

The 30-day in hospital mortality was taken into account.

**2.2 Statistical analysis**

**Descriptive Statistics:** Data was made using Mean ±

Standard Deviation.

**Analytical Statistics:** The basic parameters of the two categories were compared. Unpaired student ‘t’ test was used for continuous variables. Chi square test was used for categorical variables. Data collection was done using a prepared proforma.

**2.3 Ethical clearance:** IEC/NKPSIMS-121/2011

**3. Results**

A total of 60 patients were included in the study. 30 patients underwent single layered continuous and 30 patients underwent double layered interrupted intestinal anastomosis. Basic features of both the groups were compared and they were quite similar and comparable as far as age, gender, body weight, co morbid conditions, hemoglobin levels, serum albumin and protein levels and pathology were concerned (Table 1).

**Table 1: Shows the comparison of various Basic Features**

Basic Features (mean values) ± S.D.	Single Layer	Double Layer	P value <0.05
Age (years) ± S.D.	49.46 ± 15.94	49.66 ± 17.09	0.96 (NS) <sup>(a)</sup>
Gender	20 Males 10 Females	21 males 9 females	0.78 (NS) <sup>(b)</sup>
Weight (kgs) ± S.D.	61.53 ± 12.19	61.66 ± 9.26	0.96 (NS) <sup>(a)</sup>
Co morbid conditions	9 (30%)	6 (20%)	0.37 (NS) <sup>(b)</sup>
Hb (gm%) ± S.D.	11.25 ± 1.36	11.49 ± 1.24	0.48 (NS) <sup>(a)</sup>
S. proteins (gm%) ± S.D.	6.27 ± 0.60	6.53 ± 0.58	0.09 (NS) <sup>(a)</sup>
S. albumin (gm%) ± S.D.	3.25 ± 0.21	3.27 ± 0.18	0.74 (NS) <sup>(a)</sup>
Pathology ± S.D.	B- 13, M -17	B -19,M - 11	0.12 (NS) <sup>(b)</sup>

a – Unpaired student ‘t’ test ; b - Chi Square test; NS – not significant; S - significant

**Table 2: Shows the comparison of various outcome factors**

Outcome Factors	Single layer	Double layer	p – value
Duration of anastomosis (mins) ± S.D.	23.6 ± 2.49	33.06 ± 2.53	<b>0.000(S)</b> <sup>(a)</sup>
Anastomotic leak	3 (10%)	2 (6.66%)	0.64 (NS) <sup>(b)</sup>
Re interventions	3 (10%)	1 (3.33%)	0.30 (NS) <sup>(b)</sup>
Return of bowel sounds (days) ± S.D.	5.6 ± 0.62	5.5 ± 0.62	0.53 (NS) <sup>(a)</sup>
Day on which oral intake > 1 liter ± S.D.	9.13 ± 1.71	9 ± 2.08	0.78 (NS) <sup>(a)</sup>
Drain removal (days) ± S.D.	6.26 ± 1.38	5.56 ± 1.27	<b>0.047 (S)</b> <sup>(a)</sup>
Surgical site infection	4 (20%)	6 (13.3%)	0.48 (NS) <sup>(b)</sup>
Post operative hospital stay (days) ± S.D.	16.9 ± 4.14	16 ± 3.45	0.36 (NS) <sup>(a)</sup>
Mortality	2 (6.67%)	1 (3.33%)	0.55 (NS) <sup>(b)</sup>

a – Unpaired student ‘t’ test; b - Chi Square test; NS – not significant; S - significant

### 3.1 Duration of Anastomosis

The mean duration of anastomosis for the single layer group was less and statistically significant when compared to the double layer group with a p-value of 0.000. These findings were similar to the findings in the available literature. (Table 3)

**Table 3: Comparison Duration of anastomosis as per literature survey**

Study	Duration of Anastomosis	
	Single Layer	Double Layer
Our Study	23.6 mins	33.06 mins
Burch <i>et al</i> (2000)[3]	20.8 mins	30.7 mins
Aslam <i>et al</i> (2008)[4]	10.04 mins	19.2 mins
Khan <i>et al</i> (2010)[5]	20 mins	35 mins
Khair <i>et al</i> (2013)[6]	30 mins	45 mins

### 3.2 Anastomotic Leak

In our study, anastomotic leak was reported in 3 patients (10%) in the single layer group and in 2 patients (6.67%) in the double layer group. These findings were found to be statistically insignificant and were comparable to the results in the previous studies performed. (Table 4)

**Table 4: Comparison Anastomotic Leak as per literature survey**

Study	Anastomotic Leak	
	Single Layer	Double Layer
Our Study	3 (10%)	2 (6.67%)
Irvin <i>et al</i> (1973)[7]	5 (17%)	5 (16%)
Everett <i>et al</i> (1975)[8]	6 (15%)	13 (25%)
Goligher <i>et al</i> (1977)[9]	31 (45%)	17 (26%)
Ordorica <i>et al</i> (1988)[10]	2 (5%)	3 (7%)
Maurya <i>et al</i> (1988)[11]	4 (7%)	12 (18%)
Burch <i>et al</i> (2000)[3]	2 (3.1%)	1 (1.5%)

### 3.3. Re interventions

Re interventions were required in 3 patients (10%) in the single layer group whereas it was required in only 1 patient (3.3%) in the double layer group. It was found to be statistically insignificant and comparable to the previous studies.

### 3.4. Return of Bowel Sounds

There was no difference in the duration of return of bowels sounds in the two groups in our study (5.6 days in the single layer group and 5.5 days in the double layer group)

### 3.5. Oral Intake

In our study, there was not a significant difference in the number of days taken for the oral intake to exceed more than 1 litre over 24 hours in the two groups (9.13 days in the single layer group and 9 days in the double layer group).

### 3.6. Removal of Drain

In our study, drains were removed earlier in the double layer group (5.56 days) as compared to the single layer group (6.26 days) but this difference was insignificant.

### 3.7. Surgical Site Infections

In our study, surgical site infections occurred in 6 patients (20%) in the single layer group and 4 patients (13.33%) in the double layer which was found to be insignificant and similar to the previous studies. (Table 5)

**Table 5: Comparison Surgical Site Infections as per literature survey**

Study	Surgical Site Infections	
	Single Layer	Double Layer
Our Study	6 (20%)	4 (13.33%)
Askarpur <i>et al</i> (2005-06)[12]	5 (7.9%)	7 (11.1%)
Aslam <i>et al</i> (2008)[4]	2 (8.3%)	3 (11.5%)
Khair <i>et al</i> (2013)[6]	4 (8.0%)	3 (4.0%)

### 3.8. Hospital Stay

In our study, the mean hospital stay in the single layer group was 16.9 days with a range of 11 – 28 days whereas in the double layer group, it was 16 days with a range of 11 – 26 days. The difference was statistically insignificant and comparable to the previous studies.

### 3.9. Mortality

Shikata *et al* (2006)[13] in their meta analysis reported the mortality in one of its RCT's (Irvin *et al*) as 10% for both of the groups (3/29 in the single layer group and 3/31 in the double layer group).

Aslam *et al* (2008) in their study reported no mortality (0%) in the single layer group and in 1 patient (3.8%) in the double layer group which was statistically insignificant.

In our study, mortality occurred in 2 patients (6.67%) in the single layer group and in 1 patient (3.33%) in the double layer group, a result found to be statistically insignificant.

## 4. Discussion

In the early 19<sup>th</sup> century, through the experimental work of Travers[14] and Lembert[15], double layered intestinal anastomosis was first performed. Since then the technique has remained more or less the same except the use of different suture material for the inner layer. The single layer interrupted intestinal anastomosis was first described by Hautefeuille[16] in 1976. The present study assessed the efficacy and safety of the single layer continuous sutures against the double layered intestinal anastomosis after intestinal resection, mainly in terms of anastomotic leak and time required to construct the anastomosis.

### From our study following findings were noted

Though randomization was not done, in order to assess the comparability of the two groups,

the basic demographic features were compared. Both the groups were quite similar and comparable as far as age, gender, body weight, co morbid conditions, hemoglobin levels, serum albumin and protein levels and pathology were concerned. Hence, biases and confounders were taken care of.

The mean duration of intestinal anastomosis for the double layer group was 33.06 mins whereas for the single layer group, it was 23.6 mins, which was found to be statistically significant with a p-value of 0.000.

Anastomotic leak was reported in 2 patients (6.67%) in the double layer group and in 3 patients (10%) in the single layer group which was found to be statistically insignificant and were comparable to the results in the previous studies performed.

The other complications that included surgical site infection, re interventions and mortality were similar in both the groups and to the literature available.

Single layered intestinal anastomosis may be successful due to several factors. Any anastomosis requires adequate blood supply to hold up. In this technique, less mesentery is cleared off the two cut edges and therefore less compromise of blood supply to the anastomosis. Also, the inner layer of the double layered technique is believed to be hemostatic, but may cause strangulation of the mucosa due to apparent damage to the submucosal vascular plexus. In the double layered technique, there may be excessive inversion of the tissue, as there are two layers of anastomosis that may lead to the narrowing of the lumen.

In the single layer technique, this is prominently avoided as only one layer of sutures is incorporated. Another factor is use of nonabsorbable monofilament suture in a continuous fashion. In an anastomosis with interrupted suture line, the tension that may be exerted while suturing may lead to ischaemia. This is easily avoided in the continuous technique as speculated by Hautefeuille that in a continuous anastomosis at no point is there a segment of bowel which is completely devoid of blood supply. Bailey *et al*[17] describe that a continuous single layer suture line resembles a circular coiled spring, which may be able to expand and contract depending on the intraluminal forces, which also explains why it is rare to have a bowel stenosis. Lastly, as it is an easy technique, it can be safely introduced into a surgical training programme without a painful learning curve.

However, there were a few limitations in our study. Firstly, it is not a randomized controlled trial.

As the type of anastomosis was performed according to the preference of the operating surgeon, there is a selection bias associated with our study. As it is a study of equivalence, a prior sample size should have been calculated, which was not done in our study. Lastly, a long term follow up is required to evaluate the late complications of the two types of anastomosis which is not available with us at present.

## 5. Summary and Conclusion

From our study, it is seen that single layered intestinal anastomosis technique takes less time for construction and does not carry any increased risk of complications. Hence, we recommend single layered continuous intestinal anastomosis as a safe technique as compared to its conventional counterpart and recommend that it can be reliably introduced as a technique of intestinal anastomosis in our current surgical setting due to its easy learning curve.

## References

- [1] Singh RK, Vyas MK. Surgical procedures in Sushruta Samhita. *International Journal of Research in Ayurveda and Pharmacy* 2011; 2(5):1444 – 1450.
- [2] Damesha N, Lubana PS, Jain DK, Mathur R. A Comparative Study of Sutured and Stapled Anastomosis in Gastrointestinal Operations. *The Internet Journal of Surgery* 2008; 15(2).
- [3] Burch JM, Franciose RJ, Moore EE, Biffi WL, Offner PJ. Single-layer continuous versus two-layer interrupted intestinal anastomosis: a prospective randomized trial. *Ann Surg* 2000; 231(6):832-837.
- [4] Aslam V, Bilal A, Khan A, Bilal M, Zainulabideen, Ahmed M. *J Ayub Med Coll Abbottabad* 2008; 20(3):6-9.
- [5] Khan RAA, Hameed F, Ahmed B, Dilawaiz M, Akram M. Intestinal anastomosis; Comparative evaluation for safety, cost effectiveness, morbidity and complication of single versus double layer. *Professional Med J* 2010; 17(2):232-234.
- [6] Khair MA, Uddin MA, Khanam F, Bhuiyan MR, Reza E, Rahman MH, Shawon MR. *Mymensingh Med J* 2013;22(2):237-40.
- [7] Irvin TT, Goligher JC, Johnston D: A randomized prospective clinical trial of single-layer and two-layer inverting intestinal anastomoses. *Br J Surg* 1973;60:457-460.
- [8] Everett WG: A comparison of one layer and two layer techniques for colorectal anastomosis. *Br J Surg* 1975; 62:135-140.

- [9] Goligher JC, Lee PW, Simpkins KC, Lintott DJ: A controlled comparison one- and two-layer techniques of suture for high and low colorectal anastomoses. *Br J Surg* 1977; 64:609-614.
- [10] Ordorica-Flores RM, Bracho-Blanchet E, Nieto-Zermeno J, Reyes-Retana R, Tovilla-Mercado JM, Leon-Villanueva V, Varela-Fascinetto G: Intestinal anastomosis in children: a comparative study between two different techniques. *J Pediatr Surg* 1998; 33:1757-1759.
- [11] Maurya SD, Gupta HC, Tiwari A, Khan SS, Sharma BD: Double layer versus single layer intestinal anastomosis: a clinical trial. *Int Surg* 1984; 69:339-340.
- [12] Askarpour S, Sarmast M, Peyvasteh M, Gholizadeh B. Comparison of single and double layer intestinal anastomosis in Ahwaz educational hospitals. *The Internet Journal of Surgery* 2009; (23)2.
- [13] Shikata S, Yamagishi H, Taji Y, Shimada T, Noguchi Y. Single- versus two- layer intestinal anastomosis: a meta-analysis of randomized controlled trials. *BMC Surg* 2006;6:2
- [14] Travers B. Enquiry into the process of nature in repairing injuries of the intestine. 1812; Longman, Rees, Orme, Brown and Green, London.
- [15] Lembert A. Memoire sur l'enterographie avec la description d'un procede nouveau pour pratiquer cette operation chirurgicale. *Rep Gen Anat Physiol Path* 1826; 2:100.
- [16] Hautefeuille P. Reflexions sur les sutures digestives: a propos de 570 sutures accomplies depuis 5 ans au surjet monoplan de monobrin. *Chirurgie* 1976; 102:153-165.
- [17] Bailey HR, LaVoo JW, Max E et al Single Layer polypropylene colorectal anastomosis: experience with 100 cases. *Dis Colon Rectum* 1984; 27:19-23.