

A Clinical Study of the Factors Affecting the Outcome of Intestinal Resection and Anastomosis

Kyasa Shiva Kumar¹, Bushigampala Anil Kumar², V Shyam³, Deepak Jadhav Maloth⁴

^{1,2,3,4}Assistant Professor, Department of General Surgery, Government Medical College, Siddipet, Telangana State

Received: 18-09-2023 / Revised: 21-10-2023 / Accepted: 26-11-2023

Corresponding author: Dr. Deepak Jadhav Maloth

Conflict of interest: Nil

Abstract:

Introduction: Anastomosis refers to a surgical procedure or a natural connection between two tubular structures, such as blood vessels, intestines or other hollow organs. Anastomotic leak is one of the most common and dreaded complications after the surgical procedure of intestinal anastomosis.

Aim and Objective: To discuss about factors affecting the outcome of intestinal resection and Anastomosis.

Materials and Method: This was prospective observational study conducted on 75 patients requiring intestinal resection and anastomosis admitted in department of general surgery, Chalmeda Anand Rao Institute of Medical sciences, Karimnagar, for the duration of one year, after approval of institutional ethical committee of our institute, consent from patients and after following inclusion and exclusion criteria.

Results: 75 patients were included in the study, among which nearly 78% of the patients were from the age group of 20-60 years of age, 72% of the study population were male followed by female. 36% of the study population had comorbid condition and 57.3% of the study population underwent elective surgery followed by emergency. Leak were present among 12.96% of the population from male and 19.05% from female, patients with elevated low albumin level leak was observed among 72.72% of the population.

Conclusion: Levels of serum albumin can be used as a simple, reliable and economical prognostic marker in predicting the outcome of bowel anastomoses. This helps the surgeon in operative decision making as well as explaining the prognosis and operative risk to the patient.

Keywords: Anastomosis Leak, Serum Albumin, Gastrointestinal Suturing, Intestinal Resection etc.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Intestines form a major part of human digestive system. Both in terms of length as well as surface area, the small and large intestines constitute about 90% of the digestive system. They play a major role in absorption of nutrients, water and other micro nutrients. Thus they play a major role in growth and proper functioning of the human body. Any pathological condition of the bowel leads to disturbance in the homeostasis of the human body. Timely intervention and correction of the pathologies affecting the bowel is of utmost importance in providing a healthy functional life to the patient.

Anastomosis refers to a surgical procedure or a natural connection between two tubular structures, such as blood vessels, intestines or other hollow organs. The word anastomosis comes from the Greek word 'ana', meaning up, and 'Stomosis' a mouth, i.e. when a tubular viscus (bowel) or vessel (mostly arteries) is joined after resection or bypass without exteriorisation with a stoma.[1] Before

19th century, intestinal surgery was limited to creation of stomas, or closure of simple lacerations. In 1926, Lembert described the sero-muscular suture technique for bowel anastomosis.

Anastomotic leak is one of the most common and dreaded complications after the surgical procedure of intestinal anastomosis.[2] In intestinal anastomosis, we restore the continuity of two formerly distant segments of the intestine, re-establishing communication. The process also includes removal of a pathological segment of bowel. It is a frequently performed surgical procedure performed both electively and as an emergency. The prevalence of anastomotic leak is 0.5% to 30% in literature but is generally seen to be between 2% and 5%. It occurs usually between the 3rd to 6th post-operative day. Mortality following anastomotic leak remains high between 10-30%. [3] Anastomotic healing follows the same principles of wound healing, and hence risk factors for developing an anastomotic leak are identical to

those that predict wound dehiscence. Factors responsible for anastomotic leaks can be divided into host related factors and those related to surgical technique. However, with adequate supervision, there is little difference between the outcomes of anastomoses performed by trainees and those performed by established surgeons.[4] Hence, the host related factors influencing the anastomotic healing play an important role in the outcome, once the fundamental principles of gastrointestinal suturing are followed.[4] So in this study we are going to discuss about factors affecting the outcome of intestinal resection and Anastomosis.

Materials and Method

This was prospective observational study conducted on 75 patients requiring intestinal resection and anastomosis admitted in department of general surgery, Chalmeda Anand Rao Institute of Medical sciences, Karimnagar, for the duration of one year, after approval of institutional ethical committee of our institute, consent from patients and after following inclusion and exclusion criteria given below.

Inclusion Criteria

- Patients age >18yrs
- Patients requiring intestinal resection and anastomosis

Exclusion Criteria :

- Patient's age <18yrs
- Pregnant women, prisoners, cognitively impaired subjects
- Immuno compromised.

Method

In this study the various factors compared and studied can be broadly classified into:

Pre-operative factors

These factors are patient related. These are non-modifiable factors. In this study the pre-operative factors taken into consideration and compared are

1. Age
2. Sex
3. Co morbidities – diabetes, cardiac disease, renal disease

4. Biochemical parameters – Haemoglobin, Albumin, Renal function(Blood urea, serum Creatinine)

Intra operative factors

These are the factors that are influenced by the patient as well as the operating surgeon. These are partly non-modifiable and partly modifiable. This study evaluates how the modifiable factors influence the outcome of intestinal anastomosis.

Patient related intra operative factors include

- Aetiology – Gangrene, malignancy, trauma
- Delay in surgery – admission to incision time

Surgeon related intra operative factors include

1. Type of anastomosis based on bowel orientation

- End to end
- End to side
- Side to side

2. Type of anastomosis based on bowel involved

- Small bowel- small bowel
- Small bowel- large bowel
- Large bowel- large bowel

3. Type of anastomosis based on layers

- Single layer
- Double layer
- **Post-operative factors** studied include
- Transfusion of blood and blood products
- TPN transfusion

Statistical Analysis:

Collected data was entered in the Microsoft Excel 2016 for further statistical analysis. Categorical data were expressed in terms of frequency and percentages. Descriptive statistics were used to present data.

Observation and Results

In the study total 75 patients were included in the study, among which nearly 78% of the patients were from the age group of 20-60 years of age, 72% of the study population were male followed by female. 36% of the study population had comorbid condition and 57.3% of the study population underwent elective surgery followed by emergency shown in below table.

Table 1: Distribution of demographic profile among study population

Parameter	Frequency	Percentage
Age		
< 20 Years	4	5.3
20 - 40 Years	28	37.3
41 - 60 Years	31	41.3
> 60 Years	12	16.1
Gender		
Male	54	72

Female	21	28
Comorbid Condition		
DM + Hypertension	27	36
Renal	3	4
Cardiac	2	2.7
Other	6	8
No Comorbidity	37	49.3
Type of Surgery		
Elective	43	57.3
Emergency	32	42.7

Table 2: Distribution of risk factors and leak present among study population

Risk Factors	Frequency	Leak Present
Gender		
Male	54(72%)	7(12.96%)
Female	21(28%)	4(19.05%)
Haemoglobin		
< 10 mmhg	16(21.3%)	9(56.25%)
>10 mmhg	59(78.7%)	2(3.39%)
Albumin		
≥3 (Normal)	9(12%)	3(27.28%)
<3 (Abnormal)	66(88%)	8(72.72%)
Random Blood Sugar		
Elevated	15(20%)	10(66.7%)
Normal	60(80%)	1(1.7%)
Aetiology		
Gangrene	38(50.7%)	7(18.4%)
Malignancy	17(22.7%)	1(5.9%)
Others	20(26.6%)	3(15.0%)
Delay in Presentation		
≤1 Days	19	1(5.4%)
>1 Days	56	10(17.85%)

Leak were present among 12.96% of the population from male and 19.05% from female, patients with elevated low albumin level leak was observed among 72.72% of the population, among patients having gangrene, 18.4% of the patients had leak followed by other aetiologies. Patients who present delay more than 1 day in the hospital, observed 17.85% of the leak.

Table 3: Distribution of risk factors and leak present among study population

Parameters	Frequency	Leak Present
Bowel Involved		
Small to Small	37(49.3%)	3(8.1%)
Small to Large	21(28.0%)	8(38.1%)
Large to Large	17(22.7%)	0(0%)
Orientation of Bowel		
End to End	59(78.7%)	4(6.8%)
End to Side	16(21.3%)	7(11.9%)
Blood		
Given	63(84%)	9(14.28%)
Not Given	12(16%)	2(16.67%)
FFP		
Given	58(77.3%)	8(13.8%)
Not Given	17(22.7%)	3(17.6%)
TPN		
Given	40(53.3%)	3(7.5%)
Not Given	35(46.7%)	8(22.9%)

Table 4: Distribution of risk factors and leak present among study population

Parameters	Frequency	Leak Present
Duration of Surgery		
≤ 2.5 Hours	51(68%)	0(0%)
> 2.5 Hours	24(32%)	11(45.83%)
Time for Anastomosis		
≤ 30 Min	57(76%)	2(3.5%)
> 30 Min	18(24%)	9(50%)
Length of Hospital Stay		
< 10 Days	15(20%)	3(20.0%)
10-20 Days	47(62.7%)	7(14.9%)
>20 Days	13(17.3%)	1(7.7%)

Discussion

The healing of the intestinal anastomosis is a challenge due to the multiple factors that play a role in the healing process. Intestinal anastomosis is an operative procedure to form communication between two formerly distant portions of the bowel. This procedure reestablishes intestinal continuity after removal of a pathology affecting the bowel. There is paucity of studies on understanding healing of small bowel anastomosis and risk factors contributing to anastomotic leak even though small bowel anastomosis is common procedure especially in the emergency setting. Anastomotic leak usually occurs usually between 3rd and 6th postoperative days. Patients with anastomotic leak may present with varied clinical features

In the present study rate of anastomotic leak observed was 14.67%. The reported rate of anastomotic leak ranges between 0.8 to 35% in some studies.[5-8]. In one more study

Raghunandan et al, a total of 8 patients (20%) developed postoperative leaks among which 4 patients recovered with a relaparotomy and 4 patients recovered by conservative and supportive management. Western Literature quote variable rates of leaks ranging from 2.0% to 6%.[9, 10] Maximum number of cases with leakage in our study were males (75%) which corresponded with studies by Hyman et al, Trencheva et al, Turrentine et al, where males were 51.5%, 68.6%, 51.4%, respectively. But gender was not a statistically significant variable in our study which was similar to data shown by some studies and differed from that shown by others [11].

Analysis of our study showed that the duration of surgery was critically significant with the anastomotic complication of leakage, with all leaks occurring in surgeries which lasted greater than 2.5 hours. Buchs et al, Choi et al, Kawada et al and Silva-Velazco et al arrived at the conclusion that increasing operative time was a consequential factor to anastomotic dehiscence. In the present study haemoglobin level less than < 10 g/dl, observed major anastomotic leak (81.81%) In studies by Saha et al, Hayden et al and Farghaly et

al, they concluded that low haemoglobin <11 g/dl, <11 g/dl and <9 g/dl, respectively have an increased incidence of leak with the likely explanation that it results in decreased transportation of oxygen to the tissues and the resulting risk of ischemia.[12-14]. Also in the present study albumin level less than < 3 g/dl, had 72.78% of anastomotic leak was observed. The factors which add to anastomotic leak include hypoalbuminemia,[15] Yamamoto et al and Mäkelä et al found that hypoproteinemia and hypoalbuminemia were significant risk factors for the anastomotic dehiscence.[16-18] In the present study we have not encountered with any of the mortality, which is the strength of our study and we have managed patients with anastomotic leak post operatively in order to avoid mortality. But we have the morbidity in our study must be contributed to the higher incidence of hypoalbuminemia (88%). Arnaud Alves et al. and Varut Lohsiriwat et al,[19] have shown significant association between morbidity and hypoalbuminemia. Gibbs,[20] et al has observed among major non-cardiac surgery cases that a reduction in serum albumin from.

Conclusion

From the above observation and after discussion with other studies we can conclude that, leakage from anastomotic site is associated with decreased survival, increased and morbidity as well as hospital stays and an obvious increase in health care-related financial burden. We can also conclude that, levels of serum albumin can be used as a simple, reliable and economical prognostic marker in predicting the outcome of bowel anastomoses. This helps the surgeon in operative decision making as well as explaining the prognosis and operative risk to the patient. In our study increasing age, level of albumin, haemoglobin level, emergency surgery, and duration of surgery observed affecting factors.

References

1. Williams NS, O'Connell RP, McCaskie AW. Bailey & Love's Short practice of surgery. Chapter – 7. 27th edn. Taylor & Francis Group, CRC Press 2018;1:97-8.

2. Phillips B. Reducing gastrointestinal anastomotic leak rates: Review of challenges and solutions. *Open Access Surg.* 2016; 2016:5.
3. Zinner MJ, Ashley SW. *Maingot's Abdominal Operations*. Chapter – 7. 11th edn. Tata McGraw-Hill Education 2007: p. 184-9.
4. Hawkins WJ, Moorthy KM, Tighe D, et al. With adequate supervision, the grade of the operating surgeon is not a determinant of outcome for patients undergoing urgent colorectal surgery. *Ann R Coll Surg Engl* 2007; 89(8):760-5.
5. Amit Nair Dinker, R. Pai, S. Jagadish. Predicting anastomotic disruption after emergent small bowel surgery. *Dig Surg*, 2006; 23: 38-43.
6. Hesp, Lubbers, de Boer and Th.Hendricks. Anastomotic Insufficiency in Small Bowel Surgery - Incidence and Treatment. *Langenbecks Arch Chir*, 1986; 368: 105-111.
7. Dana A. Telem,; Edward H. Chin,; Scott Q. Nguyen,; Celia M. Divino. Risk Factors for Anastomotic Leak Following Colorectal Surgery. *Arch Surg*, 2010; 145(4): 371-376.
8. Paul et al. Definitive Risk Factors for Anastomotic Leaks in Elective Open Colorectal Arnaud Alves et al Postoperative Mortality and Morbidity in French Patients Undergoing Colorectal Surgery. *Arch Surg*, 2005; 140: 278-283. Resection. *Arch Surg*, 2008; 143(9): 907-912.
9. Katz S. Bacterial adherence to surgical sutures. A possible factor in suture induces infection. *Ann Surg*. 1981; 194:35–35.
10. Murphy JB. Cholecyst-intestinal, Gastro-intestinal, Enterointestinal anastomosis, and approximation without sutures. *Med Rec*. 2017; 42:665–71.
11. Bruce J, Krukowski ZH, Al-Khairi G, et al. Systematic review of the definition and measurement of anastomotic leak after gastrointestinal surgery. *Br J Surg*. 2001; 88:1157-1168.
12. Saha AK, Tapping CR, Foley GT, Baker RP, Sagar PM, Burke DA et al. Morbidity and mortality after closure of loop ileostomy. *Colorectal Dis*. 2009; 11(8):866-71.
13. Hayden DM, Mora Pinzon MC, Francescatti AB, Saclarides TJ. Patient factors may predict anastomotic complications after rectal cancer surgery: Anastomotic complications in rectal cancer. *Ann Med Surg*. 2015;4(1):11-6.
14. Farghaly A, Ammar M, Alghammal A, Arafa A. Risk factors for leak in emergent small bowel anastomosis. *Menoufia Med J*. 2019; 32(2):574-80.
15. Hesp, Lubbers, de Boer and Th.Hendricks. Anastomotic Insufficiency in Small Bowel Surgery - Incidence and Treatment. *Langenbecks Arch Chir*, 1986; 368: 105-111.
16. Irvin TT, Goligher JC. Aetiology of disruption of intestinal anastomoses. *Br J Surg*. 1973; 60(6):461-4.
17. Yamamoto T, Allan RN, Keighley MRB. Risk factors for intra-abdominal sepsis after surgery in Crohn's disease. *Dis Colon Rectum*. 2000; 43(8):1141-5.
18. Mäkelä JT, Kiviniemi H, Laitinen S. Risk factors for anastomotic leakage after left-sided colorectal resection with rectal anastomosis. *Dis Colon Rectum*. 2003; 46(5):653-60.
19. Frank J. Thornton, Adrian Barbul. Healing In the Gastrointestinal Tract. June 1997. *Surgical Clinics of North America*, Jun 1997; 77(3): 549-575.
20. H. Akbarshahi et al. Perioperative Nutrition in Elective Gastrointestinal Surgery –Potential for Improvement? *Dig Surg*, 2008; 25: 165–174.