International Surgery Journal
Islam AKMZ et al. Int Surg J. 2026 Jan;13(1):19-25
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20254323

Original Research Article

Evaluation of risk factors for early complications following bowel anastomosis

A. K. M. Zahedul Islam[1]*, M. Farhad Hossain[2], Masuma Sultana[3], M. Oliul Islam[4], Tanvir Ahmad[5], M. Jayer Haque[5]

[1]Department of Surgery, Saghata Upazila Health Complex, Gaibandha, Bangladesh
[2]Department of Surgery, 250 bedded General Hospital, Kurigram, Bangladesh
[3]Department of ENT and Head-neck Surgery, Rangpur Medical College and Hospital, Rangpur, Bangladesh
[4]Department of Surgery, Gobindagonj Upazila Health Complex, Gaibandha, Bangladesh
[5]Department of Surgery, Rangpur Medical College and Hospital, Rangpur, Bangladesh

Received: 05 November 2025
Accepted: 09 December 2025

***Correspondence:**
Dr. A. K. M. Zahedul Islam,
E-mail: shoaebalam9@gmail.com

ABSTRACT

Background: In emergency as well as in elective situations, gastrointestinal anastomosis is an essential step to maintain the continuity of gastrointestinal tract following intestinal resection. Anastomotic complications, primarily, anastomotic leaks is one of the most widely feared and extensively studied problems in GI surgery. That's why this study was conducted to identify the risk factors for early complications in gastrointestinal anastomosis
Methods: This was a cross sectional observational Study which took place in the department of Surgery, Rangpur Medical College Hospital and private hospitals in Rangpur, Bangladesh from 1st October 2018 to 31st March 2019 over a period of 6 months. All statistical analysis was performed using the SPPS software program version 26.0 (SPSS, Inc., Chicago, IL, United States of America). A p value<0.05 was considered statistically significant.
Results: A total number of 200 patients were included in the study by purposive sampling method. Mean age of the study population was 46±13.6 years with a male female ratio of 2:1. Among them 44% patients had gastro-jejunal anastomosis and 66% patients had anastomosis involving small and large gut. Anastomotic leaks (AL), (4.5%) and hemorrhage (2.2%) were the main post-operative complications. Re-operation was required in 3.5% patients. Operative mortality rate was 5.5%, with 06 deaths (54%) secondary to anastomotic complications. Univariate analysis of the overall population male patient, age, malnutrition, malignancy, sepsis and uses of steroids were independent predictors of postoperative complication following gastrointestinal anastomosis.
Conclusions: Anastomotic complications, particularly anastomotic leaks, remain a major unsolved problem in GI surgery.

Keywords: Bowel anastomosis, Early complications, Risk factors

INTRODUCTION

The basic principles of intestinal anastomosis were established more than 100 years ago by Travers, Lembert and Halsted and have since undergone modification.[1] Fundamentally Good anastomotic healing mainly depends on accurate approximation of the bowel ends without tension and with a good blood supply to both of the ends. An insecure intestinal anastomosis is an unacceptable iatrogenic hazard. The process of intestinal anastomotic healing mimics that of wound healing elsewhere in the body in that it can be arbitrarily divided into an acute inflammatory (lag) phase, a proliferative phase and finally, a remodeling phase.[2] A number of factors both local and systemic significantly influence the healing of anastomosis in the gastrointestinal tract. These

factors can be classified into preoperative, operative and postoperative. The sound healing process of anastomosis depends mainly on anastomotic technique, which is most important determinant. In order to devise a sound and tension free gastrointestinal anastomosis it is imperative to understand the various clinical, technical and non-clinical aspects influencing any anastomosis in the GIT. Adequate apposition, appropriate alignment, good local blood supply and tension free equally spaced stiches can affect gastrointestinal anastomosis positively. Malnutrition, abdominal sepsis, generalized sepsis and immunosuppression can negatively impact the outcome following gastrointestinal anastomosis.

The rates of complications involving anastomoses of the gastrointestinal tract have varied widely in different studies.[3,4] Major early complications are anastomotic leakage, hemorrhage and obstruction due to inflammatory edema.[5] Leaks were defined by any evidence of internal or external fistula, abscess or intra-abdominal sepsis and they were identified either at reoperation or via examinations with contrast medium.[5] Hemorrhage was defined as significant bleeding (>100 mL/h) in the immediate postoperative period that required emergency reoperation or hemodynamic resuscitation.[5] Minor anastomotic bleeding that did not require transfusion was not included.[6] Obstruction or stenosis was defined as narrowing due to inflammatory swelling or kinking of significant magnitude to delay or halt normal passage of intestinal contents.[6] This obstruction was defined either endoscopically or radiographically with contrast material. Minor complications are wound infection, urinary tract infection and pneumonia. Much discussion has appeared in the literature concerning anastomotic complications is the anastomotic leaks.[7,8]

The prevalence of intraperitoneal anastomotic leak varies in the literature between 2% and 5%. Rates as high as 30% have been reported when routine postoperative visualization with contrast material has been performed, with corresponding clinical leak rates of 10-30% reported after low anterior resections.[9] Leak rates have been lower for intraperitoneal colonic and gastric anastomoses (8% and 5%, respectively).[10]

Studies have reported various factors to be related to an increased rate of anastomotic complications: advanced age, diabetes mellitus, weight loss, emergency surgery, infection, hypotension, prolonged surgery, different levels of surgeon and performance of extra peritoneal anastomosis.[11] The reports concerning the technical aspects of anastomoses have yielded conflicting data concerning anastomotic complications when comparisons were made between sewn and stapled anastomoses; single- and double-layered sewn anastomoses and everted and inverted sewn anastomoses.[12]

There is a great deal of conflicting data regarding risk factors for anastomotic leakage, with most studies looking only at anastomoses performed at one level of gastrointestinal (GI) tract. The purpose of this study was to evaluate the incidence, possible predictive factors and result of treatment of anastomotic complications in patient undergoing at all level of GI tract.

METHODS

This was a cross-sectional observational Study which took place in the department of Surgery, Rangpur Medical College Hospital and private hospitals in Rangpur, Bangladesh from 1st October 2018 to 31st March 2019 over a period of 6 months. An ethical clearance was taken from Ethical Clearance Committee of Rangpur Medical College Hospital, Rangpur to conduct the study. An informed written consent was obtained from all the participants regarding the study procedure.

Inclusion criteria

Patients who underwent bowel anastomosis, Age>18 years.

Exclusion criteria

Patient who didn't give informed consent. Patient who were not fit for general anesthesia.

Both elective and emergency cases where bowel anastomosis was done were included in the study. All the patients received standard bowel preparation and bacteriological prophylaxis except the emergency cases. Post-operatively the patients were monitored according to the institutional protocol. Anastomotic leaks and hemorrhage were managed either by conservative approach or by re-exploration according to their severity. Patients were followed up for 1 month to identify any major complications related to bowel anastomosis

A preformed questionnaire was used for data collection. Data regarding patient's age sex and comorbidities were obtained. Pre-operative factors included primary diagnosis of the patient, presence of sepsis, anemia or hypoalbuminemia and timing of presentation (early or late). Per-operative variables included type of surgery, requirement of blood transfusion, duration of surgery, mode of surgery (laparoscopic or open), schedule of surgery (emergency or elective) and technique of anastomosis (hand-sewn or stapled anastomosis). Anastomotic leak (AL), stenosis or stricture and post-operative hemorrhage were the main outcome variables of the study. Besides, duration of hospital stays, requirement of re-operation, requirement of intensive care support (ICU) and mortality data were also extracted.

Data were analyzed by using statistical package for the social sciences (SPSS) software. Categorical variables were presented as frequencies and percentages, continuous variables as mean±standard deviation (SD). The unpaired Student's t-test was used for parametric

data and Mann Whitney U-test for nonparametric data. Chi-square test was applied to categorical variables. A p value<0.05 was considered statistically significant.

RESULTS

A total number of 200 patients were included in the study. Among them 132 patients (66%) were male and 68 patients (44%) were female with a male female ratio of 2:1. Majority of the patients belonged to 40-50 years group. Mean age of the study population was 46±13.6 years (Table 1). Diabetes mellitus (DM) (7.5%), anemia (16%) and hypoalbuminemia (20%) were the major co-morbidities of the study population. 101 patients (51%) patients presented with various types of gastrointestinal and colorectal malignancies which were the major cause of intestinal anastomosis in elective cases. Intestinal obstruction was the major presentations of emergency gastro- intestinal anastomosis (18.5%) (Table 2).

88(44%) patients had gastrojejunal anastomosis (palliative, Billroth-II, Roux-en-Y) and 112 (66%) patients had anastomosis involving small and large gut (jejunojejunal, jejunoileal, ileoileal, ileocolonic, colocolonic, colorectal). The rates of major anastomotic complications were anastomotic leaks (AL) (4.5%) hemorrhage (2.2%) and stenosis or obstruction (1.5%) respectively. Reoperation was required in 7 (3.5%) patients. Operative mortality rate was 5.5%, with 06 deaths (54%) secondary to anastomotic complications.

Wound infection (17.5%), chest complication (2%) and wound dehiscence (9.5%) were notable minor complications. In this study, anastomotic leaks rate was 5.7% for gastric and 3.6% for another gut anastomosis (Table 3). Major complication occurred in 4 of 24 patients (16.6%) when operation was done as an emergency case while complication rate of elective procedure was 7.9%. Anastomotic complication developed in 7.5% of patients who received none or one unit of whole blood during 24 hours period following induction of anesthesia. Major complication rate was 8.35 and 18.1% of patients who were given two and three units of whole blood respectively. Complication rate was higher (25%) when operation time was >180 minutes. Major complication was noted in 3 of 13 patients (23%) when peritonitis, abscess or fistula was encountered during operation. The rate of major post–operative complications where anastomosis was performed by professor or consultant, was 12 of 151 patients (7.5%) and the rate of complication was 4 of 49 patients (8.2%) which were performed by residents or trainees.

Statistically significant (p<0.05) difference was noted in terms of mean hospital stay of the study population. Among 176 elective procedures mean hospital stay without complications was 10±7.2 days and with complications it was 22±8.4 days. Among 24 emergency procedure mean hospital stay without complications was 9±3.4 days whereas with complications it was 29±5.6 days. This finding has indicated that mean hospital stay was increased by 45% if there were any post-anastomotic complications.

Univariate analysis showed presence of anaemia, perioperative blood transfusion, preoperative corticosteroid administration due to medical cause, hypoalbuminemia, malignancy, gastro-jejunostomy (billroth-II), surgeon's expertise, schedule of surgery, presence of sepsis and duration of operation were risk factors for post-anastomotic major complications. However multivariate analysis demonstrated perioperative blood transfusion, hypoalbuminemia, malignancy, schedule of surgery, presence of sepsis and duration of operation were independent predictors of early anastomotic complications (p<0.05).

Table 1: Age distribution of study population.

Age (in years)	Frequency	%
18-20	3	1.50
21-30	27	13.5
31-40	42	21.00
41-50	60	30.00
51-60	44	22.00
61-70	18	9.00
>70	6	3.00

Table 2: Pre-operative variables of major post-anastomotic complications.

Variables (n=200)	Frequency (%)	Major complications (%)
Diabetes mellitus	15 (7.5)	3 (20)
Hypoalbuminemia	40 (20.00)	7 (17.5)
Malignancy	101 (51.00)	13 (12.8)
Obstruction	37 (18.5)	3 (8.1)
Hypotension	9 (4.5)	1 (11.1)
Anemia (Hb%)	32 (16)	6 (18.7)
Steroid use	3 (1.5)	1 (33)

Table 3: Anastomotic complications of different types of anastomosis.

Types of anastomoses	Frequency	Anastomotic leak N (%)	Anastomotic hemorrhage N (%)	Anastomotic stenosis/ obstruction N (%)	Minor complications N (%)
Gastrojejunostomy (palliative)	19	0	1 (5.3)	0	3 (1.6)
Gastrojejunostomy (Billroth II)	53	4 (7.5)	1 (1.8)	0	9 (17)
Gastrojejunostomy (roux-en-Y)	16	1 (6.2)	1 (6.2)	0	4 (25)
Jejunojejunostomy	06	1 (16.7)	0	0	1 (16.7)
Jejunoileostomy	03	0	0	0	0
Ileoileostomy	37	1 (2.7)	0	2 (5.4)	4 (10.8)
Ileocolostomy	35	1 (2.8)	1 (2.8)	0	9 (25.7)
Colocolstomy	24	1 (4.2)	0	1 (4.2)	3 (12.5)
Colorectostomy	04	0	0	0	0
Ileoanal	02	0	0	0	1 (50)
Coloanal	01	0	0	0	0
Total	200	9 (4.5)	4 (2.0)	3 (1.5)	33 (16.5)

Table 4: Per-operative variables related to anastomotic complications.

Variables	Category	Anastomoses	Major complications (%)
Schedule	Elective	176	12 (6.8)
	Emergency	24	4 (16.6)
Infection/sepsis	Yes	13	3 (23)
	No	187	13 (6.9)
Peri-operative blood transfusion	No or 1 unit	117	8 (7.2)
	2 unit	72	6 (8.3)
	3 or >3 unit	11	2 (18.1)
Technique	Single layered extramucosal	105	8 (7.6)
	Double layered through and through	93	8 (8.6)
	Stapled	2	0 (0.00)
Surgeon	Professor/ consultant	151	12 (7.9)
	Trainee/ resident	49	4 (8.2)
Duration of operation	<60 mins	7	0 (0.00)
	60-120 mins	120	9 (7.5)
	120-180 mins	69	6 (8.7)
	180-240 mins	4	1 (25)

Table 5: Risk factors of early anastomotic complications.

Variable	Univariate analysis Odds ratio(OR) (95%CI)	P value	Multivariate analysis Odds ratio(OR) (95%CI)	P value
Presence of anaemia	1.643 (1.56-1.68)	0.001	1.13 (1.08-1.17)	0.184
Perioperative blood transfusion	1.13 (1.02-1.18)	0.03	1.08 (1.021-1.12)	0.001
Preoperative corticosteroid administration due to medical cause	1.296 (1.18-1.38)	0.001	1.41 (1.24-1.52)	0.087
Hypoalbuminemia	1.39 (1.26-1.48)	0.042	1.724 (1.716-1.738)	0.001
Malignancy	1.26 (1.12-1.346)	0.001	1.361 (1.20-1.47)	0.02
Gastro-jejunostomy(billroth-II)	1.54 (1.42-1.62)	0.001	1.54 (1.41-1.63)	0.124
Surgeon's expertise	1.154 (1.144-1.162)	0.001	0.428 (0.416-0.432)	0.082
Schedule of surgery	1.38 (1.28-1.42)	0.001	1.642 (1.638-1.651)	0.001
Presence of sepsis	1.13 (1.02-1.143)	0.014	1.718 (1.713-1.724)	0.002
Duration of operation	1.21 (1.24-1.38)	0.002	1.274 (1.21-1.343)	0.003

DISCUSSION

Anastomotic complications, primarily, anastomotic leaks is one of the most widely feared and extensively studied problems in GI surgery. The overall incidence of clinically significant anastomotic leakage was 4.5% in this study. This figure comparable with previous reports which analyzed GI anastomoses retrospectively.[13,14] In this study leaks rate were 5.7% for gastric and 3.6% for remaining gut anastomosis which are comparable to other studies.

The current study showed the risk of anastomotic complications in male patients was 3 times higher than that of females. Besides, advanced age was also associated with major anastomotic complications more. But in multivariate analysis none of these factors proved to be an independent predictor of post-anastomotic complications ($p>0.05$). Various studies showed that leakage was more frequent in emergency resection than in elective operations.[15] This difference can be partially attributed to heamorrhage and infection. In this study major complications rate 16.6% in emergency cases while rate of complications of elective cases was 6.8% and difference was statistically significant (OR: 1.642; 95% CI-1.638-1.651, $p>0.05$).

Majority of investigators agreed that the technique of anastomoses (hand and stapled) is not the determinant factors for development of AL.[16] In this study only two patients underwent stapled anastomoses for lower rectal cases and no significant differences between stapled and hand-sewn anastomoses were noted. Like other studies, this study found no differences between end to end, end to side or side to side anastomoses in either small bowel or colon resections ($p>0.05$).[17]

The presence and absence of infection appeared to be a critical determinant of outcome of gut anastomosis. Collagenase activity of the gut is enhanced by infection adjacent to bowel anastomosis and theoretically this could be the mechanism by which infected anastomoses were weakened. The present study showed presence of sepsis or infection was an independent predictor of early complications which was comparable to the study conducted by Fielding et al and Chassian et al.[18,19] This study demonstrated anemia (Hb<10gm/dl) had significant effect ($p<0.05$) on anastomotic complications although all anemic patients were transfused pre-operatively. Studies shows that anemia have significant adverse effect on colonic healing, whereas others have noted no effect of pre-existing anemia.[20] However multivariate analysis demonstrated presence of anaemia was not an independent predictor of AL in this study (OR: 1.13, 95% CI: 1.08-1.117, $p=0.184$). Intra-operative blood transfusion is a significant factor in anastomotic leakage as wound healing is retarded by hypovalemia, hypoxia or other consequences of massive hemorrhage and multiple transfusion especially following colonic anastomosis.[21] The current study showed perioperative blood transfusion especially in the per-operative period is a risk factor for anastomotic complications (OR:1.08, 95% CL:1.021-1.12, $p=0.001$).

Hypoalbuminemia is known to be associated with delayed wound healing. The hypoalbuminemic state interferes with the normal functioning of the gastrointestinal tract. In a study conducted by Anandan PK et al, showed pre-operative albumin of <3.5gm/dl is significantly associated with post-operative anastomotic leak which is similar to our findings (OR:1.724, 955 CI:1.716-1.738 $p=0.001$).[22]

In this study, 151 operations were performed by consultant and professors while 49 operations were performed by trainee/resident under supervision. No significant differences in anastomotic complications among various attending surgeons were noted. Although many other studies have noted no adverse effect on outcome of different groups of surgeons participation ($p>0.05$). Recent studies have shown the impact of prolonged operative time on the risk of developing postoperative AL. In their research, Choi and colleagues found that the operative time was significantly associated with AL.[23] Similarly the current study identified prolong duration of surgery is a significant factor for post-anastomotic complications (OR: 1.274, 95% CI: 1.21-1.343, $p=0.003$).

Long-term corticosteroid use was found to be related to higher AL rates. Another research showed that prolonged and perioperative use of corticosteroids was also correlated with post anastomotic complications which coincided with findings of current study but failed to be an independent predictor in multivariate analysis($p>0.05$).[24]

The reports concerning the technical aspects of anastomoses have yielded conflicting data concerning anastomotic complications when comparison was made between single and double layered.[25] In this study all gastrojejunostomy were done by double layered and 112 small and large gut anastomoses nearly all anastomoses (107) done by single layered extramucosal anastomoses. No significant differences in anastomotic complications between single and double layered anastomoses were noted.

The current study had some limitations. This study was conducted in a single tertiary hospital only and may not reflect the actual situation of the country. Besides, this study was done within a short period of time with a small sample size. Multicenter studies conducted with larger sample size can give a better conclusion.

CONCLUSION

Anastomotic complications, particularly leaks, remain a major unsolved problem in gastrointestinal surgery. This can be held to an acceptable level with attention to

technical details regardless of whether the anastomosis is constructed with hand sewn or stapler, single layered extramucosal or double layered, performed by a trainee/resident or a consultant surgeon. Further large-scale studies should be conducted to identify the risk factors for anastomotic complications.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Daams F, Luyer M, Lange JF. Colorectal anastomotic leakage: aspects of prevention, detection and treatment. World J Gastroenterol. 2013;19(15):2293–7
2. Collaborative EESA. ESCP Safe Anastomosis ProGramme in CoLorectal SurgEry (EAGLE): Study protocol for an international cluster randomised trial of a quality improvement intervention to reduce anastomotic leak following right colectomy. Colorectal Dis. 2021;23(10):2761–71.
3. Buchs NC, Gervaz P, Secic M, Bucher P, Mugnier-Konrad B, Morel P. Incidence, consequences and risk factors for anastomotic dehiscence after colorectal surgery: a prospective monocentric study. Int J Colorectal Dis. 2008;23(3):265–70.
4. Krarup PM, Nordholm-Carstensen A, Jorgensen LN, Harling H. Anastomotic leak increases distant recurrence and long-term mortality after curative resection for colonic cancer: a nationwide cohort study. Ann Surg. 2014;259(5):930–8.
5. Turrentine FE, Denlinger CE, Simpson VB, Garwood RA, Guerlain S, Agrawal A, et al. Morbidity, mortality, cost and survival estimates of gastrointestinal anastomotic leaks. J Am Coll Surg. 2015;220(2):195–206.
6. Brown SR, Mathew R, Keding A, Marshall HC, Brown JM, Jayne DG. The impact of postoperative complications on long-term quality of life after curative colorectal cancer surgery. Ann Surg. 2014;259(5):916–23.
7. Kube R, Mroczkowski P, Granowski D, Benedix F, Sahm M, Schmidt U, et al. Anastomotic leakage after colon cancer surgery: a predictor of significant morbidity and hospital mortality and diminished tumour-free survival. Eur J Surg Oncol. 2010;36(2):120–4.
8. Ozmen I, Grupa VEM, Bedrikovetski S, Dudi-Venkata NN, Huisman DE, Reudink M, et al. Risk Nomogram Does Not Predict Anastomotic Leakage After Colon Surgery Accurately: Results of the Multi-center LekCheck Study. J Gastrointest Surg. 2022;26(4):900–10.
9. Hedrick TL, Kane W. Management of Acute Anastomotic Leaks. Clin Colon Rectal Surg. 2021;34(6):400–5.
10. Dias VE, Castro P, Padilha HT, Pillar LV, Godinho LBR, Tinoco ACA, et al. Preoperative risk factors associated with anastomotic leakage after colectomy for colorectal cancer: a systematic review and meta-analysis. Rev Col Bras Cir. 2022;49:223-5.
11. Farrah JP, Lauer CW, Bray MS, McCartt JM, Chang MC, Meredith JW, et al. Stapled versus hand-sewn anastomoses in emergency general surgery: A retrospective review of outcomes in a unique patient population. J Trauma Acute Care Surg. 2013;74(5):1187-94.
12. Telem DA. Risk factors for anastomotic leak following colorectal surgery: a case-control study. Arch Surg. 2010;145(4):371.
13. Yeung DE, Peterknecht E, Hajibandeh S. C-reactive protein can predict anastomotic leak in colorectal surgery: a systematic review and meta-analysis. Int J Colorectal Dis. 2021;36(6):1147–62.
14. Trencheva K, Morrissey KP, Wells M. Identifying important predictors for anastomotic leak after colon and rectal resection: prospective study on 616 patients. Ann Surg. 2013;257:108–13.
15. Choudhuri AH, Uppal R, Kumar M. Influence of non-surgical risk factors on anastomotic leakage after major gastrointestinal surgery: audit form a tertiary care teaching institute. Int J Crit Illn Inj Sci. 2013;3(4):246–9.
16. McDermott ED, Heeney A, Kelly ME. Systematic review of preoperative, intraoperative and postoperative risk factors for colorectal anastomotic leaks. BJS. 2015;102:462–79.
17. Makela J, Kiviniemi HK, Laitinen S. Risk factors for anastomotic leakage after left-sided colorectal resection with rectal anastomosis. Dis Colon Rectum. 2013;46(5):653–60.
18. Fielding LP, Stewart-Brown S, Blesovsky L, Kearney G. Anastomotic integrity after operations for large-bowel cancer: a multicenter study. Br Med J. 2020;281:411-4.
19. Chassin JL, Rifkind KM, Sussman B. The stapled gastrointestinal tract anastomosis: incidence of postoperative complications compared with the sutured anastomosis. Ann Surg. 2018;188:689-96.
20. Parthasarathy M, Greensmith M, Bowers D. Risk factors for anastomotic leakage after colorectal resection: a retrospective analysis of 17518 patients. Colorectal Dis. 2016;19:288–98.
21. Frye J, Bokey EL, Chapuis PH. Anastomotic leakage after resection of colorectal cancer generates prodigious use of hospital resources. Colorectal Dis. 2019;11:917–20.
22. Anandan PK, Hassan MMN, Mathew M. Pre-operative hypoalbuminemia is a major risk factor for anastomotic leak in emergency gastrointestinal resection and anastomosis. Int Surg J. 2017;4:1405-8.
23. Choi DH, Hwang JK, Ko YT, Jang HJ, Shin HK, Lee YC, et al. Risk Factors for Anastomotic Leakage after Laparoscopic Rectal Resection. J. Korean Soc. Coloproctol. 2020;26:265–73.

24. Slieker JC, Komen N, Mannaerts GH, Karsten TM, Willemsen P, Murawska M, et al. Long-Term and Perioperative Corticosteroids in Anastomotic Leakage: A Prospective Study of 259 Left-Sided Colorectal Anastomoses: A Prospective Study. Arch Surg. 2022;147:447–52.
25. Zarnescu EC, Zarnescu NO, Costea R. Updates of Risk Factors for Anastomotic Leakage after Colorectal Surgery. Diagnostics. 2021;11:2382.

Cite this article as: Islam AKMZ, Hossain MF, Sultana M, Islam MO, Ahmad T, Haque MJ. Evaluation of risk factors for early complications following bowel anastomosis. Int Surg J 2026;13:19-25.