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Original Research Article

Risk factor analysis of enterocutaneous fistula after small bowel surgery

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ABSTRACT

Background: Enterocutaneous fistula (ECF) most frequently follows a complication of abdominal surgery, although a smaller number occur spontaneously in association with conditions such as inflammatory bowel disease or malignancy. It ranks right up there in the list of most disappointing experiences for both the surgeon and the physician. The current study was aimed at identifying the risk factors of ECF formation after small bowel surgery.
Methods: This prospective study was conducted in the Department of Surgery of Shaheed Ziaur Rahman Medical College and Hospital (SZRMCH), Bogura, Bangladesh from January 2015 to January 2017 over a period of 24 months. All the patients who underwent small bowel surgery in the Department of Surgery of SZRMCH during the study period after fulfilling the inclusion and exclusion criteria well included in the study. Logistic regression analysis was performed to assess the independent relationship between the factors. A p value <0.05 was considered to be significant.
Results: A total number of 150 patients were enrolled in the current study. Among them, 15 patients (10%) developed ECF following small bowel surgery. 38% of the patients were in the age group of 21-30 years of age with a mean of 31.88±10.30 years. Majority (n=120) were males with a male female ratio of 4:1. Traumatic gut perforation (50.00%) was the most prevalent cause of admission followed by typhoid ulcer (24%) and tubercular ulcer perforation (20%) among the emergency cases (n=100). Intestinal obstruction due to malignancy (n=18) and inflammatory bowel disease (n=14) were the common causes of small bowel surgery in elective cases (50 cases). Univariate analysis showed presence of female sex, age >50 years, diabetes mellitus (DM), anaemia, hypoalbuminemia, malignancy, IBD, Tuberculosis, emergency surgery, jejunal surgery risk factors for post-operative ECF formation.
Conclusions: The current study demonstrated hypoalbuminemia, emergency surgery and inflammatory bowel disease is an independent predictor of post-operative ECF development after small intestinal surgery. All surgeon should consider these predictors while performing small intestinal surgery in order to prevent postsurgical ECF.

Keywords: Risk factors, Enterocutanous fistula, Small bowel surgery

INTRODUCTION

An enterocutaneous fistula (ECF) is a pathologic connection between the bowel and skin, resulting in the passage of bowel contents through the skin.[1] ECF most frequently follows a complication of abdominal surgery, although a smaller number occur spontaneously in association with conditions such as inflammatory bowel disease or malignancy.[2] It ranks right up there in the list of most disappointing experiences for both the surgeon and the physician. In spite of the many advances in critical care, antibiotics, and, in particular, nutritional therapy, the

management of ECF is still a challenge for the surgeon today, a mortality rate being a constant 5-15%.[3] The management aims for a restoration of GI tract integrity, enabling enteral feeding, thereby producing a decrease in morbidity and mortality rates. A multi-disciplinary approach is necessary in the successful treatment which is either through operative or non-operative measures. This requires proper medical treatment along with good and proper surgical care wherever necessary along with proper psychosocial support to the patient.[4]

ECF development has a complex pathophysiology that includes infection, anastomotic breakdown, ischaemia, and factors related to technical operations.[5] The delicate balance between perioperative care, patient physiology, and surgical decision-making in determining ultimate results is further highlighted by these paths. The literature states that surgical complications are the most common cause of ECF, while there are other causes as well. Additional risk factors include cancer, diverticular disease, inflammatory bowel disease, post-radiation therapy for cancer, distal obstruction, iatrogenic or spontaneous intestinal injury, and complex intra-abdominal infections like typhoid, amoebiasis, and tuberculosis.[6] ECF can be categorized in a number of ways, including output, aetiology, and source. Generally speaking, moderate-output fistulas fall between 200 ml and 500 ml in 24 hours, low-output fistulas are defined as less than 200 ml in 24 hours, and high-output ECFs are defined as surpassing 500 ml in 24 hours. Type I (abdominal, esophageal, gastroduodenal), type II (small bowel), type III (big bowel), and type IV (enteroatmospheric, regardless of origin) are further classifications for ECFs based on the organ of origin. This mortality rate is significantly higher in those patients who present high-output ECFs. This mortality rate reaches about 30% in such patients relative to approximately 6% among those with low-output fistulas.[7]

Fistulography, computed tomography (CT) scans, and ultrasounds are three imaging modalities that can be utilized to help describe a fistula. Endoscopic tests and small bowel follow-through may also be beneficial. A CT scan with oral contrast is regarded as the most effective radiologic examination, as it may detect the tract, abdominal leakage, intra-abdominal abscesses, distal blockage, and foreign items. Fistulography is infrequently employed but can be advantageous when CT or ultrasonography is unavailable or results are ambiguous.[8]

The regimen frequently employed in ECF management is represented by the acronym "SNAP," highlighting the significance of skin care, sepsis control, nutritional adequacy, and the accurate delineation of fistula anatomy to inform treatment choices.[9] Enterocutaneous fistulas are optimally managed by a multidisciplinary team comprising a stoma or wound care nurse, dietician, and therapist. It is essential to swiftly replenish fluids and electrolytes, as these patients may decompensate rapidly. It is necessary to determine the cause of sepsis. It takes clinical knowledge and sound judgement to decide between nonsurgical and surgical treatment. The cause of the fistula determines the result; malignant cases typically have the worst prognosis, whereas those in Crohn's disease patients may take months or years to heal.[10]

While most fistulas are managed non-operatively, there are some situations when rapid surgical repair may be necessary. This is due to the fact that 90% of fistulas spontaneously close after five weeks of medical care. Before considering surgical treatment of a fistula, two to three months will be tried, depending on the surgeon.[11] The fistula has enough time to close on its own thanks to this waiting period. Additionally, it lowers surgical correction's morbidity and mortality.

Surgical complications, such enterotomies or intestinal anastomotic dehiscence, are associated with a significant chance of developing an enterocutaneous fistula. Approximately 75% to 90% of ECF arise as iatrogenic complications subsequent to surgical procedures.[12] For small bowel procedures, risk stratification is often divided into surgical (technical) and patient-related factors. Risk factors for ECF during small intestinal surgery including patient characteristics (malnutrition, inflammatory bowel illness, history of radiation, sepsis), surgical variables (stress on anastomosis, intestine injury, inadequate blood supply, mesh), and underlying diseases (Crohn's disease, malignancy, blockage).[13]

The current study is aimed at identifying the risk factors of ECF formation after small bowel surgery.

METHODS

This prospective study was conducted in the Department of Surgery of Shaheed Ziaur Rahman Medical College and Hospital (SZRMCH), Bogura, Bangladesh from January 2015 to January 2017 over a period of 24 months. All the patients who underwent small bowel surgery in the Department of Surgery of SZRMCH during the study period after fulfilling the inclusion and exclusion criteria well included in the study. A purposive sampling technique was used. An ethical clearance was taken from Ethical Clearance Committee of Shaheed Ziaur Rahman Medical College and Hospital to conduct the study. An informed written consent was obtained from all the participants regarding the study procedure.

Inclusion criteria

Patients who underwent bowel repair, resection and anastomosis, patients with age >18 years.

Exclusion criteria

Patient who didn't give informed consent. Patient who was not fit for general anesthesia. Patients underwent large bowel surgery. Patient who underwent gastric surgery.

Both elective and emergency cases were included in the study. All the patients received standard bowel preparation and bacteriological prophylaxis except the emergency cases. The small bowel surgery was done (repair or anastomosis) by polyglactin 3-0 suture by single layer extramucosal interrupted suturing technique. Post-operatively the patients were monitored according to the institutional protocol.

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. Per-operative variables included type of surgery, duration of surgery, mode of surgery (laparoscopic or open), schedule of surgery (emergency or elective). Incidence of ECF and risk factors of ECF were main outcome variable of the study. Besides, type of ECF, complications following ECF, management outcome and mortality data were also extracted.

Statistical Package for Social Science (SPSS) version 26 for windows was used to analyze the data. Associations among qualitative and quantitative variables of various factors were studied by using chi- square test and t-test respectively. Logistic regression analysis was performed to assess the independent relationship between the factors. Categorical variables were presented as frequencies and percentages, continuous variables as mean± standard deviation (SD). A p value <0.05 was considered to be significant.

RESULTS

This prospective observational study was carried out among 150 patients having small bowel surhery who admitted into Department of Surgery, Shaheed Ziaur Rahman Medical College and Hospital (SZRMCH), Bogura, Bangladesh to analyze the risk factors and incidence of ECF after small bowel surgery. Among them, 15 patients (10%) developed ECF following small bowel surgery.

Out of 150 respondents, 38% of the patients were in the age group of 21-30 years of age with a mean of 31.88 ± 10.30 years. Majority (n=120) were males with a male female ratio of 4:1. Most of the respondents were day laborers (34.0%). The greater portion of respondents (n=130) were from lower class while the rest (n=20) were from middle class family. Diabetes mellitus was the most prevalent co-morbidly of the study population (15.0%) followed by hypertension (10.0%). Anaemia was present in 85 patients (57%) while 24% patients (n=36) had low albumin level (Table 1).

Traumatic gut perforation (50.00%) was the most prevalent cause of admission followed by typhoid ulcer (24%) and tubercular ulcer perforation (20%) among the emergency cases (n=100). Intestinal obstruction due to malignancy (n=18) and inflammatory bowel disease (n=14) were the common causes of small bowel surgery in elective cases (50 cases).

Table 1: Demographic variables of the patients.

Variable	Frequency (%)
Age (mean±SD)	31.88±10.30 years
Sex	
Male	120 (80.00)
Female	30 (20.00)
Comorbidity	
Diabetes mellitus	22 (15)
Hypertension	15 (10)
Ischemic heart disease	8 (5.3)
Anaemia	85 (56.67)
Hypo-albuminemia	36 (24.0)
Others	21 (14.0)

Table 2: Disease pattern of the study population.

Disease	Frequency	%
Emergency cases (n=100)		
Traumatic gut perforation	50	50.00
Typhoid ulcer perforation	24	24.00
Tubercular ulcer perforation	20	20.00
Acute intestinal obstruction due to bands and adhesions	6	6.00
Elective case (n=50)		
Small bowel obstruction due to malignancy	18	36.00
Small bowel obstruction due to Inflammatory	14	28.00
Bowel disease (IBD)		
Post-operative adhesions	5	10.00
En bloc resection of other surgeries	10	20.00
Others:	3	6.00

Out of 150 patients. 15 patients developed post-operative ECF. Most of the fistulas were high output fistula involving proximal jejunum and ileum. Most of the ECF developed in the patients who underwent emergency surgery. Among them traumatic gut injury is the most prevalent disease for ECF formation. In elective cases, IBD was the most common disease for ECF formation. Most of the fistula appeared between 7th to 10th post-operative days. All the patient suffered from skin excoriation and variable degrees of electrolyte imbalance.[10] patients underwent conservative management while 33.33% patient underwent early surgical management (Table 3). In the conservative group, after optimization the 4 patients (26.67%) underwent surgical correction after 6 weeks. Rest of the patients had spontaneous fistula closure (n=6). 2 patients developed re-appearance of ECF who suffered from IBD. There was one mortality of the patient who died during hospital stay due to sepsis.

Univariate analysis showed presence of female sex, age >50 years, diabetes mellitus (DM), anaemia, hypoalbuminemia, malignancy, IBD, Tuberculosis, emergency surgery, jejunal surgery risk factors for post-operative ECF formation. However multivariate analysis demonstrated hypoalbuminemia, IBD, emergency surgery were independent predictors of ECF formation after small bowel surgery ($p<0.05$).

Table 3: Different variables of postoperative enterocutanous fistula of the study population.

Variable	Frequency	%
Fistula type		
High output	8	53.33
Low output	7	46.67
Anatomic location		
Jejunum	8	53.33
Ileum	7	46.67
Operation type		
Emergency	10	66.67
Elective	5	33.33
Complication of ECF		
Skin excoriation	15	100
Electrolyte imbalance	15	100
Sepsis	3	20.00
Pulmonary complications	4	26.67
Mode of management		
Conservative	10	66.67
Early surgical	5	33.33
Disease associated with ECF		
Inflammatory bowel disease	5	33.33
Traumatic gut injury	4	26.67
Tuberculosis	3	20.00
Others	3	20.00

Table 4: Risk factors of enterocutanous fistula after small bowel surgery.

Variable	Univariate analysis Odds ratio (OR) (95%CI)	P value	Multivariate analysis Odds ratio (OR) (95%CI)	P value
Presence of anaemia	1.78 (1.46-1.918)	0.002	1.13 (1.08-1.17)	0.184
Female sex	2.13 (2.02-2.31)	0.04	2.08 (1.021-2.124)	0.219
Age >50 years	1.78 (1.58-1.82)	0.002	1.36 (1.24-1.52)	0.487
Diabetes mellitus	1.142 (1.138-1.146)	0.001	1.28 (1.01-1.45)	0.074
Hypoalbuminemia	2.39 (2.16-1.48)	0.042	3.724 (3.716-3.738)	0.001
Malignancy	1.39 (1.22-1.56)	0.001	1.43 (1.20-1.57)	0.143
Inflammatory bowel disease	3.54 (3.24-3.62)	0.001	3.21 (2.41-3.63)	0.001
Emergency surgery	2.18 (2.08-2.32)	0.001	2.542 (2.538-1.751)	0.001
Tuberculosis	1.43 (1.02-1.154)	0.002	1.21 (1.13-1.24)	0.164
Jejunal surgery	1.21 (1.16-1.38)	0.03	1.42 (1.21-1.53)	0.081

DISCUSSION

Gastrointestinal (GI) fistulas represent a significant complication following abdominal surgery. The small intestine is the source of between 34.4% and 65.0% of these fistulas.[14] Intestinal fistula patients need a specialized, multidisciplinary therapy, which sometimes leads to lengthy hospital stays and expensive expenses. Treatment of sepsis, dietary support, fistula output control, and skin care are all part of the conservative initial therapy of intestinal fistulas. 15.6–69.9% of patients respond well to medical treatment.[15] Surgical reconstruction is necessary for patients with persistent intestinal fistulas. Even for skilled surgeons, definitive surgical repair of small intestinal fistulas is still somewhat difficult. 31.0% of patients experience re-fistulation following final surgery. Postoperative mortality ranges from 3.5% to 14%, which is more in developing countries. The aim of the current study was to identify the incidence and factors

associated with ECF formation after small intestinal surgery.[16]

The current study documented an incidence of ECF at 10.00% subsequent to surgical intervention for small intestinal pathology.[17] The presence of ECF was a reflection of the ongoing problem with ECF in abdominal surgery, especially in settings with limited resources when wound care and close nutrition assistance may be insufficient.

Despite advancements in medical care, an estimated 75%–85% of enterocutaneous fistulas are postoperative complications resulting from intestinal injury caused by unintentional enterotomy and/or anastomotic leaking, and 30%–80% eventually require surgical repair. It has been demonstrated that serum albumin levels are an important predictor of intestinal fistula repair.[18] Lu et al found a significant correlation between enteric fistula healing/recovery and a higher serum albumin level (p=0.029) and a lower fistula drainage amount (<500 ml/d) (p=0.013) following multivariate analysis in a retrospective chart review of 53 GI cancer patients with postoperative enteric fistula complications.[19] Furthermore, more than 90% of fistulas completely cured with conservative therapy following total parenteral nutrition (TPN) in patients with both rising albumin levels and less than 500 ml/d of fistula drainage.[20] In the current study, serum albumin level proved to be an significant factor for postoperative complications like ECF (OR: 3.724, 95%CI: 3.716-3.738, p=0.001).

Both Crohn's disease (CD) and ulcerative colitis (UC) are classified as inflammatory bowel disease having autoimmune origin. Because of persistent inflammatory damages to the gut wall, it frequently results in spontaneous fistulas particularly in Crohn's disease, which is a significant risk factor for enterocutaneous fistulas (ECFs). Malnutrition, infection, previous abdominal surgeries (high-risk for leaks), and the requirement for complicated reconstructive surgery are additional major hazards for IBD patients acquiring ECFs. Besides smoking significantly increases the chance of recurrence.[21] In our study we also found IBD is an independent predictor of ECF formation after small intestinal surgery (OR: 3.21, 95%CI: 2.41-3.63, p=0.001).

Surgical complications account for around 80% of ECFs, with emergency procedures being far riskier than elective ones.[22] ECFs are more common in patients undergoing emergency gastrointestinal surgery because of things like malnourishment, pre-existing sepsis, and the incapacity to do routine preoperative bowel preparation. After emergency procedures for intestinal blockages (40%) and enteric perforations (28%), fistulas frequently form. Following emergency surgery, ECF is linked to a mortality incidence of 10.1% (compared to 5.4% in elective cases) and a markedly increased risk of readmission to the hospital within 90 days.[23] In the current study emergency surgery was risk factor for ECF which was statistically significant (p<0.05). Besides there was one mortality who underwent emergency surgery showing similarities with previous studies.

Most of the patient in our study underwent conservative approach which includes proper enteral feeding, infection control, and routine monitoring, may be successful. In some individuals, this method prevented needless surgical procedures by allowing the fistulas to heal on their own. However, it was found that each person's rate of spontaneous healing varied greatly, suggesting that patients who are candidates for this therapeutic approach must be carefully chosen.[24] The ideal timing of definitive surgery for enterocutaneous fistulas remains unclear. Brenner et al. showed that operations performed before the 6th week or between the 13th and 36th weeks after fistula formation were associated with the lowest recurrence rates (8% and 10%, respectively), whereas no fistula recurrence was observed if surgical intervention took place within the first 2 weeks.[25] In our study most of the patients (66.67%) underwent conservative management and had delayed surgery after 6 weeks which coincide with previous studies.

The present study had some limitations. The study had a small sample size which was conducted over a brief period of time. Besides, it was single center study. Further large-scale multicenter study should be conducted for better management.

CONCLUSION

The current study demonstrated hypoalbuminemia, emergency surgery and inflammatory bowel disease is an independent predictor of post-operative ECF development after small intestinal surgery. All surgeon should consider these predictors while performing small intestinal surgery in order to prevent postsurgical ECF. Lastly careful selection meticulous judgement, prompt recognition and multidisciplinary approach is the key to reduce the burden of ECF in the patients postoperatively.

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