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RESEARCH ARTICLE

Our Surgical Experience and Clinical Results in Non-traumatic Small Bowel Perforations

Non-travmatik İnce Bağırsak Perforasyonlarında Cerrahi Deneyimlerimiz ve Klinik Sonuçlarımız

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ABSTRACT

Aim: In this study, we aimed to share our surgical experiences and clinical results in non-traumatic small bowel perforations.

Method: Patients who underwent surgical treatment for non-traumatic small bowel perforation between 2009-2019 were included in the study. Patients were divided into two groups according to postoperative 90-day mortality status: Group 1 (no mortality), Group 2 (mortality). The demographic, clinical features, treatment methods and results of the patients were compared between the groups.

Results: Forty-two patients participated in our study. Group 1 consisted of 25, and Group 2 consisted of 17 patients. Male sex was dominant in Group 2 (48% vs 76.5%, p=0.062). Mean age was higher in Group 2 (54 vs 61, p=0.218). American Anesthesiology Association score (ASA) was statistically significantly higher in Group 2 (12% vs 58.8%). Forty-two percent of patients had abdominal surgery and 30% had a history of malignancy. The presence of electrolyte imbalance was similar in the groups (56% vs 76.5%, p=0.049). The days between the first complaint and laparotomy were similar between the groups (6.40 vs. 5.70 p=0.699). In perforated areas, jejunum was dominant in Group 2 with 64.7%, and ileum in Group 1 with 68%. The multiple perforation rate was higher in Group 2, but was not statistically significant (12% vs 23.5%, p=0.284). From postoperative complications, anastomosis leakage was higher in Group 1, but it was not statistically significant (12% vs 5.9%, p=0.501).

Conclusion: Morbidity and mortality of non-traumatic small bowel perforations is high. While the ASA score and hypoalbuminemia were associated with postoperative mortality in non-traumatic small bowel perforations, we did not find the localization of the perforation and the time between the first complaint and laparotomy to be related to mortality.

Keywords: Hypoalbuminemia, mortality, resection, small bowel perforation, stoma

ÖZ

Amaç: Bu çalışmada non-travmatik ince bağırsak perforasyonlarındaki cerrahi deneyimlerimizi ve klinik sonuçlarımızı paylaşmayı amaçladık.

Yöntem: 2009-2019 yılları arasında non-travmatik ince bağırsak perforasyonu nedeniyle cerrahi tedavi uyguladığımız hastalar çalışmaya dahil edildi. Hastalar postoperatif 90 günlük mortalite durumuna göre iki gruba ayrıldı: Grup 1 (mortalite yok), Grup 2 (mortalite var). Gruplarda hastaların demografik, klinik özellikleri, labarotuvar parametreleri, uygulanan tedavi yöntemleri ve sonuçları karşılaştırıldı.

Bulgular: Çalışmamıza 42 hasta dahil edildi. Grup 1: 25, Grup 2: 17 hastadan oluşuyordu. Grup 2'de erkek cinsiyet baskındı (%48 vs %76,5 p=0,062). Grup 2'de yaş daha büyük (54 vs 61 p=0,218). Grup 2'de Amerikan Anesteziyoloji Derneği sınıflandırması, sınıflandırması (ASA) istatistiksel olarak anlamlı ölçüde daha yüksekti (%12 vs %58,8). Hastaların %42'sinde geçirilmiş batın cerrahisi, %30'unda malignite öyküsü vardı. Elektrolit imbalansı varlığı gruplarda benzerdi (%56 vs %76,5 p=0,049). İlk şikayet ile laparotomi arasındaki süre gruplar arasında benzerdi (6,40 vs 5,70 p=0,699). Perforasyon alanı açısından Grup 2'de jejunum %64,7 Grup 1'de ileum %68 ağırlıktaydı. Multiple perforasyon oranı Grup 2'de daha fazla idi fakat istatistiksel olarak anlamlı değildi (%12 vs %23,5 p=0,284). Postoperatif komplikasyonlardan anastomoz kaçağı Grup1'de daha fazla ancak istatistiksel olarak anlamlı değildi (%12 vs %5,9 p=0,501).

Sonuç: Non-travmatik ince bağırsak perforasyonlarının morbidite ve mortalitesi yüksektir. Travmatik olmayan ince barsak perfosyonlarında ASA skoru ve hipoalbunemi postoperatif moratalite ile ilişkili iken perforasyonun lokalizasyonu ve ilk şikayet ile laparotomi arası süreyi mortalite ile ilişkili bulmadık.

Anahtar Kelimeler: Hipoalbunemi, mortalite, rezeksiyon, ince bağırsak perfosyonu, stoma

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Introduction

Although small bowel perforations, which are generally caused by non-traumatic reasons, are considered spontaneous, some call this condition as non-traumatic small bowel perforations. Non-traumatic perforation of the small intestine is an emergency that surgeons often encounter in developing countries.[1]

The most common causes include various malignancies, infections, non-specific inflammation and, in children, necrotising enterocolitis.[2,3] The causes of non-traumatic perforation of the small intestine in developing countries are different from those observed in developed countries. While malignancies and inflammatory bowel disease are the most common aetiological factors in western populations, infections and typhoid fever are the leading causes in developing countries.[4,5]

Rapid diagnosis is vital in these patients to achieve the best possible outcome. Unfortunately, non-specific clinical and laboratory findings associated with the underlying disease cause a delay in diagnosis. Patients often apply to the hospital late with purulent peritonitis and poor general condition.[2,6] Although radiological imaging procedures help diagnosis, early diagnosis is low, and most cases are diagnosed during laparotomy.[7]

Primary repair or resection-anastomosis is surgical procedures performed with or without ileostomy depending on the disease's cause and the degree of peritoneal contamination. Despite advances in surgical techniques and improved intensive care conditions, non-traumatic small bowel perforation mortality remains high, and some report a mortality rate of up to 42%.[8,9]

In this study, we aimed to group patients who underwent surgical treatment in our clinic for non-traumatic small bowel perforation according to mortality and presented our own experiences in light of the literature.

Materials and Methods

Patients who underwent surgical treatment due to small bowel perforation between 2009 and 2019 were included in the study. Patients with duodenal ulcer perforations, traumatic small bowel perforations and missing medical records were excluded. A common database was created by examining patient files and hospital information system records. Patients were analysed retrospectively using this database.

Patients were divided into two groups according to their postoperative 90-day mortality status: Group 1 (no mortality) and Group 2 (mortality).

Demographic and clinical features of patients, their presenting complaints, the time between the first complaint and the laparotomy, American Anesthesiology Association score (ASA), laboratory findings, presence of electrolyte imbalance, immunosuppression history, history of abdominal surgery, presence of malignancy, inflammatory bowel disease, the location and number of the perforated areas, the type of surgery and anastomosis performed, additional organ resection, length of hospital stay and postoperative complications were compared between the groups.

The surgical procedure was decided according to the patient's haemodynamic parameters and the findings during the operation.

Anastomosis leak was defined as a disruption in the integrity of the anastomosis documented by the combination of clinical, radiological and operative tools. Wound infection was defined as a superficial or deep incisional surgical site infection occurring in the surgical wound, according to the definition of the Centers for Disease Control.[10]

Statistical Analysis

SPSS 23.0 package programme was used for statistical analysis of the data. Categorical measurements were summarised as numbers and percentages, and continuous measurements as mean and standard deviation (median and minimum-maximum, where necessary). Pearson's chi-square test was used to compare categorical variables. In comparing the groups' continuous measurements, the distributions were checked, and an independent Student t-test was used for binary variables. The statistical significance level was accepted as 0.05 in all tests.

Results

Forty-two patients participated in our study. Group 1 consisted of 25, and Group 2 consisted of 17 patients. The male sex was dominant in Group 2 (48% vs 76.5%, p=0.062). The mean age was higher in Group 2 (54 vs 61 years, p=0.218). Patients with ASA 3 score was statistically significantly higher in Group 2 (12% vs 58.8%). A history of immune suppression (p=0.433), previous abdominal surgery (p=0.310), history of malignancy (p=0.065) and type (p=0.0320), number of comorbid diseases (p=0.883), presenting complaint (p=0.448) and inflammatory bowel disease (p=0.200) between the groups. Demographic and clinical characteristics are shown in Table 1.

The albumin value was lower in Group 2 (3.05 vs 2.53, p=0.049). The presence of electrolyte imbalance was similar in the groups (56% vs 76.5%, p=0.049). Other laboratory parameters were similar. Laboratory parameters are shown in Table 2.

The days between the first complaint and laparotomy were similar between the groups (6.40 vs 5.70 days, p=0.699). In

the perforated areas, the jejunum was dominant in Group 2 with 64.7%, and the ileum in Group 1 with 68%. The multiple perforation rate was higher in Group 2 but was not statistically significant (12% vs 23.5%, p=0.284). The surgical techniques (p=0.366) and anastomosis techniques (p=0.635) applied were similar. From postoperative complications, anastomosis leakage was higher in Group 1, but it was not statistically significant (12% vs 5.9%, p=0.501). Intraoperative and postoperative outcomes are shown in Table 3.

Discussion

Spontaneous small bowel perforations are rare but essential because of their high morbidity and mortality rates. Currently, it remains an important problem in clinical, surgical practice.

Today, treatment results of non-traumatic small bowel perforation cases are better than in the last decade, due to improvements in imaging methods, surgical techniques and intensive care conditions. Although the mortality rate of small bowel perforation has decreased from 40% to 20%, it remains high.[8,9,10,11] The most commonly blamed

Table 1. Demographic and clinical characteristics

Mean ± SD		Group 1 (n=25) Mean ± SD	Group 2 (n=17)	p
Sex	Male	12 (48.0)	13 (76.5)	0.062
	Female	13 (52.0)	4 (23.5)	
Age (years)		54.08±21.24	61.47±14.30	0.218
ASA	1	11 (44.0)	4 (23.5)	0.005*
	2	11 (44.0)	3 (17.6)	
	3	3 (12.0)	10 (58.8)	
Immunosuppression history		7 (28.0)	6 (35.3)	0.433
Previous abdominal surgery		12 (48.0)	6 (35.3)	0.310
History of malignancy		5 (20.0)	8 (47.1)	0.065
Type of malignity	Lung	1 (4.0)	2 (11.8)	0.320
	Colon	2 (8.0)	4 (23.5)	
	Stomach	0 (0.0)	1 (5.9)	
	Ovary	1 (4.0)	0 (0.0)	
	Rectum	1 (4.0)	1 (5.9)	
	None	20 (80.0)	9 (52.9)	
Comorbid disease	Multiple	6 (24.0)	5 (29.4)	0.883
	Single	9 (36.0)	5 (29.4)	
	None	10 (40.0)	7 (41.2)	
Presenting complaint	Diarrhoea	0 (0.0)	1 (5.9)	0.448
	Abdominal pain	13 (52.0)	11 (64.7)	
	Abdominal pain and constipation	7 (28.0)	2 (11.8)	
	Abdominal pain and vomiting	4 (16.0)	3 (17.6)	
	Abdominal pain and nausea	1 (4.0)	0 (0.0)	
Inflammatory bowel disease history		3 (12.0)	0 (0.0)	0.200

ASA: American Anesthesiology Association score, SD: Standard deviation

reason for the poor outcomes is the late presentation to the hospital.[9,12] Early diagnosis is a critical factor in morbidity and mortality. The delay in surgical treatment worsens electrolyte imbalance and systemic toxaemia due to the rapid progression of peritonitis.[13] The study of Ben-Baruch et al.[14] found that mortality rates were as low as 7.1%. It should be considered that 78.5% of the patients in the study were operated on within the first 24 hours after the onset of their symptoms. In our study, admission time to the hospital was not related to mortality.[14]

In the Uzunoglu et al.[2] study series of spontaneous small bowel perforations, the most common admission types were

Table 2. Laboratory parameters

	Group 1 (n=25) Mean ± SD	Group 2 (n=17) Mean ± SD	p
WBC (mm^3/L)	13.03±4.73	12.55±10.21	0.840
Neutrophil (mm^3/L)	10.80±4.85	10.96±9.48	0.943
Lymphocyte (mm^3/L)	1130.40±637.19	978.23±753.60	0.485
Platelet (mm^3/L)	339.08±123.81	282.41±191.42	0.250
Haemoglobin (g/dL)	11.99±2.66	12.61±2.94	0.482
Albumin (g/dL)	3.05±0.84	2.53±0.79	0.049*
Electrolyte imbalance	14 (56.0)	13 (76.5)	0.151

WBC: White blood cell, SD: Standard deviation

Table 3. Intraoperative and postoperative outcomes

		Group 1 (n=25) Mean ± SD	Group 2 (n=17) Mean ± SD	p
Days between first complaint and laparotomy		6.40±6.44	5.70±4.26	0.699
Hospital stay (days)		33.41±41.74	11.94±9.71	0.045*
Perforated area localisation	Ileum	17 (68.0)	6 (35.3)	0.054
	Ileum + colon	1 (4.0)	0 (0.0)	
	Jejunum	7 (28.0)	11 (64.7)	
Perforation	Single	22 (88.0)	13 (76.5)	0.284
	Multiple	3 (12.0)	4 (23.5)	
Performed surgery	Resection + anastomosis	5 (20.0)	5 (29.4)	0.366
	Resection + stoma	20 (80.0)	12 (70.6)	
Anastomosis technique	Hand-sewn	2 (8.0)	3 (17.6)	0.635
	Stapler	3 (12.0)	2 (11.8)	
	None	20 (80.0)	12 (70.6)	
Additional organ resection	Colon	4 (16.0)	1 (5.9)	0.315
	None	21 (84.0)	16 (94.1)	
Postoperative complication	Anastomosis leakage	3 (12.0)	1 (5.9)	0.501
	Acute kidney failure	1 (4.0)	1 (5.9)	
	Wound site infection	5 (20.0)	1 (5.9)	
	None	16 (64.0)	14 (82.4)	

SD: Standard deviation

abdominal pain (100%), vomiting (76%) and constipation (31%). In their series, 28% of patients had a history of abdominal surgery, and 42% had comorbid diseases. In 88% of patients, there was a perforation in one area, and ileal perforation rate was higher (71%). In their series, the primary repair rate was 11%, resection-anastomosis rate was 62% and resection stoma rate was 26%.[2] The rate of abdominal surgery in our series was similar to that in the literature. In our series, 60% of patients had another disease. Almost all our patients presented with abdominal pain, typically accompanied by constipation and vomiting, similar to the literature. Perforated areas were dominated by the ileum, similar to the literature; however, the jejunum was predominant in patients with mortality. Our perforations frequently developed from a single region. In the decision of the surgical procedure, we considered the aetiology and degree of peritoneal contamination. We did not perform anastomosis on many patients after resection. We associated this with the degree of peritonitis due to patients' admission to the hospital with an average delay of six days. We also attributed the high rate of anastomosis leakage to patients' late admission, low albumin values, comorbid diseases and electrolyte imbalance. The development of postoperative complications did not increase patient mortality. We linked our low hospital stay in the mortality group to the mortalities developing due to early term sepsis.

Albumin is known as a nutritional marker, representing malnutrition in patients. It is also known that albumin is a negative acute phase protein. Therefore, hypoalbuminaemia represents the patient's increased inflammatory state.[15] In a series of 204,819 cases, 25.4% of whom had major cardiovascular surgery, 19.0% had orthopaedic surgery and 55.6% had oncological surgery, mortality rates were approximately four times higher (3.81% vs 0.87%; p<0.001) in the hypoalbuminaemia cohort.[16] Our series supported the literature, and the albumin level was lower in the mortality group.

Inflammatory bowel diseases, such as Crohn's disease and ulcerative colitis, can lead to a perforation in the gastrointestinal tract. Crohn's disease is typically a chronic disease that involves transmural inflammation of the intestinal wall. As a result of Crohn's disease, intestinal perforation usually occurs during an acute exacerbation. Perforation in Crohn's disease continues to be an ongoing cause of acute surgical intervention. Perforation of the small or large intestine secondary to Crohn's disease requires resection, primary anastomosis, or stoma.[17] In our series, three patients had a history of Crohn's disease.

Tan et al.[11] found that ASA 3-4 scores were associated with postoperative poor results and mortality in a far-east study. They evaluated the factors related to morbidity and mortality in small bowel perforations.[11] It was expected that mortality would be more common in patients with various comorbid diseases, immunosuppression and malignancy and high ASA scores.

Study Limitations

Our study's most important limitations were that it was a single centre study and had a retrospective design. However, considering the low incidence of spontaneous small bowel perforations, our series was more extensive.

Conclusion

Patient mortality from spontaneous small bowel perforations was due to the other diseases of the primary patient and the albumin level before the operation. The surgical technique, the perforation location and the time of admission to the hospital did not increase mortality.

Ethics

Ethics Committee Approval: We did not receive an ethics committee approval because the study is retrospective.

Informed Consent: Because the study was retrospective, we could not get informed consent.

Peer-review: Externally and internally peer reviewed.

Authorship Contributions

Surgical and Medical Practices: F.D., E.M.S., T.B.A., G.K.B., M.A., Concept: F.D., U.T., E.M.S., T.B.A., M.A., Design: F.D., U.T., E.M.S., T.B.A., M.A., Data Collection or Processing: E.M.S., G.K.B., Analysis or Interpretation: E.M.S., G.K.B., M.A., Literature Search: F.D., U.T., E.M.S., Writing: F.D., U.T., E.M.S., M.A.

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References

1. Karbhari SS, Hosamani V, Dhaded RB. An overview of management of small intestinal perforation. J Evolution Med Dent Sci 2014;70:14883-14889.
2. Uzunoglu MY, Altintoprak F, Dikicier E, Zengin I. Treatment results of small bowel perforations due to unusual causes. PaK J Med Sci 2018;34:974-977 .
3. Khan RA, Narasimhan KL. Spontaneous intestinal perforation. Ann Ital Chir 2012;83:437-439.
4. Eid HO, Hefny AF, Joshi S, Abu-Zidan FM. Nontraumatic perforation of the small bowel. Afr Health Sci 2008;8:36-39.
5. Freeman HJ. Spontaneous free perforation of the small intestine in adults World J Gastroenterol 2014;20:9990-9997.
6. Türkoğlu A, Ülger B, Uslukaya Ö, Oğuz A, Zengin Y, Taş İ. Patient management and clinical outcomes in non-traumatic small bowel perforations. J Clin Exp Invest 2015;6:130-134.

7. Yusif-Zada K, Safarov R, Gafarov A. Isolated small bowel perforation following blunt abdominal trauma. Ann Ital Chir 2013;84:699-703.
8. Eid HO, Hefny AF, Joshi S, Abu-Zidan FM. Non-trau¬matic perforation of the small bowel. Afr Health Sci 2008;8:36-39.
9. Akyildiz HY, Akcan AC, Sözüer E, Küçük C, Yilmaz N, Artiş T. Unusual causes of intestinal perforation and their surgical treatment. TJTES 2009;15:579-583.
10. American College of Surgeons. User Guide for the 2012 ACS NSQIP participant use data file. Chicago: American College of Surgeons; 2013. Available from: https://www.facs.org/-/media/files/quality-programs/nsqip/ug12.ashx
11. Tan KK, Bang SL, Sim R. Surgery for small bowel perforation in an Asian population: predictors of morbidity and mortality. J Gastrointest Surg 2010;14:493-499.
12. Sefr R, Rotterova P, Konency J. Perforation peritonitis in primary intestinal tuberculosis. Dig Surg 2001;18:475-479.
13. Ara C, Sogutlu G, Yildiz R, Kocak O, Isik B, Yilmaz S, Kirimlioglu V. Spontaneous small bowel perforations due to intestinal tuberculosis should not be repaired by simple closure. J Gastrointest Surg 2005;9:514-517.
14. Ben-Baruch D, Powsner E, Wolloch Y, Dintsman M. Free perforation of small intestine in adults. Panminerva Med 1990;32:67-70.
15. Kim S, McClave SA, Martindale RG, Miller KR, Hurt RT. Hypoalbuminemia and clinical outcomes: what is the mechanism behind the relationship?. Am Surg 2017;83:1220-1227.
16. Meyer CP, Rios-Diaz AJ, Dalela D, Ravi P, Sood A, Hanske J, Chun FKH, Kibel AS, Lipsitz SR, Sun M, Trinh QD. The association of hypoalbuminemia with early perioperative outcomes–a omprehensive assessment across 16 major procedures. Am J Surg 2017;214:871-883.
17. Brown CV. Small bowel and colon perforation. Surg Clin North Am 2014;94:471-475.