

Factors Associated with Morbidity and Mortality in Patients with Mechanical Bowel Obstruction

Mekanik Barsak Tıkanıklığı Olan Hastalarda Morbidite ve Mortalite ile İlişkili Faktörler

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Abstract

Objective: The aim of this study was to investigate the factors affecting morbidity and mortality by evaluating the demographical, etiological and clinical characteristics of patients with mechanical bowel obstruction.

Materials and Methods: Data for 171 mechanical bowel obstruction patients were evaluated retrospectively. The patients were assessed in mortality (n=21), morbidity (n=55) and recovery (n=95) groups.

Results: Of the patients, 70% were men; and 27.4% were ≥55 years of age. While gender had no impact on mortality and morbidity, age did. Adhesion was observed to be the leading cause (45.6%) of mechanical bowel obstruction, followed by incarcerated hernia in 17.5%. Intestinal necrosis was associated with mortality but not with morbidity. Late presentation and multiple concomitant diseases had no impact on mortality but were associated with morbidity. The presence of a concomitant disease and leukocytosis or leukopenia had a significant impact on both mortality and morbidity.

Conclusion: Older age and presence of a concomitant disease, leukocytosis or leukopenia were established to be associated with mortality and morbidity. Late presentation and multiple concomitant diseases were associated only with morbidity. The presence of intestinal necrosis was associated only with mortality. Establishing the risk factors well will be beneficial in lowering the incidences of morbidity and mortality. (*JAEM 2012; 11: 1-5*)

Key words: Mechanical bowel obstruction, risk factor, morbidity, mortality

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Özet

Amaç: Mekanik barsak tıkanıklığı tanısı konulmuş hastalarda demografik, etiyolojik ve klinik özellikler değerlendirilerek morbidite ve mortaliteyi etkileyen faktörlerin araştırılması amaçlandı.

Gereç ve Yöntemler: Mekanik barsak tıkanıklığı tanısı alan 171 hastanın bilgileri retrospektif olarak değerlendirildi. Hastalar; mortalite grubu (n=21), morbidite grubu (n=55) ve şifa grubuna (n=95) ayrılarak değerlendirildi.

Bulgular: Hastaların %70'i erkek olup, %27.4'ü ≥55 yaş idi. Cinsiyetin mortalite ve morbiditeye etkisi anlamlı bulunmazken ileri yaştan etkisi anlamlı bulundu. Yapışıklık en fazla (%45.6) görülen mekanik barsak tıkanıklığı nedeni idi, bunu %17.5 ile inkarsere herni takip etti. Barsak nekrozu mevcudiyeti, mortalite grubu için anlamlı iken, morbidite grubu için anlamlı bulunmadı. Geç başvuru ve birden fazla ek hastalık bulunması mortalite grubu için anlamsız iken morbidite grubu için anlamlı bulundu. Ek hastalık mevcudiyeti ve lökositoz veya lökopeni varlığı mortalite ve morbidite grubu için istatistiksel olarak anlamlı idi.

Sonuç: Mekanik barsak tıkanıklığı olan hastalarda ileri yaş, ek hastalık, lökositoz veya lökopeni mevcudiyeti yüksek mortalite ve morbidite ile ilişkili iken geç başvuru ve birden fazla ek hastalık mevcudiyeti yalnızca morbidite ile ve barsak nekrozu varlığı yalnızca mortalite ile ilişkili bulunmuştur. Risk faktörlerinin iyi bilinmesi morbidite ve mortaliteyi azaltmada etkili olacaktır. (*JAEM 2012; 11: 1-5*)

Anahtar kelimeler: Mekanik barsak tıkanıklığı, risk faktörü, morbidite, mortalite

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Introduction

Acute mechanical bowel obstruction is a common condition among surgical emergencies. It has high morbidity and creates a major burden financially due to its recurrent nature. Natural progression and risk factors of bowel obstruction have not been clearly defined, and the surgical approach to be adopted, timing of the intervention and procedures for preventing relapses are still issues that are being debated (1). The causes and therapeutic approaches

of bowel obstruction vary (2). Previous studies carried out in different parts of Turkey reported that, although an increase was observed in the incidence of post-surgical adhesion related bowel obstruction in socioeconomically developed regions, incarcerated hernia was still the leading cause of bowel obstruction (3-6). Development of effective medical and surgical therapeutic approaches, combined with better diagnostic tests, have contributed significantly to the decrease in the incidence of complications and mortality and morbidity rates in patients with bowel obstruction (7, 8). The purpose of the present

study was to investigate the factors with an impact on morbidity and mortality by evaluating the demographical characteristics, etiological factors and clinical characteristics of the patients diagnosed with mechanical bowel obstruction.

Materials and Methods

Data were evaluated retrospectively for 171 patients operated on with the diagnosis of acute mechanical bowel obstruction at the Department of Emergency Medicine, Dicle University Faculty of Medicine between 1 January 2001 and 31 December 2004. The information regarding age, gender, symptoms, vital signs, laboratory results, air-fluid level in both erect and supine abdominal x-ray, existing concomitant systemic diseases, time elapsed from the onset of symptoms to presentation at the emergency clinic, time elapsed from presentation to surgery, history of surgery, cause of mechanical bowel obstruction, presence of intestinal necrosis, complications that developed and the outcome were recorded on standard forms. Patients were excluded from the study if their information was incomplete or they were diagnosed as paralytic ileus and treated by non-surgical methods. The patients were classified into three groups. Group 1: The mortality group (n=21) who died as a result of systemic complications; Group 2: The morbidity group (n=55) who experienced either systemic or local complications (i.e., pulmonary, renal, cardiac, neurological complications, septicemia and surgical site infections); Group 3: The recovery group, consisting of patients discharged without developing complications (n=95). Statistical analysis was carried out for the patient groups in terms of age (≥ 55 years), gender (male/female), tachycardia (≥ 100 beats per minute), hypertension (systolic blood pressure ≥ 140 mmHg), hypotension (systolic blood pressure ≤ 90 mmHg), fever ($\geq 38^\circ\text{C}$), leukocytosis (white blood cell $\geq 12000/\text{mm}^3$), leukopenia (white blood cell $\leq 4000/\text{mm}^3$), anemia (hematocrit $\leq 25\%$), hyponatremia ($\text{Na} \leq 135$ mEq/L), hypernatremia ($\text{Na} \geq 145$ mEq/L), hyperuremia (urea ≥ 100 mg/dL), hypercreatininemia (creatinine ≥ 3 mg/dL), late presentation (≥ 72 h after the onset of symptoms) and extended preoperative period (≥ 48 h after presentation at hospital).

Univariate analyses were performed for the risk factors that could have an impact on mortality and morbidity in Group 1 and Group 2. Multivariate analyses were carried out for the parameters established to be significant as a result of univariate analysis in terms of mortality. Univariate analyses were carried out with chi-square test

for categorical variables, and with student's t test for continuous variables. The Backward Stepwise Wald Logistic Regression method was employed in multivariate analyses to establish the effect of several factors on morbidity or mortality, including laboratory results related to leukopenia or leukocytosis, anemia, hyperuremia, hypercreatininemia, and the presence of hypertension, or intestinal necrosis, or concomitant disease. Statistical significance was set at $p < 0.05$.

Results

Of the 171 patients enrolled, the surgical interventions were performed by ostomy in 69.6% (n=119) and both resection and primary anastomosis in 30.4% (n=52). The overall mortality was observed in 12.3% (n=21) (Group 1) and morbidity was observed in 32.2% (n=55) (Group 2). The remaining 55.5% (n=95) of the patients (Group 3) recovered and were discharged without any complications. Of the patients, 119 (70%) were men, 52 (30%) were women, with a mean age of 66.0 years (age range: 14-86 years) in Group 1, 66.4 years (age range: 37-95 years) in Group 2 and 39.5 years (age range: 36-90 years) in Group 3. There were 47 (27.4%) patients who were aged ≥ 55 years. While gender was not established to be associated with mortality and morbidity, and older age was significantly associated with both mortality and morbidity. The patient groups with respect to gender and age are given in Table 1. Of the patients, 79 (52.6%) had a concomitant disease, 39 (22.8%) had necrosis, 14 (8.2%) had more than one concomitant disease, 90 (52.6%) had presented late, 12 (7.0%) had hypotension, 40 (23.4%) had hypertension and 28 (16.4%) had tachycardia. Having a concomitant disease was established to be statistically significant in terms of mortality and morbidity. The presence of necrosis, hypotension or tachycardia was observed to have a significant impact on the mortality group but had no significance for the morbidity group. The presence of more than one concomitant disease, late presentation or hypertension had no impact on mortality but had significance in terms of morbidity. Of the patients, 81 (47.4%) had leukocytosis or leukopenia, 8 (4.7%) had anemia, 18 (10.5%) had hyperuremia and 9 (5.3%) had hypercreatininemia. Laboratory results and clinical features are summarized in Table 2 with respect to the groups. Having leukocytosis or leukopenia was established to be significantly associated with mortality and morbidity. On the other hand, anemia, hyperuremia and hypercreatininemia were significantly associated with mortality but not with morbidity. Presence of fever, hyponatremia,

Table 1. Clinical and demographic characteristics of patients with respect to groups

Variable	Group 1 n (%)	Group 2 n (%)	Group 3 n (%)	Group 1 p	Group 2 p
Gender					
Female	6 (28.6)	16 (29.0)	30 (31.6)	0.893	0.885
Male	15 (71.4)	39 (71.0)	65 (68.4)	0.893	0.885
≥ 55 years of age	18 (85.7)	9 (16.4)	20 (21.0)	<0.001	<0.001
Concomitant disease	18 (85.7)	38 (69.1)	23 (24.2)	<0.001	<0.001
Necrosis	14 (66.7)	16 (29.1)	9 (9.5)	<0.001	0.177
Multiple concomitant diseases	3 (14.3)	11 (20.0)	0 (0.0)	0.340	<0.001
Late presentation	15 (71.4)	36 (65.4)	39 (41.0)	0.065	0.021
Hypotension	7 (33.3)	3 (5.4)	2 (2.1)	<0.001	0.582
Hypertension	6 (28.6)	23 (41.8)	11 (11.6)	0.549	<0.001

hypernatremia, hypopotassemia or hyperpotassemia as well as air-fluid level in upright plain abdominal x-ray, rebound tenderness, vomiting and extended preoperative period were not established to have a significant effect on morbidity or mortality ($p>0.05$). Multivariate analyses by employing Backward-Wald logistic regression method were performed for older age, hypotension, tachycardia, leukocytosis or leukopenia, anemia, hyperuremia, hypercreatininemia, concomitant disease and necrosis, which were established to be associated significantly with mortality as a result of univariate statistical analyses; as well as for older age, hypertension, leukocytosis or leukopenia, concomitant disease, multiple concomitant disease and late presentation, which were established to be associated significantly with morbidity in the univariate statistical analyses. The data established to be significant with respect to mortality and morbidity are presented in Tables 3 and 4. The most common cause of mechanical bowel obstruction was established to be adhesion with 45.6% ($n=78$), followed by incarcerated hernia with 17.5% ($n=30$). Moreover, intra-abdominal malignant disease and adhesion were the leading causes of mortality with 61.9% and morbidity with 50.9% in patients with mechanical bowel obstruction, respectively. The causes of bowel obstruction according to the groups are given in Table 5. Among all the patients, 105 (61.4%) had a history of one or more abdominal operations. While appendectomy was the most common type with 14.0% ($n=24$), colorectal surgery was in the second place with 9.4% ($n=16$). The third most common type was genitourinary surgery with 7.6% ($n=13$). The other previous surgeries were small bowel with 7% ($n=12$), hernia with 6.4% ($n=11$), hepatobiliary with 5.3% ($n=9$), gastroduodenal with 4.1% ($n=7$), and multiple surgeries with 7.6% ($n=13$). While 55.5% of the patients were observed with no complications, 44.5% had developed at least one. The most common complications observed were those of the respiratory system (pneumonia, atelectasia, empyema, etc), noted in 15.8% of the patients. Cardiac complications such as dysrhythmias, myocardial infarction, heart failure, and shock were the second most common type, which were observed in 8.8% of the patients (Table 6). The common cause of mortality in patients with mechanical bowel obstruction resulted from multiple complications (i.e., cardiopulmonary failure).

Discussion

There is limited information regarding the factors that have an impact on morbidity and mortality in patients undergoing therapy due to acute mechanical bowel obstruction. Patient-related factors such as age, concomitant disease, necrosis of the bowels and delayed therapy were associated with mortality in previous studies (9-12). Fevank et al. (13) reported age to be the most significant factor in terms of death and complications. The study demonstrated that, while the rate of complications was 12.0% in patients under the

age of 50 years, it was 23.0% for patients between 50 and 75 years of age, rising to 38% for those over the age of 75 years. Furthermore, a significant correlation was reported between age and concomitant disease; and 52.0% of the patients over the age of 75 years, 36.0% of the patients between the ages of 50 and 75 years, and 11.0% of the patients under the age of 50 years were observed with concomitant diseases. It has been reported that the rate of complications in patients with mechanical intestinal obstruction was 21.0% under the age of 50 years, 32.9% between the ages of 50 and 75 years, and 88.2% over the age of 75 years. The risk of complications was established to be 28 times higher in patients over the age of 75 years, as compared to that in younger patients. However, age was not established to have a significant impact on mortality (9). In the present study, 88.7% of the patients with mortality and 16.4% of the patients with morbidity were over the age of 55 years; and 79.5% of the patients in that age group were observed with concomitant systemic diseases. Older age was established to be correlated with morbidity and mortality in this study, consistent with the results in the literature. We maintained that the elevated incidence of concomitant systemic diseases and complications developing secondary to those conditions, combined with poorer resistance mechanisms in older people, could be accountable for that result.

It has been reported that the presence of a concomitant disease increased the risk of complications by 1.7 times (13). Uludag et al. (9) stated that 48.0% of the patients in their study were established with one or more concomitant systemic disease; and that the patients with concomitant systemic diseases were 4.5 times more likely to develop complications. In this study, 85.7% of the mortality group and 69.1% of the morbidity group were observed with a concomitant systemic disease; and the impact of concomitant systemic disease on morbidity and mortality was established to be statistically significant.

Table 3. Risk factor analysis in terms of morbidity

Characteristic	p	Odds ratio	95% CI
Hypertension	0.021	0.368	0.157-0.863
Leukocytosis or leukopenia	0.033	2.202	1.066-4.546
Concomitant disease	0.011	0.362	0.166-0.791
CI: confidence interval			

Table 4. Risk factor analysis in terms of mortality

Characteristic	p	Odds ratio	95% CI
Tachycardia	0.019	0.151	0.031-0.734
Leukocytosis or leukopenia	0.038	0.201	0.044-0.912
Concomitant disease	0.021	0.061	0.006-0.660
Necrosis	0.005	0.114	0.025-0.526
CI: confidence interval			

Table 2. Laboratory results in the groups

Characteristic	Group 1 n (%)	Group 2 n (%)	Group 3 n (%)	Group 1	Group 2
				p	p
Leukopenia or leukocytosis	15 (71.4)	19 (34.5)	47 (49.5)	0.018	0.021
Anemia	3 (14.3)	3 (5.4)	2 (2.1)	0.026	0.741
Hyperuremia	7 (33.3)	9 (16.4)	2 (2.1)	<0.001	0.087
Hypercreatininemia	3 (14.3)	5 (9.1)	1 (1.0)	0.048	0.123

Table 5. The etiology of mechanical bowel obstruction with respect to the groups

Cause	Group 1 n (%)	Group 2 n (%)	Group 3 n (%)	Total n
Adhesion	5 (6.4)	28 (35.9)	45 (57.7)	78
Incarcerated hernia	2 (6.7)	9 (30)	19 (63.3)	30
Invagination	0 (0)	1 (20)	4 (80)	5
Sigmoid volvulus	1 (6.2)	4 (25)	11 (68.8)	16
Malignancy	13 (46.4)	10 (35.7)	5 (17.9)	28
Meckel diverticulitis	0 (0)	0 (0)	2 (100)	2
Fecal impaction	0 (0)	2 (25)	6 (75)	8
Foreign body	0 (0)	1 (25)	3 (75)	4

Table 6. Complications in the patients with mechanical bowel obstruction

Complication	n (%)
No complications	95 (55.5)
Pulmonary	27 (15.8)
Renal failure	4 (2.3)
Surgical site infection	3 (1.8)
Cardiac	15 (8.8)
Neurological (cerebral thromboembolism)	2 (1.2)
Multiple complications	25 (14.6)
Total	171 (100.0)

Playfort et al. (10) pointed out the adverse effects of therapeutic delay in patients with mechanical bowel obstruction, and reported that the increase in time intervals from onset of symptoms to hospitalization, and in-hospital delay prior to surgery led to an increase in the rate of complications and death. It has been stated that therapeutic delay of over 24 h tripled the mortality risk (13). Uludag et al. (9), however, did not establish the timing of therapy to be significantly associated with complications and mortality. The study on adhesive small bowel obstructions conducted by Tanhiphat et al. (14) compared patients operated on 48 h after hospitalization with patients operated on 12 h after hospitalization in terms of mortality, and reported that the difference was not significant. In the present study, 71.4% of the patients who died, 65.4% of the patients observed with complications and 52.6% of all patients had been hospitalized 72 h after the onset of symptoms. While the impact of delayed presentation was not established to have a significant impact on mortality, its impact on complications was noteworthy. No statistically significant differences were observed between the patients who had undergone surgical intervention within the first 48 h of hospitalization and after the first 48 h of hospitalization in terms of mortality and complications. This particular result may be attributable to the fact that the patients with severe symptoms underwent surgery without delay. Sinha et al. (15) indicated the presence of necrosis to be a significant factor in terms of developing complications. Uludag et al. (9) observed complications in 29.2% of the patients without necrosis and 63% of the patients with necrosis; and associated necrosis with a 13.2 times higher mortality risk. Deutsch et al. (16) reported mortality in 29.0% of the patients with necrosis and 13.0% of the patients without necrosis in their study carried out on 264 patients with small bowel obstruction. Fevank et al. (13) established the mortality rate to

be 16.0% in patients with necrosis and 4.0% in patients without necrosis. In our series, morbidity and mortality rates were 12.3% and 32.2%, respectively. We established the presence of necrosis to be a significant factor in terms of mortality. Of the patients who died, 66.7% had necrosis; and both univariate and multivariate analyses revealed the impact of necrosis on mortality to be significant. Of the patients developing complications, 29.1% had necrosis, which was not established to be statistically significant. Our study also established the presence of hypotension, tachycardia, leukopenia/leukocytosis, anemia, hyperuremia or hypercreatininemia to have a significant effect on mortality. The presence of hypertension or leukocytosis/leukopenia was established to be significant in terms of morbidity. Higher mortality rates may be attributed to the fact that, in general, the patients with the above mentioned parameters presented late, or had necrosis, were in poorer condition due to therapeutic delay and had started developing multi-organ dysfunction.

Fevang et al. (13) established the presence of necrosis in the bowels, history of abdominal surgery and therapeutic delay to be significant factors in terms of mortality in their multivariate analysis. Similarly, multivariate analyses performed in the study carried out by Ti and Yong indicated older age, concomitant disease, necrosis, large intestine obstruction and malignancy to be factors increasing mortality (17). Margenthaler et al. (18) reported the factors increasing 30-day mortality rates to be history of disseminated cancer, advanced American Society of Anesthesiologists (ASA) class, preoperative hematocrit <38%, preoperative sodium >145 mEq/L, preoperative creatinine >1.2 mg/dL, contaminated/infected wound, dyspnea and older age. In the present study, multivariate analyses revealed tachycardia, leukocytosis/leukopenia, concomitant disease and necrosis to be associated with increased mortality, while hypertension, leukocytosis/leukopenia and concomitant disease were established to be significantly associated with increased morbidity. While the leading cause of mechanical bowel obstruction is adhesions in developed countries, it is incarcerated hernia in developing countries and eastern nations. As elective surgery for hernia is more commonly performed in areas with higher income and better educational standards, the incidence of incarcerated hernia is lower. Therefore, abdominal adhesions become the main reason as a result of the increased numbers of abdominal surgery (9, 19). Mc Entee et al. (20) investigated the etiology of mechanical bowel obstruction in 228 patients and reported the etiological cause to be adhesions in 32.0%, while 26.0% was attributed to malignancies and 25.0% to incarcerated hernia. Chen et al. (12) indicated the most common cause of acute intestinal obstruction to be adhesions with 62.0% in their series of 705 patients, followed by neoplasms with 23.7%. Markogiannakis et

al. (21) listed the causes of bowel obstruction as adhesion (64.8%), incarcerated hernia (14.8%) and large bowel cancer (13.4%). Although a number of studies in the last 20 years in Turkey have reported abdominal adhesions to be the most common cause of mechanical bowel obstruction, incarcerated hernia remains the leading cause (3, 5, 6, 22). Gürleyik et al. (23) compared the results from two cities, one in western and the other in eastern Turkey, and observed significant etiological and clinical differences in patients with acute large bowel obstruction. They reported the most common cause to be obstructive cancer (52.5%) in the west and volvulus (80.2%) in the east. Küçük et al. (5) reported adhesion to be the leading cause with 45.5% in acute mechanical bowel obstruction, followed by colon tumor with 21.6%. In the present study, post-operative adhesive ileus cases were the overwhelming majority for causative disease of mechanical bowel obstruction (45.6%), and incarcerated hernia (17.5%), malignancy (16.4%), sigmoid volvulus (9.4%), fecal impaction (4.7%), foreign body (2.3%), and Meckel diverticulitis (1.2%) causing mechanical obstruction in the bowel cavity were less frequent causes, consistent with the results in the literature. The number of elective hernia operations has increased considerably in recent years in our region due to the increase in the number of surgeons, easier access to surgical clinics, better operative conditions as well as improved socio-economic and educational standards. Therefore, while there has been a drop in the incidence of hernia-related bowel obstruction, the incidence of adhesion-related bowel obstruction as a result of abdominal operations has increased. Füzun et al. (3) investigated 256 cases in their study and established the most common abdominal surgery to be appendectomy. Tanhiptat et al. (14) also reported appendectomy to be the most common abdominal surgery with 34.2%, followed by peptic ulcer and other abdominal operations in their study on adhesive small bowel obstruction with 266 cases. In the present study, we observed appendectomy to be the most common type of abdominal surgery with 14.0%, followed by colorectal surgery with 9.4%.

Uludag et al. (9) carried out a study with 152 patients and established the most common complications to be systemic complications (15.8%), resulting from pulmonary, cardiac and renal causes. The second most common complication was wound site infections with 11.2%. Fevang et al. (13) observed cardiovascular and respiratory system complications to be those with the highest rate. Kaya et al. (6) reported wound infections as the leading type of postoperative complication, followed by sepsis, multi-organ dysfunction, post-operative ileus and pneumonia. Systemic complications had the highest rate in the present study. The respiratory system was in the first place with 15.8%, followed by the cardiovascular system with 8.8%. When we considered patients who developed complications, a pre-existing disease affecting the particular organ system, in which the complication occurred, was noted.

Conclusion

The present study revealed the most common cause of mechanical bowel obstruction to be adhesion; and older age as well as the presence of a concomitant disease, leukocytosis or leukopenia was established to be associated with higher mortality and morbidity rates. However, it is important to bear in mind that the causes and risk factors may vary over time and in different regions. Better understanding of the causes and risk factors of mechanical bowel obstruction will ensure the selection of the most appropriate therapeutic approach, which will decrease morbidity and mortality rates.

Conflict of Interest

No conflict of interest was declared by the authors.

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