

RAPID COMMUNICATION

Acute mechanical bowel obstruction: Clinical presentation, etiology, management and outcome

Haridimos Markogiannakis, Evangelos Messaris, Dimitrios Dardamanis, Nikolaos Pararas, Dimitrios Tzertzemelis, Panagiotis Giannopoulos, Andreas Larentzakis, Emmanuel Lagoudianakis, Andreas Manouras, Ioannis Bramis

Haridimos Markogiannakis, Evangelos Messaris, Dimitrios Dardamanis, Nikolaos Pararas, Dimitrios Tzertzemelis, Panagiotis Giannopoulos, Andreas Larentzakis, Emmanuel Lagoudianakis, Andreas Manouras, Ioannis Bramis, 1st Department of Propaedeutic Surgery, Hippokraton Hospital, Athens Medical School, University of Athens, Vasilissis Sofias 114 Avenue, Athens 11527, Greece

Correspondence to: Dr. Haridimos Markogiannakis, MD, Kerasoudos 54 street, 15771 Zografou, Athens, Greece. hmarkogiannakis@mycosmos.gr

Telephone: +30-697-6788806 Fax: +30-210-7707574

Received: 2006-11-12 Accepted: 2006-12-12

causes of obstruction, as well as of bowel ischemia, necrosis, and perforation. Although an important proportion of these patients can be nonoperatively treated, a substantial portion requires immediate operation. Great caution should be taken for the treatment of these patients since the incidence of bowel ischemia, necrosis, and perforation is significantly high.

© 2007 The WJG Press. All rights reserved.

Key words: Acute mechanical bowel obstruction; Clinical presentation; Etiology; Management; Outcome

Markogiannakis H, Messaris E, Dardamanis D, Pararas N, Tzertzemelis D, Giannopoulos P, Larentzakis A, Lagoudianakis E, Manouras A, Bramis I. Acute mechanical bowel obstruction: Clinical presentation, etiology, management and outcome. *World J Gastroenterol* 2007; 13(3): 432-437

<http://www.wjgnet.com/1007-9327/13/432.asp>

Abstract

AIM: To identify and analyze the clinical presentation, management and outcome of patients with acute mechanical bowel obstruction along with the etiology of obstruction and the incidence and causes of bowel ischemia, necrosis, and perforation.

METHODS: This is a prospective observational study of all adult patients admitted with acute mechanical bowel obstruction between 2001 and 2002.

RESULTS: Of the 150 consecutive patients included in the study, 114 (76%) presented with small bowel and 36 (24%) with large bowel obstruction. Absence of passage of flatus (90%) and/or feces (80.6%) and abdominal distension (65.3%) were the most common symptoms and physical finding, respectively. Adhesions (64.8%), incarcerated hernias (14.8%), and large bowel cancer (13.4%) were the most frequent causes of obstruction. Eighty-eight patients (58.7%) were treated conservatively and 62 (41.3%) were operated (29 on the first day). Bowel ischemia was found in 21 cases (14%), necrosis in 14 (9.3%), and perforation in 8 (5.3%). Hernias, large bowel cancer, and adhesions were the most frequent causes of bowel ischemia (57.2%, 19.1%, 14.3%), necrosis (42.8%, 21.4%, 21.4%), and perforation (50%, 25%, 25%). A significantly higher risk of strangulation was noticed in incarcerated hernias than all the other obstruction causes.

CONCLUSION: Absence of passage of flatus and/or feces and abdominal distension are the most common symptoms and physical finding of patients with acute mechanical bowel obstruction, respectively. Adhesions, hernias, and large bowel cancer are the most common

INTRODUCTION

Acute mechanical bowel obstruction is a common surgical emergency and a frequently encountered problem in abdominal surgery^[1,2]. It constitutes a major cause of morbidity and financial expenditure in hospitals around the world^[3] and a significant cause of admissions to emergency surgical departments^[2,4]. Intestinal obstruction belongs to highly severe conditions, requiring a quick and correct diagnosis as well as immediate, rational and effective therapy^[5,6].

Surgeons are concerned about bowel obstruction cases because strangulation, causing bowel ischemia, necrosis and perforation might be involved, and it is often difficult to distinguish simple obstruction from strangulation. Accurate early recognition of intestinal strangulation in patients with mechanical bowel obstruction is important to decide on emergency surgery or to allow safe nonoperative management of carefully selected patients^[1,2,7,8]. Although close and careful clinical evaluation, in conjunction with laboratory and radiologic studies, is essential for the decision of proper management of patients with acute mechanical bowel obstruction^[1], a preoperative diagnosis of bowel strangulation cannot be made or excluded reliably by any known parameter, combinations of parameters, or

by experienced clinical judgement^[7-9].

Mechanical bowel obstruction is an old and common surgical emergency^[1,2]. Immediate and correct diagnosis of this condition and its etiology is essential^[5,6,9-11], and appropriate treatment is of utmost importance^[5,6,9-11]. The clinical picture, however, of these patients^[6,12,13] along with the etiology of obstruction^[1,3,11,14-16] and strangulation prevalence are variable^[8,17,18], while appropriate management remains controversial^[1-3,10,17,19]. We, therefore, conducted this prospective study to identify and analyze the clinical presentation of patients with acute mechanical bowel obstruction in our department, the etiology of obstruction as well as management and outcome of these patients. Moreover, we evaluated the incidence and causes of bowel ischemia, necrosis, and perforation.

MATERIALS AND METHODS

This is a prospective observational study of all adult (over 14 years old) patients admitted to the 1st Department of Propaedeutic Surgery, Hippokraton Hospital, Athens Medical School, University of Athens with a diagnosis of acute mechanical bowel obstruction between January 2001 and December 2002. The enrollment of the patients in the study was approved by the ethics committee of the University of Athens and written informed consent was obtained from all patients. Patients with paralytic ileus were excluded from our study while, since our hospital does not have a Pediatric Surgery Department, patients under 14 years of age are not referred to our hospital. Consequently, all adult patients with clinical and radiological evidence of acute mechanical bowel obstruction were included in the study.

Data collection (including pre-hospital, emergency department and in-hospital information) was started immediately after patients' arrival at the Surgical Emergency Department and continued on a daily basis. Recorded variables were: age, gender, time between the onset of symptoms and arrival at the emergency department, vital signs (systolic and diastolic arterial blood pressures, heart rate, breathing rate, and body temperature), symptoms and physical examination findings, white blood cell (WBC) counts, imaging features, types of management, time between arrival and operation, operative findings, etiology of obstruction, incidence and causes of bowel ischemia, necrosis, and perforation, complications, admission in the Intensive Care Unit (ICU), length of ICU and hospital stay, and the final outcome of the patients.

Vital signs were non-invasively measured every 3 h apart from the patients who were admitted to the ICU and had continuous invasive monitoring. Serial clinical examinations every 6 h by the same attending surgical team were performed in all patients to evaluate the patients' symptoms and signs. All patients underwent WBC count testing as well as plain abdominal X-ray every 24 h. Abdominal ultrasound (US) was performed in all patients on arrival at the Surgical Emergency Department while an abdominal computed tomography (CT) scan and colonoscopy were performed in a portion of the patients based on the clinical judgement of the attending surgical team.

Table 1 Demographic, clinical, and laboratory data of the total study group on arrival at the Emergency Department (*n* = 150)

Value	Variable
Age (yr) ¹	63.8 ± 1.3 (65.0) (range: 16-98)
Sex (Male/Female) ²	M: 60 (40%)/F: 90 (60%)
Time between onset of symptoms and arrival (h) ¹	33.5 ± 2.3 (24.0) (range: 2-120)
Systolic arterial blood pressure (mmHg) ¹	121.2 ± 1.7 (120.0) (range: 80-170)
Diastolic arterial blood pressure (mmHg) ¹	62.1 ± 0.9 (65.0) (range: 40-90)
Heart rate (/min) ¹	80.4 ± 0.8 (79.5) (range: 60-130)
Breathing rate (/min) ¹	15.4 ± 0.1 (15.0) (range: 11-22)
Body temperature (°C) ¹	36.4 ± 0.03 (36.4) (range: 35.5-37.4)
Fever (temperature > 38.0°C) ²	0 (0%)
Absence of passage of flatus ²	135 (90%)
Absence of passage of feces ²	121 (80.6%)
Vomiting ²	118 (78.6%)
Nausea ²	89 (59.3%)
Abdominal discomfort ²	99 (66%)
Abdominal distension ²	98 (65.3%)
Colicky abdominal pain ²	111 (74%)
Continuous abdominal pain ²	22 (14.6%)
Abdominal muscle guarding ²	56 (37.3%)
Rebound tenderness ²	7 (4.6%)
Small bowel obstruction ²	114 (76%)
Large bowel obstruction ²	36 (24%)
White blood cell (WBC) count (10 ⁹ /L) ¹	9.93 ± 0.29 (8.90) [range: 3.58-24.4]
Leukocytosis ² (WBC count > 10.8 × 10 ⁹ /L) ²	55 (36.6%)

¹Values are expressed as mean ± SE and median (parenthesis); ²Values are expressed as number of patients and percentage (parenthesis).

Criteria for operative management of the patients were hemodynamic instability despite fluid resuscitation with crystalloid solution or recurrence of instability after initial stabilization, peritoneal signs on physical examination, identification by imaging studies (X-ray, US, or CT scan) of bowel ischemia, necrosis, and/or perforation, and failure of nonoperative management on the 4th post-admission day.

Intraoperative findings were also recorded with great emphasis on the etiology of obstruction as well as the incidence and causes of bowel ischemia, necrosis, and perforation.

RESULTS

During the two years study period, 150 consecutive adult patients with acute mechanical bowel obstruction were admitted and composed our study group. Mean age of the patients was 63.8 ± 1.3 years while women comprised 60% of the group. The majority of the patients (76%) presented with small bowel obstruction. Demographic, clinical, and laboratory data of the study group on arrival at the Emergency Department are presented in Table 1. Regarding clinical presentation of the patients, absence of passage of flatus (90%) and/or feces (80.6%) were the most common presenting symptoms and abdominal distension (65.3%) was the most frequent physical finding on clinical examination.

Table 2 Etiology of acute mechanical bowel obstruction *n* (%)

Cause	Small bowel obstruction group (<i>n</i> = 114)	Large bowel obstruction group (<i>n</i> = 36)	Total study group (<i>n</i> = 150)
Adhesions	84 (73.8%)	13 (36.3%)	97 (64.8%)
Hernia	21 (18.5%)	1 (2.7%)	22 (14.8%)
Large bowel cancer	3 (2.6%)	17 (47.4%)	20 (13.4%)
Small bowel tumor	3 (2.6%)	0 (0%)	3 (2.0%)
Retroperitoneal tumor	0 (0%)	2 (5.5%)	2 (1.3%)
Crohn's disease	2 (1.7%)	0 (0%)	2 (1.3%)
Small bowel volvulus	1 (0.8%)	0 (0%)	1 (0.6%)
Ovarian cystadenocarcinoma	0 (0%)	1 (2.7%)	1 (0.6%)
Acute diverticulitis	0 (0%)	1 (2.7%)	1 (0.6%)
Sigmoid volvulus	0 (0%)	1 (2.7%)	1 (0.6%)

Table 4 Incidence of bowel ischemia, necrosis, and perforation *n* (%)

Value	Small bowel obstruction group (<i>n</i> = 114)	Large bowel obstruction group (<i>n</i> = 36)	Total study group (<i>n</i> = 150)
Ischemia	15 (13.2%)	6 (16.6%)	21 (14%)
Necrosis	8 (7%)	6 (16.6%)	14 (9.3%)
Perforation	4 (3.5%)	4 (11.1%)	8 (5.3%)

The etiology of obstruction is shown in Table 2. Regarding patients with small bowel obstruction, adhesions, incarcerated hernias, large bowel cancer, and small bowel tumors were the most frequent causes of obstruction (73.8%, 18.5%, 2.6%, and 2.6%, respectively). Large bowel cancer, adhesions, retroperitoneal tumors, and hernias were the most common causes in large intestinal obstruction group (47.4%, 36.3%, 5.5%, and 2.7%, respectively). Finally, in the total study group of patients with small or large bowel obstruction, adhesions, incarcerated hernias, and large bowel cancer constituted the most frequent causes (64.8%, 14.8%, and 13.4%, respectively). Moreover, all patients with adhesive obstruction had previously undergone abdominal operations; the vast majority of these cases had undergone one operation (*n* = 70, 72.1%), 18 (18.6%) had two, and 9 (9.3%) had three operations. In terms of the types of previous operations, 34 patients (25.6%) had undergone an appendectomy, 31 (23.3%) gynecological procedures, 21 (15.8%) had a cholecystectomy, 15 (11.2%) had large bowel cancer resection, 13 (9.8%) had adhesiolysis in previous mechanical bowel obstruction episodes, 8 (6.0%) had abdominal wall hernia repair surgical procedures, and 11 (8.3%) had other surgical procedures. It is of note that, except for 3 patients with a laparoscopic cholecystectomy in the group of two previous abdominal operations, all patients had undergone open surgical procedures. Furthermore, regarding the types of incarcerated hernias, 9 patients (40.9%) presented with an inguinal hernia, 4 (18.2%) with an umbilical hernia, 3 (13.6%) with an incisional hernia, and 2 (9.1%) with a femoral hernia, while in 4 patients (18.2%) an internal hernia was intraoperatively identified. Sigmoid cancer was overrepresented accounting for 15 (75%) of the 20 patients with obstruction due to

Table 3 Management and outcome of the patients

Value	Small bowel obstruction group (<i>n</i> = 114)	Large bowel obstruction group (<i>n</i> = 36)	Total study group (<i>n</i> = 150)
Operative treatment ¹	35 (30.7%)	27 (75%)	62 (41.3%)
Nonoperative treatment ¹	79 (69.3%)	9 (25%)	88 (58.7%)
Time between arrival and operation (h) ²	30.2 ± 4.1 (10.0) [range: 2-96]	71.2 ± 3.2 (78.0) [range: 4-164]	48.1 ± 4.2 (26.0) [range: 2-164]
Operation on the 1st day ¹	22 (19.3%)	7 (19.4%)	29 (19.3%)
Operation on the 2nd day ¹	4 (3.5%)	2 (5.5%)	6 (4%)
Operation on the 3rd day ¹	5 (4.3%)	3 (8.3%)	8 (5.3%)
Complication ¹	4 (3.5%)	2 (5.5%)	6 (4%)
Intensive Care Unit (ICU) admission ¹	6 (5.2%)	3 (8.3%)	9 (6%)
ICU length of stay (d) ²	6.3 ± 0.5 (2.0) [range: 1-25]	4.0 ± 0.7 (5.0) [range: 2-5]	5.5 ± 2.4 (3.0) [range: 1-25]
Hospital length of stay (d) ²	6.0 ± 0.6 (5.0) [range: 2-32]	9.8 ± 1.1 (11.0) [range: 3-20]	6.9 ± 0.3 (6.0) [range: 2-32]
Mortality ¹	1 (0.8%)	1 (2.7%)	2 (1.3%)

¹Values are expressed as number of patients and percentage (parenthesis);

²Values are expressed as mean ± SE and median (parenthesis).

a large bowel cancer, whereas two (10%) patients had an ascending colon cancer, one (5%) had a transverse colon cancer, one (5%) had a descending colon cancer, and one (5%) had a rectum cancer.

Data regarding management and outcome of the patients are described in Table 3. Eighty-eight patients (58.7%) of the total study group were safely and effectively treated conservatively. Nonoperatively treated patients composed the highest proportion (69.3%) of the patients with acute mechanical small bowel obstruction, while they only accounted for the minority (25%) in the large intestinal obstruction group. Of the 62 patients (41.3% of the total study group) who were operatively treated, a substantial portion (19.3%) required surgical intervention on the first day. Six cases (4%) sustained complications; two suffered from septic shock along with acute respiratory and renal failure, one suffered from pneumonia, one suffered from myocardial infarction, one had urinary tract infection, and one was reoperated because of an anastomotic leakage. Two patients died, resulting in a mortality rate of 1.3%; one died due to multiple organ failure attributable to sepsis and one died owing to myocardial infarction.

As it is shown in Table 4, the rate of bowel ischemia, necrosis, and perforation in the total study group were significantly high (14%, 9.3%, and 5.3%, respectively). In the small bowel obstruction group, ischemia was intraoperatively reversible in 7 out of 15 patients, whereas the remaining 8 patients had bowel necrosis. In contrast, no reversible ischemia was observed in the large bowel obstruction group. Therefore, although patients with small bowel obstruction and those with large bowel obstruction presented similar ischemia rate, the incidence of necrosis

Table 5 Etiology of small bowel ischemia, necrosis, and perforation (small bowel obstruction group, *n* = 114) *n* (%)

Cause	Ischemia (<i>n</i> = 15)	Necrosis (<i>n</i> = 8)	Perforation (<i>n</i> = 4)
Hernia	11 (73.3%)	5 (62.5%)	3 (75%)
Adhesions	2 (13.3%)	2 (25%)	1 (25%)
Small bowel volvulus	1 (6.7%)	1 (12.5%)	0 (0%)
Large bowel cancer	1 (6.7%)	0 (0%)	0 (0%)
Small bowel tumor	0 (0%)	0 (0%)	0 (0%)

and perforation was much higher in the large intestine group.

Etiology of bowel ischemia, necrosis, and perforation in the small bowel obstruction group, the large bowel obstruction group, and the total study group is presented in Table 5, Table 6 and Table 7, respectively. Incarcerated hernias were the cause in the vast majority of the small bowel obstruction group, that presented ischemia, necrosis, and perforation, while adhesions were the second most frequent cause. Regarding the large bowel obstruction group, large bowel cancer, adhesions, and hernias constituted the most common causes. Finally, in the total group, hernias, large bowel cancer, and adhesions were the most frequent causes of bowel ischemia, necrosis, and perforation. It was notable that bowel ischemia was reversible in half of the cases with obstruction due to incarcerated hernias justifying, thus, immediate operative intervention in these patients.

With regard to the risk of strangulation, a significantly much higher risk was noticed in incarcerated hernias than all the other obstruction causes. Of the 22 patients with acute mechanical bowel obstruction caused by incarcerated hernias, 12 (54.6%) had bowel ischemia, 6 (27.3%) had necrosis, and 4 (18.2%) had sustained perforation. On the contrary, only 3 (3.1%) of the 97 cases with adhesive obstruction presented ischemia and necrosis, and 2 (2.1%) had perforation. Additionally, out of 20 patients with obstruction due to large bowel cancer, 4 (20%) had ischemia, 3 (15%) had necrosis, and 2 (10%) had perforation.

DISCUSSION

Acute mechanical bowel obstruction remains a frequently encountered problem in abdominal surgery and a common surgical emergency^[1,2], which is a frequent cause of admissions to hospital emergency surgical departments^[2,4].

The majority of our study group presented with acute mechanical small bowel obstruction. This has also been found in other studies with small bowel obstruction accounting for about 80% of total obstruction cases^[9,20,21]. Regarding clinical presentation of our patients, absence of passage of flatus and/or feces were the most frequent presenting symptoms and abdominal distension was the most common physical finding on clinical examination. Additionally, vomiting, nausea, colicky abdominal pain, and abdominal discomfort were frequent symptoms on arrival. Our results, even though some differences are noticed, are in accordance with the literature^[6,12,13,22,23].

Table 6 Etiology of large bowel ischemia, necrosis, and perforation (large bowel obstruction group, *n* = 36) *n* (%)

Cause	Ischemia (<i>n</i> = 6)	Necrosis (<i>n</i> = 6)	Perforation (<i>n</i> = 4)
Large bowel cancer	3 (50%)	3 (50%)	2 (50%)
Adhesions	1 (16.6%)	1 (16.6%)	1 (25%)
Hernia	1 (16.6%)	1 (16.6%)	1 (25%)
Sigmoid volvulus	1 (16.6%)	1 (16.6%)	0 (0%)
Retropertitoneal tumor	0 (0%)	0 (0%)	0 (0%)
Ovarian cystadenocarcinoma	0 (0%)	0 (0%)	0 (0%)

Table 7 Etiology of bowel ischemia, necrosis, and perforation (total study group, *n* = 150) *n* (%)

Cause	Ischemia (<i>n</i> = 21)	Necrosis (<i>n</i> = 14)	Perforation (<i>n</i> = 8)
Hernia	12 (57.2%)	6 (42.8%)	4 (50%)
Large bowel cancer	4 (19.1%)	3 (21.4%)	2 (25%)
Adhesions	3 (14.3%)	3 (21.4%)	2 (25%)
Small bowel volvulus	1 (4.7%)	1 (7.2%)	0 (0%)
Sigmoid volvulus	1 (4.7%)	1 (7.2%)	0 (0%)
Small bowel tumor	0 (0%)	0 (0%)	0 (0%)
Retropertitoneal tumor	0 (0%)	0 (0%)	0 (0%)
Ovarian cystadenocarcinoma	0 (0%)	0 (0%)	0 (0%)

Particularly, Cheadle *et al*^[6] reported abdominal pain (92%), vomiting (82%), abdominal tenderness (64%), and distention (59%) as the most frequent symptoms and signs, whereas abdominal distension, bilious vomiting, absolute constipation and abdominal pain were the main signs and symptoms in another series^[12]. Perea *et al*^[13] prospectively studied 100 patients with adhesive small bowel obstruction and found that the presenting symptoms were vomiting (77%), colicky abdominal pain (68%), absence of passage of flatus and/or feces (52%), and constant pain (12%), whereas abdominal distension constituted the most frequent clinical sign with a prevalence of 56%. In a study of patients with bowel obstruction due to large bowel volvulus, the most common sign of sigmoid volvulus was distension (79%) and the most frequent symptoms were pain (58%) and obstipation (55%), whereas most patients with cecal volvulus presented with pain (89%)^[22]. Furthermore, in a review of cases with obstruction because of small and large bowel intussusception, abdominal pain, nausea, vomiting, and abdominal distension were the commonest symptoms and signs, respectively^[23].

Adhesions, incarcerated hernias, and large bowel cancer constitute the most frequent causes of obstruction^[3,4,9,11,14,16,17,20,21,24-30]. This finding was also noticed in our study. Moreover, adhesions were the most prevalent etiology of obstruction in the small bowel obstruction group and the total study group and the second most common etiology in the large bowel group. Several studies postulate that adhesions are responsible for 32%-74% of bowel obstruction and are the leading cause of small intestinal obstruction representing 45%-80% of it^[1-4,7,9,14,17,20,24-26,28-30]. The vast majority (65%-90%) of the patients with adhesive obstruction have undergone previous abdominal operations^[6,13,14,18,19,26,28,29]. In the present study,

this was observed in all such patients. As for the types of previous operations in our study patients, appendectomies, gynecological operations, cholecystectomies, and large bowel cancer resections were more prevalent. This is also in accordance with the literature^[2,18,19,28,29]. Even though the appropriate management of adhesive obstruction is still controversial, a substantial share of these patients, ranging from 35% to 75% in several studies, can safely and effectively be treated with nonoperative management as it was also shown in our patients^[2,3,9,12,16-19,24,28-30]. The increasing role of adhesions as a cause of acute intestinal obstruction demands greater need for routine preventive measures against adhesion formation^[14]. A number of intraoperative measures are now encouraged during elective abdominal surgery to reduce the incidence of adhesions that might subsequently produce intestinal obstruction^[1].

As it was also observed in our study, large bowel cancer, particularly sigmoid cancer, is the most common etiology of obstruction in patients with large intestinal obstruction with a prevalence of 40%-90%^[9,10,14,21]. The majority of such patients in our study were operatively treated. Moreover, incarcerated hernias were the second most common etiology of obstruction as well as the predominant cause of bowel ischemia, necrosis, and perforation. It should also be emphasized that bowel ischemia was reversible in half of our cases with obstruction due to incarcerated hernias justifying, thus, immediate surgery in these patients. Since abdominal hernias continue to account for 8%-25% of all cases of intestinal obstruction^[1,4,14,17,20,24,26,30], while in a few series represent the most common cause of intestinal obstruction accounting for 30%-55%^[11,16,21,27], and, moreover, they still remain the most common cause of strangulation^[1,4,11,17,21,24,27], surgeons should continue their aggressive attitude towards elective repair of all abdominal hernias as well as towards immediate operative intervention in patients with acute mechanical bowel obstruction secondary to incarcerated hernias.

Other less common causes of obstruction reported in the literature are Crohn's disease^[3,17,20] and gallstones^[21], accounting for 3%-7% and 2% of small bowel obstruction cases, respectively, and bowel volvulus^[14,15,20,24] and intussusception^[14,20,25], accounting for 4%-15% and 4%-8% of total obstruction cases, respectively. In our series, the prevalence of Crohn's disease and bowel volvulus was much lower, whereas no case of obstruction due to gallstone or intussusception was observed.

An important share of our patients was successfully nonoperatively treated. This was more prevalent regarding adhesive small bowel obstruction. This has also been noticed in other studies^[2,3,9,12,16-19,24,28-30]. Similar to other studies^[12,24], of those patients that were operated, a substantial proportion required immediate operation.

Much attention should be paid to the treatment of these patients since the incidence of bowel ischemia, necrosis, and perforation is significantly high. Strangulation rate in the literature ranges from 7% to 42%^[4,8,12,17,24,26,28]. In addition, Kossi *et al*^[18] reported an incidence of ischemia of 20%, of necrosis of 8%, and of perforation of 2%. In regard to the risk of strangulation in the present study, a

significantly much higher risk was noticed in incarcerated hernias in comparison to all the other obstruction causes. Moreover, the incidence of bowel ischemia, necrosis, and perforation in adhesive obstruction was very low. These results have been also described in other studies^[1,4,11,17,21,24,27].

In our study, complication and mortality rate were relatively low. In the literature, complication rate ranges from 6% to 47%^[6,20,25,27,31,32] whereas mortality ranges from 2% to 19%^[4,6,11,14,17-20,24-27,31,32].

In general, appropriate treatment of acute mechanical bowel obstruction as well as timing of surgery for patients selected to undergo operative intervention still remain controversial^[1-3,10,17,19]. Management of this condition requires careful assessment and awareness while the appropriate treatment needs to be tailored to the individual situation^[10,19]. Furthermore, no specific factors that may predict success of conservative or surgical management have been identified^[19]. Although modern surgical management continues to focus appropriately on avoiding operative delay whenever surgery is indicated, not every patient is always best served by immediate operation. As it was also proved in the present study, certain entities, such as bowel obstruction secondary to incarcerated abdominal wall hernia, and patients with clinical signs and symptoms suggestive of strangulation do require prompt operative intervention^[1,3,16,17]. Other conditions, however, such as postoperative adhesions, particularly in patients with numerous previous abdominal procedures or concomitant medical problems, often justifiably benefit from a trial of nonoperative management^[1-3,9,16-18,28-30]. A substantial portion of these patients was successfully conservatively treated in our study. As it was also shown in this study, the risk of strangulation with adhesive bowel obstruction is significantly lower as compared to incarcerated hernia^[1,4,17,24].

Strangulated obstruction requires emergency surgery, and early recognition is often life-saving since delay in treatment is an independent predictive factor of mortality and, in addition, bowel strangulation is an independent predictor of complication and, even more, of mortality while the mortality rates of patients with strangulated obstruction are two to 10 times higher than those of patients with non-strangulated obstruction^[4,6,10,11,12,14,16,17,31]. Moreover, accurate early recognition of intestinal strangulation in patients with mechanical bowel obstruction is important to allow safe nonoperative management of carefully selected patients^[1,2,7,8]. Traditionally, such recognition is based on the presence of one or more of the classical signs: vascular compromise, continuous abdominal pain, fever, tachycardia, peritoneal signs on physical examination, leukocytosis, and metabolic acidosis^[7,8]. Close and careful clinical evaluation, in conjunction with laboratory and radiologic studies, is essential for the decision of proper management of patients with acute mechanical bowel obstruction; if any uncertainty exists, prompt operative intervention is indicated^[1]. It should be emphasized, though, that great caution should be taken for the management of these patients since studies have shown that preoperative diagnosis of bowel strangulation cannot be made or excluded reliably by any known clinical, laboratory, or

radiologic parameter, combinations of parameters, or by experienced clinical judgement^[7-9].

In conclusion, absence of passage of flatus and/or feces and abdominal distension are the most common symptoms and physical finding of patients with acute mechanical bowel obstruction, respectively. Adhesions, hernias, and large bowel cancer are the most common causes of obstruction as well as of bowel ischemia, necrosis, and perforation. Although an important share of these patients can be safely and effectively nonoperatively treated, particularly those with adhesive obstruction, a substantial portion requires immediate operation. Moreover, the risk of strangulation is significantly higher in incarcerated hernias than other obstruction causes. Great caution should be taken for the treatment of patients with acute mechanical bowel obstruction since the incidence of bowel ischemia, necrosis, and perforation is significantly high. Further studies are necessary in order to determine appropriate management for treatment of these patients as well as to identify accurate early predictors of success of conservative or operative treatment and, particularly, of intestinal strangulation giving the greatest attention to reversible ischemia.

REFERENCES

- Mucha P. Small intestinal obstruction. *Surg Clin North Am* 1987; **67**: 597-620
- Miller G, Boman J, Shrier I, Gordon PH. Natural history of patients with adhesive small bowel obstruction. *Br J Surg* 2000; **87**: 1240-1247
- Miller G, Boman J, Shrier I, Gordon PH. Etiology of small bowel obstruction. *Am J Surg* 2000; **180**: 33-36
- Ihedioha U, Alani A, Modak P, Chong P, O'Dwyer PJ. Hernias are the most common cause of strangulation in patients presenting with small bowel obstruction. *Hernia* 2006; **10**: 338-340
- Díte P, Lata J, Novotný I. Intestinal obstruction and perforation--the role of the gastroenterologist. *Dig Dis* 2003; **21**: 63-67
- Cheadle WG, Garr EE, Richardson JD. The importance of early diagnosis of small bowel obstruction. *Am Surg* 1988; **54**: 565-569
- Richards WO, Williams LF. Obstruction of the large and small intestine. *Surg Clin North Am* 1988; **68**: 355-376
- Sarr MG, Bulkley GB, Zuidema GD. Preoperative recognition of intestinal strangulation obstruction. Prospective evaluation of diagnostic capability. *Am J Surg* 1983; **145**: 176-182
- Renzulli P, Krähenbühl L, Sadowski C, al-Adili F, Maurer CA, Büchler MW. Modern diagnostic strategy in ileus. *Zentralbl Chir* 1998; **123**: 1334-1339
- Lopez-Kostner F, Hool GR, Lavery IC. Management and causes of acute large-bowel obstruction. *Surg Clin North Am* 1997; **77**: 1265-1290
- Chiedozi LC, Aboh IO, Piserchia NE. Mechanical bowel obstruction. Review of 316 cases in Benin City. *Am J Surg* 1980; **139**: 389-393
- Kuremu RT, Jumbi G. Adhesive intestinal obstruction. *East Afr Med J* 2006; **83**: 333-336
- Perea García J, Turégano Fuentes T, Quijada García B, Trujillo A, Cereceda P, Díaz Zorita B, Pérez Díaz D, Sanz Sánchez M. Adhesive small bowel obstruction: predictive value of oral contrast administration on the need for surgery. *Rev Esp Enferm Dig* 2004; **96**: 191-200
- Lawal OO, Olayinka OS, Bankole JO. Spectrum of causes of intestinal obstruction in adult Nigerian patients. *S Afr J Surg* 2005; **43**: 34-36
- Gürleyik E, Gürleyik G. Small bowel volvulus: a common cause of mechanical intestinal obstruction in our region. *Eur J Surg* 1998; **164**: 51-55
- Tamijmarane A, Chandra S, Smile SR. Clinical aspects of adhesive intestinal obstruction. *Trop Gastroenterol* 2000; **21**: 141-143
- Bizer LS, Liebling RW, Delany HM, Gliedman ML. Small bowel obstruction: the role of nonoperative treatment in simple intestinal obstruction and predictive criteria for strangulation obstruction. *Surgery* 1981; **89**: 407-413
- Kössi J, Salminen P, Laato M. The epidemiology and treatment patterns of postoperative adhesion induced intestinal obstruction in Varsinais-Suomi Hospital District. *Scand J Surg* 2004; **93**: 68-72
- Williams SB, Greenspon J, Young HA, Orkin BA. Small bowel obstruction: conservative vs. surgical management. *Dis Colon Rectum* 2005; **48**: 1140-1146
- Mohamed AY, al-Ghaithi A, Langevin JM, Nassar AH. Causes and management of intestinal obstruction in a Saudi Arabian hospital. *J R Coll Surg Edinb* 1997; **42**: 21-23
- Wysocki A, Krzywoń J. Causes of intestinal obstruction. *Przegl Lek* 2001; **58**: 507-508
- Lau KC, Miller BJ, Schache DJ, Cohen JR. A study of large-bowel volvulus in urban Australia. *Can J Surg* 2006; **49**: 203-207
- Zubaidi A, Al-Saif F, Silverman R. Adult intussusception: a retrospective review. *Dis Colon Rectum* 2006; **49**: 1546-1551
- McEntee G, Pender D, Mulvin D, McCullough M, Naeeder S, Farah S, Badurdeen MS, Ferraro V, Cham C, Gillham N. Current spectrum of intestinal obstruction. *Br J Surg* 1987; **74**: 976-980
- Kirshtein B, Roy-Shapira A, Lantsberg L, Avinoach E, Mizrahi S. Laparoscopic management of acute small bowel obstruction. *Surg Endosc* 2005; **19**: 464-467
- Roscher R, Frank R, Baumann A, Beger HG. Results of surgical treatment of mechanical ileus of the small intestine. *Chirurg* 1991; **62**: 614-619
- Akçakaya A, Alimoğlu O, Hevenk T, Baş G, Sahin M. Mechanical intestinal obstruction caused by abdominal wall hernias. *Ulus Travma Derg* 2000; **6**: 260-265
- Cox MR, Gunn IF, Eastman MC, Hunt RF, Heinz AW. The operative aetiology and types of adhesions causing small bowel obstruction. *Aust N Z J Surg* 1993; **63**: 848-852
- Stricker B, Blanco J, Fox HE. The gynecologic contribution to intestinal obstruction in females. *J Am Coll Surg* 1994; **178**: 617-620
- Foster NM, McGory ML, Zingmond DS, Ko CY. Small bowel obstruction: a population-based appraisal. *J Am Coll Surg* 2006; **203**: 170-176
- Uludağ M, Akgün I, Yetkin G, Kebudi A, İşgör A, Sener A. Factors affecting morbidity and mortality in mechanical intestinal obstruction. *Ulus Travma Derg* 2004; **10**: 177-184
- Biondo S, Parés D, Frago R, Marti-Ragué J, Kreisler E, De Oca J, Jaurrieta E. Large bowel obstruction: predictive factors for postoperative mortality. *Dis Colon Rectum* 2004; **47**: 1889-1897

S- Editor Liu Y L- Editor Zhu LH E- Editor Lu W