Available online at www.medicinescience.org

ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2023;12(1):217-23

Evaluation of the findings affecting the treatment decision in cases of adhesive intestinal obstruction

Ali Isler[1], Mehmet Bugra Bozan[2], Ahmet Necati Sanli[3], Fatih Mehmet Yazar[4]

[1]Islahiye State Hospital, Faculty of Medicine, Department of General Surgery, Gaziantep, Türkiye

[2]Sutcu Imam University, Faculty of Medicine, Department of General Surgery, Kahramanmaraş, Türkiye

[3]Abdulkadir Yuksel State Hospital, Faculty of Medicine, Department of General Surgery, Gaziantep ,Türkiye

[4]Sular Akademi Hospital, Faculty of Medicine, Department of General Surgery, Kahramanmaraş, Türkiye

Received 12 December 2022; Accepted 16 January 2023
Available online 24.02.2023 with doi: 10.5455/medscience.2022.12.266

Abstract

To establish a standard approach in patient management by determining the parameters that affect the decision of surgical or conservative treatment in adhesive small bowel obstructions. 94 patients who were admitted to the emergency department with symptoms of ileus and were diagnosed with adhesive intestinal obstruction according to clinical, examination and imaging findings were grouped as patients who were followed up with conservative methods (Group 1) and patients who underwent surgery (Group 2). All patients' laboratory values (hemoglobin, white blood cell (WBC), C- reactive protein (CRP), Blodd urea nitrogen (BUN)/creatinin, sodium, potassium, Lactate dehydrogenase (LDH), lactate and amylase) and imaging findings (air-fluid level in direct abdominal X-ray, increase in small intestine diameter (≥3.95 cm) in computerized tomography), wall thickness increase (>3mm), transition zone, fecal sign, and presence of contrast in the colon) were evaluated, and criteria for early surgery and non-operative follow-up-treatment criteria were determined. 72% (n:68) of the patients were classified as Group 1 and 28% (n:26) as Group 2, and no significant difference was found between the groups according to age and gender. Surgical treatment with increased lactate (r:0.326, p=0.001), diameter increase in the small intestine (r:0.299, p=0.003) and wall thickness increase (r:0.540, p<0.001), change in air-fluid levels on direct X-ray (A significant correlation was found between r:-0.291, p=0.004) and contrast transfer to the colon on tomography (r:-0.668, p<0.001) and the decision for conservative treatment. Although adhesive intestinal obstruction is a condition that can mostly be managed non-operatively, the early surgical decision significantly reduces mortality and morbidity in cases with an operation indication. It was concluded that the standard approach protocol based on laboratory and imaging findings determined in the non-operative or operative treatment management helps in the differential diagnosis and early surgical decision and reduces the length of stay of the patient.

Keywords: Adhesive obstruction, ileus, acute abdomen, surgery

Introduction

Peritoneal adhesions are pathological bands formed between the omentum, intestinal loops and abdominal wall. They are classified as congenital or acquired according to their etiology (postinflammatory or postoperative) [1]. Postoperative adhesions are among the major unanticipated complications of surgery. Postoperative peritoneal and intestinal adhesions are important complications that may occur after abdominal surgery [2]. Abdominal adhesions begin to form on the 5th to 7th day after surgery [3]. Although it is usually seen after abdominal surgery and cholecystectomy operations such as appendicitis, gynecological operations and colon surgery, it can also be caused by non-

CITATION
Isler A, Bozan MB, Sanlı AN, Yazar FM. Evaluation of the findings affecting the treatment decision in cases of adhesive intestinal obstruction. Med Science. 2023;12:217-23.

Corresponding Author: Ali Isler, Islahiye State Hospital, Faculty of Medicine, Department of General Surgery, Gaziantep, Türkiye
Email: dralisler@hotmail.com

DOI: 10.5455/medscience.2022.12.266

operative causes such as peritonitis and inflammatory bowel diseases. Adhesions can cause infertility, chronic abdominal pain and pelvic pain, most commonly intestinal obstruction. Since each new operation is a risk factor for the development of new adhesions, the decision for the operation to be performed due to adhesion should be made correctly [2].

Small bowel obstruction (IBO) is one of the most important reasons for admission to the surgical service in developed countries (1 of 6 patients). In most cases, improvement is observed with nonoperative treatment (70-80%), but recurrences are common (20-53%) [4,5]. IBOs often occur due to adhesions[5]. The management of adhesive IBOs is based on clinical investigations, biological testing, and imaging modalities. There is still no clear rule on the application of surgery or non-operative follow-up at the time of admission. The fact that the majority of adhesive IBOs are due to previous surgeries creates a paradox about the place of surgery in treatment[5]. Mostly, obstruction can be treated conservatively by using a nasogastric tube, intravenous fluid therapy, administration of analgesics, and correction of electrolyte imbalance [5].

The study aimed to determine the possible clinical, laboratory and radiological parameters for the standard treatment approach in cases of intestinal obstruction due to adhesion. In addition, it is to reduce the morbidity and mortality rates due to complications by making the surgical treatment decision as soon as possible in cases with surgical indications.

Material and Methods

After obtaining approval from the local ethics committee, the study was conducted on patients who applied to the emergency department of our hospital between April 2019 and April 2020 and were diagnosed with adhesive intestinal obstruction with clinical-imaging findings. All procedures performed in studies involving human participants were by the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The study was approved by the Bioethics Committee of the Medical Faculty of XXX (Date:06/02/2019; Session Number: 2019/2; Decision No: 18)

Patients with non-adhesive obstruction etiology according to computed tomography (CT) findings, pregnant women, patients with contrast allergy and patients under 18 years of age were excluded from the study. The patients included in the study were classified according to the American Association for the Surgery of Trauma (AAST) grading and divided into Group 1 (conservative) and Group 2 (operative) (Table 1) [2]. Age, gender, examination findings, comorbidities and surgical histories of all patients were recorded.

CRP, potassium, lactate levels, small bowel wall thickness on tomographic examination, small bowel diameter ≥3.95 cm, localized air-fluid level on X-ray, and passage of contrast material into the colon were determined as potential predictors for the surgical decision.

Surgery was performed in patients who had acute abdomen findings on physical examination or who had ischemia, necrosis or perforation according to CT findings. Oral intake of all other patients was stopped and they were followed up with nasogastric tube decompression, IV hydration and medical treatment. Follow-up patients were evaluated with physical examination, laboratory and imaging methods when necessary at maximum 8-hour intervals in terms of the need for emergency surgical intervention.

In laboratory examination, hemoglobin, WBC, CRP, BUN/creatinine, sodium, potassium, LDH and amylase and lactate values in blood gas were evaluated.

Table 1. Conservative and surgical treatment planning classification according to AAST

Stage	AAST Disease Staging	Intestinal Obstruction
I	Non-complicated Organ limited, minimal Abnormal finding	Partial Obstruction
II	Non-complicated Limited to the organ Severe abnormal finding	Complete Obstruction No intestinal ischemia
III	Complicated Local impact	Complete Obstruction Non-gangrenous reversible ischemic bowel
IV	Complicated Advanced into the surrounding tissue	Complete Obstruction Gangrenous bowel or locally limited perforation
V	Complicated Past the surrounding tissue Widespread impact	Diffuse Peritoneal contamination Developed perforation

Imaging analysis

Direct Graphs: presence, extent and location of air-fluid levels, and air-fluid level displacements at follow-up were evaluated (Figure 1). Direct radiographs were performed at 24 hour intervals. While evaluating the displacement of the air-fluid level, the abdomen was divided into 9 quadrants and the differences between localizations were compared [3,4]

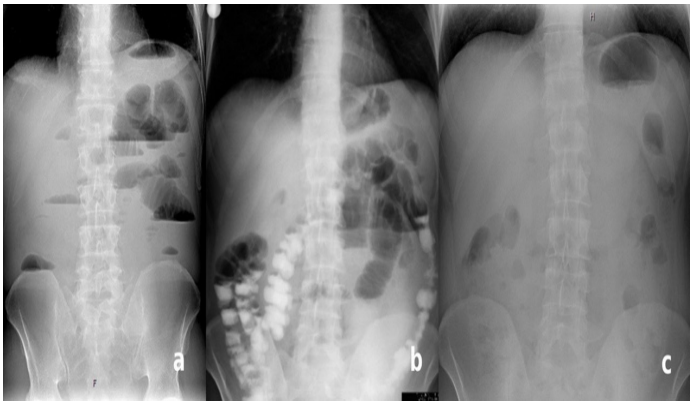

Figure 1. a) Air-liquid levels (arrows), b) Displacement of air-liquid levels and contrast transition to the column, c) Decreasing air-liquid levels

DOI: 10.5455/medscience.2022.12.266

Computed Tomography: abdominal CT within the first 24-hour by applying IV and oral contrast material was performed for all patients. All CT scans were performed by Toshiba Alexion Advance device, Mas: 120 Kv, 3.0 slice thickness. 50cc urographin (a mixture of sodium diatrizoate and meglumine diatrizoate) diluted 1/10 and administered 500 ml by oral or nasogastric route. Low-volume administration was preferred because of the difficulty in oral intake of the gastrograph, and the risk of aspiration and vomiting. An average of 4-6 hours later, an abdominal CT was performed.

Small intestine diameter, wall thickness, transition zone, fecal sign and presence of contrast in the colon were evaluated with CT examination (Figure 2,3). An intestinal diameter increase of 3 cm or more was considered abnormal. For wall thickness, values of 3 mm and above were determined as abnormal wall thickening [5-7].

Figure 2. In the axial section, sudden thinning and tapering (transition zone) (arrow) in the shape of a bird's beak in lumen calibration in a segment of small bowel at the abdominal lower quadrant

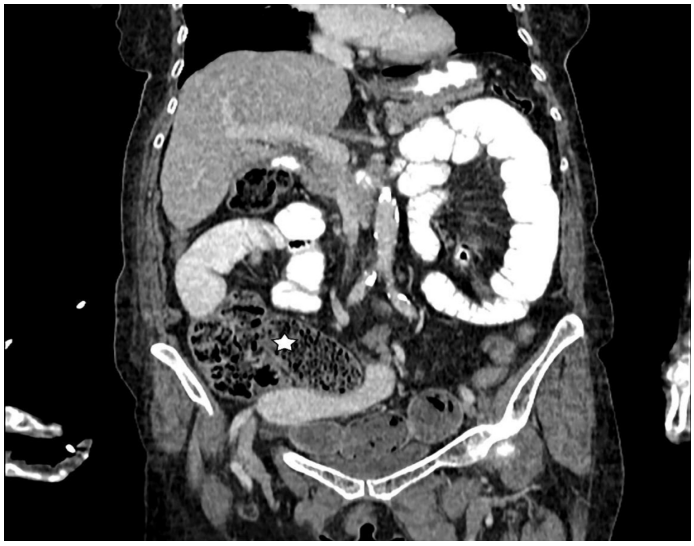

Figure 3. Sign of fecelization (white star)

Management of the patients

Patients without an indication for emergency surgery were followed up by stopping oral intake, inserting a nasogastric tube, and arranging IV hydration therapy. The patients were followed up for a maximum of 72 hours, as recommended in the literature, in terms of daily spontaneous gas-stool output, the character and amount of the contents draining from the nasogastric tube, fever, pulse, blood pressure, abdominal auscultation findings, and direct abdominal X-ray, WBC, CRP, electrolytes and other biochemical parameters. [3,8]. Patients who developed acute abdomen symptoms during their follow-up were operated, and patients whose symptoms regressed and who tolerated oral intake and had gas-stool discharge were discharged after 72 hours.

Statistical Analysis

The data obtained in the study were statistically analyzed using the IBM Statistics Package for Social Sciences (SPSS) ver 20.0 software. The conformity of the data to the normal distribution was tested using the Shapiro-Wilk test and Levene test, as well as the homogeneity of variance. Independent samples t-test and Mann-Whitney U test were used to compare numerical data. Chi-Square and Fischer's Exact tests were used to compare categorical data. Pearson and Spearman's correlation analyzes were used to evaluate the factors associated with surgery. The contribution of the factors to the surgical decision was calculated by binary logistic regression analysis. Optimal cut-off values for the surgical application of each value were determined by the Receivers operating characteristic (ROC) curves. Quantitative data were expressed in the tables as mean ± standard deviation (SD) (Maximum-Minimum) and median (25%-75% values). Categorical data were expressed as n (numbers) and percentages (%). A value of $p<0.05$ was considered statistically significant.

Results

Among 228 patients admitted to the emergency department, 94 patients who were diagnosed with adhesive intestinal obstruction by oral and IV contrast-enhanced abdominal CT and met the inclusion criteria were included in the study (Figure 4).

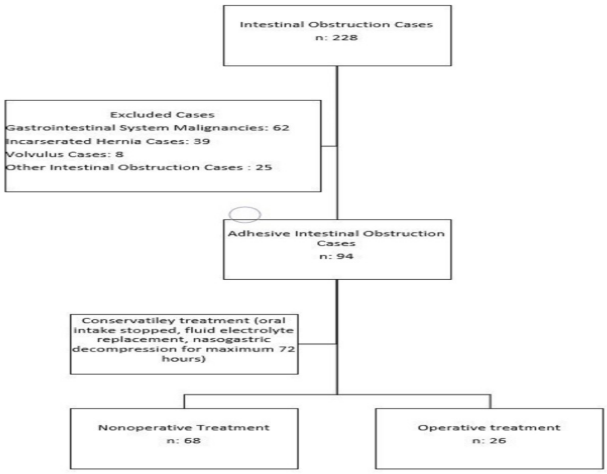

Figure 4. Flowchart of the study design

DOI: 10.5455/medscience.2022.12.266

The mean age of the patients was 55.14±18.74 years (18-86) in Group 1 and 56.73±17.43 years (19-85) in Group 2, and no significant difference was found between the groups (p=0.710). Although there was no statistically significant difference between the groups in terms of gender (p=0.722), the number of male patients was higher in both groups than females, and 64% of Group 1 (n=43); 66% (n=17) of Group 2 were male. The number of previous surgeries was 2.21±1.28 in Group 1 and 2.27±1.01 in Group 2, and no significant difference was found between the two groups (p=0.861). The mean duration of stool discharge in patients followed in Group 1 was 42.35±19.35 hours (8-72). The mean time to decide on surgical treatment in group 2 was 37.69±23.57 hours (range: 2-72). The mean hospital stay was 3.16±1.36 days (1-7) in Group 1, 8.69±3.37 days in Group 2 (5-16), and it was statistically significantly higher in Group 2 (p=0.001) (Table 2).

WBC was 9.68±3.52 (3.4-14.75) in Group 1, 10.53±5.29 (2.9-19.8) in Group 2, CRP was 51.58±61.62 in Group 1, 75.07±88.39 in Group 2, no statistically significant difference between the group was detected (p=0.370, p=0.149, respectively). When the electrolytes and BUN/creatinine parameters were examined, the mean K value was 4.29±0.80 mmol/l in Group 1 and 3.95±0.60 mmol/l in Group 2; The lactate level in blood gas was 1.17±0.46 U/L in Group 1, 1.71±1.10 U/L in Group 2, and K and lactate levels were significantly higher in Group 2 (p=0.045, p=0.001, respectively). There were no significant differences between the groups in terms of Na, LDH and amylase values and BUN/creatinine ratios (p=0.782, LDH p=0.353, amylase p=0.111, p=0.928, respectively) (Table 1)

While changes and regression in the localization of air-fluid levels were observed in 90% (n:61) of the patients in Group 1, it was observed that it persisted in 77% (n:20) of the patients in Group 2 (p=0.001).

There was no significant difference between the groups in terms of the incidence of intraperitoneal free fluid, the rate of visibility of the transition zone, and the finding of fecalization detected by CT (p=0.541, p=0.079, p=0.079, respectively). Contrast transfer rates to the colon in Group 1 and intestinal wall thickness were statistically significantly higher in Group 2 (p<0.001) (Table 3). When all parameters were examined, it was seen that some findings were effective in the choice of surgical treatment. When factors related to surgery are evaluated, laboratory parameters include lactate elevation (r:0.326, p=0.001), increase in small intestine diameter on tomography (≥3.95 cm) (r:0.299, p=0.003) and increase in small intestinal wall thickness (>3mm) (r :0.540, p<0.001), a positive correlation was detected. A negative correlation was observed with the displacement of air-fluid levels on the graphy (r:-0.291, p=0.004) and with the transfer of contrast material to the colon (r:-0.668, p<0.001) on the tomography. Absence of contrast transfer to the colon (OR: 8.66, 95%CI:1.34-56.09, p<0.001), increased small bowel wall thickness (>3mm) (OR:2.23, 95%CI: 1.36-14.07, p=0.023) and thin Intestinal diameter over 3.95 cm (OR: 5.53, 95% CI: 1.87-25.58, p=0.001) was found to be among the reasons that increased the probability of surgery.

Gas-stool discharge time in group 1 was calculated as 42.35±19.35 (min:8, max:72) hours on average. In Group 2, the mean time to decision on surgical treatment was 37.69±23.57 (2-8) hours.

Table 2. Clinical and laboratory findings

	Group 1 (conservative treatment) (n=68)	Group 2 (surgery) (n=26)	p
Age (years)	55.14±18.74	56.73±17.43	0.710
Gender (Female) (n/%)	25 (%36)	9 (%34)	0.722
Number of previous surgeries	2.21±1.28	2.27±1.01	0.861
BMI (kg/m^2)	25.96±4.71	26.08±4.27	0.895
Stool discharge time (For conservative treatment group)	42.35±19.35	-	
Surgery time	-	37.69±23.57	
Hospitalization day	3.16±1.36	8.69±3.37	**0.001**
WBC	9.68±3.52	10.53±5.29	0.370
CRP	51.58±61.62	75.07±88.39	0.149
Na	138.16±3.58	138.38±3.17	0.782
K	4.29±0.80	3.95±0.60	**0.045**
BUN/creatinine	21.59±8.36	21.78±10.65	0.928
Lactate	1.17±0.46	1.71±1.10	**0.001**
Amylase	57.64±37.58	80.96±103.76	0.111
LDH	258.07±88.17	283.91±130.03	0.353

DOI: 10.5455/medscience.2022.12.266

Table 3. Radiological findings

		Group 1 (conservative treatment) (n=68)	Group 2 (surgery) (n=26)	p
Air-fluid level displacement on X-ray	Yes	61	6	0.001
	No	7	20	
CT	Yes	35	13	0.541
Free fluid	No	33	13	
CT	Yes	15	21	<0.001
Increase in wall thickness	No	53	5	
CT	Yes	29	16	**0.079**
Transition zone	No	39	10	
CT	Yes	17	10	0.150
Feces sign	No	51	16	
CT and X-ray	Yes	60	5	**<0.001**
Contrast transition to the colon	No	8	21	

Discussion

Although hemoglobin value in the diagnosis of intestinal obstruction is significant in terms of etiologies such as inflammatory bowel diseases, malignancies and Meckel's diverticulum, it does not have specific importance in the differential diagnosis of adhesive obstruction. However, leukocytosis may indicate the presence of complications such as perforation and peritonitis and may guide the clinician in terms of operation indication or timing. The values of blood urea nitrogen, creatinine, sodium, potassium and other electrolytes are important in determining the value and severity of hypovolemia and metabolic disorders [9]. Evaluation of blood gas parameters gains more importance in patients presenting with systemic disease symptoms such as fever, tachycardia, confusion and hypotension. Metabolic alkalosis in blood gas may result from severe vomiting, but metabolic acidosis may develop as a result of severe hypovolemia and intestinal ischemia [8]. Elevated LDH is an indicator of tissue damage. Since LDH is in many tissues, it does not provide information about the location and cause of tissue damage. However, it can give an idea about whether tissue damage has developed in a patient with obstruction symptoms. Serum lactate levels are not a reliable and specific laboratory parameter for ischemia, but they are significant in terms of ischemia predictivity in patients with small bowel obstruction. Pancreatic amylase can be elevated in small bowel pathologies (such as ischemia and perforation) [10]. For this reason, it can help the diagnosis in patients who are thought to have obstruction.

The use of abdominal CT in cases of intestinal obstruction is becoming increasingly common. It has high sensitivity and specificity in determining the etiology and level of obstruction [11].

In our study, the rate of patients diagnosed with adhesive intestinal obstruction and treated conservatively was 72%, which was found to be compatible with the literature [8,12]. The fact that the number of male patients was higher than females in both groups in our study suggests that the male gender is a risk factor for acute intestinal obstruction. The mean age of the patients in our study was 55, which is relatively low compared to similar publications in the literature. The mean age of the patients in our study was 55, which is relatively low compared to similar publications in the literature. However, it has been shown in the literature that the risk of developing adhesive obstruction increases with age.

In a study on the time of follow-up and surgical decision-making by applying an oral gastrograph, the absence of contrast in the colon after 24 hours is recommended as an indication for surgical treatment [13]. However, in our study, only 46% of our patients had gas-stool discharge in the first 24 hours, and 54% had 24-72 hours of discharge, indicating that it would be more appropriate to extend the conservative treatment period up to 72 hours. Thus, it would cause surgical complications, long hospital stays, increased surgical cost and increased probability of adhesion. Thus, it would cause surgical complications, long hospital stays, increased surgical cost and increased probability of adhesion. From this point of view, we think that it would be more accurate to follow up with conservative treatments.

The aim of radiological imaging in patients with intestinal obstruction is primarily to determine the transition zone and the etiology of the obstruction. The next aim is to investigate the presence of complications such as ischemia and perforation [14]. In cases where an intestinal obstruction is suspected, the first imaging method to be performed is an abdominal X-ray. However, the place of conventional radiographs in the diagnosis of obstruction decreases to 46% despite the latest technological

DOI: 10.5455/medscience.2022.12.266

developments [15].

Although ultrasonography is successful in showing especially enlarged bowel loops, bowel diameters, and intra-abdominal free fluid in patients with ileus, its use is limited in demonstrating the level and etiology of obstruction [16]. In the study of Baid et al., it was shown that CT findings overlap with the perioperative and intraoperative findings at a high rate (86.67%). CT findings are very important in the management of patients, it shows emergency operation indications such as ischemia and perforation with high accuracy and helps clinicians with their rapid examination time [15]. In a meta-analysis, CT has been shown to have a sensitivity of 92% (81-100%) and specificity of 93% (range 68-100%) in complete obstructions. However, no standard conclusion has been reached for years regarding the CT procedure, contrast agent use, and CT scan time [17]. The use of intravenous contrast is very useful in the diagnosis of strangulation and in determining the localization, etiology and degree of obstruction [18]. In addition, the use of intravenous contrast has a unique diagnostic importance in terms of possible ischemic mechanical bowel obstruction by illuminating mesenteric vascular pathologies [19]. The use of oral contrast varies according to the patient's condition and the experience of the clinics. Direct CT is performed without the use of oral contrast in patients with suspected strangulation, perforation or complete obstruction. In patients with stable general conditions, oral contrast application not only provides a more accurate determination of the transition zone, but also provides a therapeutic effect with intraluminal pressure [20,21].

Our study has some limitations. The most important limitation is that it was planned retrospectively. Since we are the tertiary reference hospital in our city, most complicated cases admit to our hospital. There are similar studies in the literature. However, despite these, the most important contribution of our study to the literature is that it provides data that will predict in which patient's medical treatment may be more successful, especially according to imaging methods.

Conclusion

As a result, radiological findings are more important than laboratory parameters in determining the decision and time of surgery in cases diagnosed with intestinal obstruction. A small bowel diameter of 3.95 cm, intestinal wall thickness greater than 3 mm, and the absence of passage of oral contrast into the colon are the most reliable radiological parameters in terms of operation indication.

Conflict of interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical approval
The study protocol was approved by Kahramanmaras Sutcu Imam University, Medical Faculty Ethics Committee (Date: 06.02.2019 No: 2019/02-18)

References

1. Attard JA, MacLean AR. Adhesive small bowel obstruction: epidemiology, biology and prevention. Can J Surg. 2007;50:291-300.
2. Hernandez MC, Haddad NN, Cullinane DC, et al. The American Association for the Surgery of Trauma Severity Grade is valid and generalizable in adhesive small bowel obstruction. J Trauma Acute Care Surg. 2018;4:372-78.
3. Ten Broek RPG, Krielen P, Di Saverio S, et al. Bologna guidelines for diagnosis and management of adhesive small bowel obstruction (ASBO): 2017 update of the evidence-based guidelines from the world society of emergency surgery ASBO working group. World J Emerg Surg. 2018;13:24.
4. Silva AC, Pimenta M, Guimaraes LS. Small bowel obstruction: what to look for. Radiographics. 2009;29:423–39.
5. Petrovic B, Nikolaidis P, Hammond NA, et al. Identification of adhesions on CT in small-bowel obstruction. Emerg Radiol. 2006;12:88–93.
6. Silva AC, Pimenta M, Guimaraes LS. Small bowel obstruction: what to look for. Radiographics. 2009;29:423–439.
7. Deshmukh SD, Shin DS, Willmann JK, et al. Non-emergency small bowel obstruction: assessment of CT findings that predict need for surgery. Eur Radiol. 2011;21:982–6.
8. Brunicardi, F. Charles. Schwartz'sprinciples of surgery. McGraw-Hill, 2018.
9. Karakaş DÖ, Yeşiltaş M, Gökçek B, Eğin S, Hot S. Etiology, management, and survival of acute mechanical bowel obstruction: Five-year results of a training and research hospital in Turkey. Ulus Travma Acil Cerrahi Derg. 2019;25:268-80.
10. Verma I, Kaur S, Goyal S, et al. Diagnostic value of lactate levels in acute abdomen disorders. Indian J Clin Biochem. 2014;29:382-5.
11. Taydaş O, Ünal E, Onur MR, Akpınar E. Role of computed tomography in intestinal obstruction. Istanb Med J. 2018;19:105-12.
12. Behman R, Nathens AB, Hong NL, et al. Evolving management strategies in patients with adhesive small bowel obstruction: a population-based analysis. J Gastrointest Surg. 2018;22:2133–41.
13. Chen S, Lin F, Lee P, et al. Water-soluble contrast study predicts the need for early surgery in adhesive small bowel obstruction. Br J Surg. 1998;85:1692–4.
14. Paulson EK, Thompson WM. Review of small-bowel obstruction: the diagnosis and when to worry. Radiology. 2015;275:332-42.
15. Baid G, Manohar LD, Ashok P. Role of CT scan in evaluation and management of intestinal obstruction. Int J Surg. 2017;4:2257-61.
16. Tamburrini S, Lugarà M, Iaselli F, et al. DiagnosticAccuracy of Ultrasound in the Diagnosis of Small Bowel Obstruction. Diagnostics (Basel). 2019;9:88.
17. Mallo RD, Salem L, Lalani T, Flum DR. Computed tomography diagnosis of ischemia and complete obstruction in small bowel obstruction: a systematic review. J Gastrointest Surg. 2005;9:684-90.
18. Saini DK, Chaudhary P, Durga CK, Saini K. Role of multislice computed tomography in evaluation and management of intestinal obstruction. Clin Pract. 2013;3:e20.
19. Vernuccio F, Picone D, Scerrino G, et al. Intravenous Contrast Agent in Abdominal CT: Is It Really Needed to Identify the Cause of Bowel Obstruction? Proof of Concept. Gastroenterol Res Pract. 2019;2019:2350948.

DOI: 10.5455/medscience.2022.12.266

20. Hassan M, Ali M, Shazlee MK, et al. Detection of Transition Zone in Bowel Obstruction via Curved Multiplanar Reformations with Multidetector Computed Tomography. Cureus. 2019;11:e4233.
21. Thompson JS. Contrast radiography and intestinal obstruction. Ann Surg. 2002;236:7-8.