Am J Transl Res 2022;14(10):7585-7592
www.ajtr.org /ISSN:1943-8141/AJTR0145065

Original Article

Clinical value of radiography after transnasal ileus intubation for the surgical timing of small bowel obstruction

Zheng Zhao, Kuanxue Sun, Jian Sun, Xiaoyan Cai, Jie Lu, Jiangnan Dong

Department of General Surgery, Gongli Hospital, Shanghai 200135, China

Received July 1, 2022; Accepted October 10, 2022; Epub October 15, 2022; Published October 30, 2022

Abstract: Objective: To explore the guiding value of radiography after transnasal ileus intubation for the treatment of small bowel obstruction and the selection of surgical timing. Methods: This retrospective study analyzed the clinical data of 133 patients with small bowel obstruction who were admitted to Gongli Hospital from January 2013 to December 2020. The patients were included in a nasogastric intubation group (n=65) or a transnasal ileus intubation + radiography group (n=68), according to different treatment methods. The response rate of non-surgical treatment, bowel function, observation time before surgery, postoperative complications and the recurrence rate were observed in both groups. Results: There was no significant difference in the response rate of non-surgical treatment and the incidence of postoperative complications between the two groups (P=0.257 and P=0.959, respectively). The observation time before surgery was shorter and the recurrence rate of obstruction was lower in the transnasal ileus intubation + radiography group than those in the nasogastric intubation group. The pain relief time, first flatus time and hospital stay were shorter in the transnasal ileus intubation + radiography group than those in the nasogastric intubation group, with statistically significant differences (all P<0.05). It was found that ascites and observation time before surgery were the influencing factors of surgical timing in patients with small bowel obstruction. Conclusion: Transnasal ileus intubation is an effective treatment for small bowel obstruction. Radiography after transnasal ileus intubation is helpful to determine the optimal surgical timing for small bowel obstruction, shorten the postoperative recovery time and reduce the recurrence rate in patients, so it is recommended in clinical practice.

Keywords: Small bowel obstruction, radiography after transnasal ileus intubation, nasogastric intubation, clinical response, complications

Introduction

Ileus, also known as bowel obstruction is commonly seen in patients undergoing abdominal surgery, and acute ileus is a type of acute abdominal emergency, accounting for over half of bowel obstruction. Small bowel obstruction is mostly mechanical obstruction, with main causes being intestinal adhesion, intestinal tumor, intestinal foreign body, volvulus and intussusception [1, 2]. Studies have shown that almost all patients undergoing abdominal surgery have different degrees of intestinal adhesions. Reducing the degree of intestinal adhesions and eliminating the potential acute-angle adhesions in the intestinal lumen can decrease the occurrence of acute bowel obstruction [3, 4]. However, there is no clinically unified approach in preventing and treating the adhesions [5, 6]. Therefore, improving transnasal ileus treatment is of great significance to relieving bowel obstruction after abdominal surgery.

Small bowel obstruction after abdominal surgery is a partial obstruction in the vast majority of patients, so non-surgical treatment is usually the first choice. However, the effect of traditional gastrointestinal decompression for drainage of intestinal contents is still not ideal [7-9]. Recent clinical data have shown that transnasal ileus intubation is the primary conservative treatment for ileus due to its promising decompression effect [10, 11]. For patients with acute complete small bowel obstruction, timely surgi-

cal treatment is required. Therefore, the determination of the surgical timing is of great significance to the prognosis of the patients. Furthermore, study showed that oral meglumine diatrizoate during bowel radiography can help to locate and define the degree of obstruction, as well as to guide the incision [12]. Previous studies have mostly focused on the observation time before surgery, so there is a lack of comprehensive evaluation of radiography after transnasal ileus intubation for the treatment of small bowel obstruction and its guiding value on the determination of surgical timing [13]. This study investigated the relevant preoperative, perioperative and postoperative indicators, and compared the guiding value for surgical timing and clinical response between nasogastric intubation and transnasal ileus intubation for small intestinal obstruction, so as to improve the treatment for ileus.

Materials and methods

General data

This retrospective study analyzed the clinical data of 133 patients with small bowel obstruction admitted to Gongli Hospital from January 2013 to December 2020. The patients were included in a nasogastric intubation group (n=65) or a transnasal ileus intubation + radiography group (n=68) according to the different treatment methods. Both groups of patients signed an informed consent for treatment, and this study has been approved by the ethics committee of Gongli Hospital.

Inclusion criteria: 1. Patients with mechanical obstruction; 2. Patients who showed clinical manifestations such as abdominal pain or distension, vomiting, or no flatus and defecation; 3. Patients who had bowel dilatation (≥3 cm) and air-fluid levels suggested by computed tomography or X-ray [14]; 4. Patients who complied with the treatment; and 5. Patients who had complete data.

Exclusion criteria: 1. Patients who had mesenteric vascular obstruction or signs of peritonitis; 2. Patients who had dynamic bowel obstruction, such as paralytic ileus; 3. Patients with severe insufficiency in heart, liver or kidney; 4. Patients who had incomplete clinical data; 5. Patients with a history of disputes.

Treatment methods

After admission, both groups were routinely fasted, and given anti-infection care, as well as adjustment of internal environment and nutritional therapy.

Patients in the nasogastric intubation group were given a traditional nasogastric tube for gastrointestinal decompression. The specific operation procedures were as follows. A nasogastric tube was inserted from the nasal cavity to about 45-55 cm deep, and a negative pressure aspirator was connected for gastrointestinal decompression. If patients showed unrelieved or aggravated symptoms or peritonitis, surgery was applied.

For patients in the transnasal ileus intubation + radiography group, the intestinal obstruction tube was placed into the stomach through the nose under X-ray fluoroscopy, and the tube was gently pushed through the pylorus until 50 cm away from jejunum (far-end). Then, 10 to 15 mL of sterilized distilled water was injected into the anterior sac to assist the tube to move toward the distal small intestine, so as to gradually reach the obstruction site or the terminal ileum for full decompression. Additional selective radiography (using 40 mL meglumine diatrizoate (H43021120, Hansen Pharmaceutical Co., Ltd., Hunan, China)) via the ileus tube was performed 24-72 h later, when the ileus tube reached the site of the obstruction lesion, or reached the end of ileum it was drawn back to the proximal jejunum. First, the water in the anterior sac of the ileus tube was released, and 30-60 mL of air was injected into the back sac. Next, fluoroscopy was used to confirm a well filled air sac, closed intestinal cavity, an anastomose of the air sac and the intestinal wall to prevent countercurrent flow of the contrast agent. Then, 100-200 mL of contrast agent was injected into the main drainage tube to observe the passage of contrast agent in the obstructed intestinal canal via dynamic fluoroscopy. Radiographs were taken in a timely manner to retain information. If the contrast agent was able to pass through the obstructed intestinal canal and reach the colon within 24-48 h, and the patient's clinical symptoms were relieved with recovery of voluntary flatus and defecation, the above conservative treatment was continued. On the contrary, timely surgery

Table 1. Comparison of general data between the two groups

Group	n	Age (years old)	Sex (male/ female)	BMI	Cause					
					Intestinal adhesion	Intestinal tumor	Intestinal foreign body	Volvulus	Intussusception	Other
Ileus intubation + radiography group	68	65.4±5.7	38/30	25.0±2.4	48	9	4	2	1	3
Nasogastric intubation group	65	65.0±4.3	32/33	25.4±3.0	48	10	3	1	1	2
t/χ^2	-	0.776	0.353	0.884			0.773			
P	-	0.442	0.552	0.531			0.993			

Note: BMI: Body Mass Index. Measurement data were processed using t test, and t is the statistical value. Counting data were processed using Chi-square test, and χ^2 is the statistical value.

was applied if the contrast agent failed to pass through the narrow intestine, remained in the proximal end of the obstruction and was not able to reach the colon, or when patients showed aggravated clinical symptoms.

Outcome measures

Main outcome measures included the response rate of non-surgical treatment (response rate = (cases of markedly effective + cases of effective)/total number of cases * 100%), observation time before surgery (time from conservative treatment to surgery), incidence of bowel necrosis, postoperative complications and recurrence rate of bowel obstruction. The clinical response was classified as follows, markedly effective: no more symptoms or signs of abdominal distention and pain, complete recovery of voluntary flatus and defecation, normal bowel sounds during auscultation, no air-fluid level found on abdominal plain film, and no obvious bowel dilation; effective: relief of clinical symptoms such as abdominal distention, nausea and vomiting, partial relief of obstruction (showing by abdominal plain film) and recovery of voluntary flatus and defecation; ineffective: no improvement or aggravation of obstruction or air-fluid levels, showing peritonitis or shock and requiring emergent surgical intervention.

Secondary outcome measures included the abdominal pain relief time, first flatus time and hospital stay, which were recorded and compared between the two groups.

Statistical processing

Statistical software SPSS 23.0 was used to analyze the data. Continuous variables with a normal distribution were expressed as mean ± standard deviation ($\bar{x} \pm sd$). The comparisons within group were performed by paired t test, and the comparisons between the two groups by independent sample t test. The enumeration data were expressed as (n, %) and subjected to Pearson's chi-square test. Logistic regression was used to analyze the influencing factors of the surgical timing in patients. A difference of $P<0.05$ was considered statistically significant.

Results

Comparison of baseline data

There was no statistically significant difference in age, sex, body mass index and surgical history between the two groups, showing comparability (all $P>0.05$). See **Table 1**.

Comparison of response rate of non-surgical treatment

There were 15 patients in the transnasal ileus intubation + radiography group and 21 patients in the nasogastric intubation group who underwent surgery due to the ineffectiveness of non-surgical treatment, and no significant difference in the response rate of non-surgical treatment was found between the two groups ($P>0.05$). See **Table 2**.

Comparison of incidence of postoperative complications and recurrence rate

The incidence of postoperative complications was lower in the transnasal ileus intubation + radiography group than that in the nasogastric intubation group, but the difference was not statistically significant ($P>0.05$), while the recurrence rate in the transnasal ileus intubation + radiography group was significantly lower than that in the nasogastric intubation group ($P<0.05$). See **Table 3**.

Table 2. Comparison of response rate of non-surgical treatment between the two groups (n, %)

Group	n	Markedly effective	Effective	Ineffective	Response rate
Ileus intubation + radiography group	68	30 (44.12)	23 (33.82)	15 (22.06)	77.94
Nasogastric intubation group	65	25 (38.46)	19 (29.23)	21 (32.31)	67.69
χ^2	-		1.287		
P	-		0.257		

Note: Counting data were processed using Chi-square test, and χ^2 is the statistical value.

Table 3. Comparison of incidence of postoperative complications and recurrence rates between the two groups (n, %)

Group	n	Complication				One-year recurrence rate
		Infection of incision	Intestinal fistula	Abdominal cavity infection	In total	
Ileus intubation + radiography group	15	2 (13.33)	0 (0.00)	1 (6.67)	3 (20.00)	1 (6.67)
Nasogastric intubation group	21	5 (23.80)	1 (4.76)	1 (4.76)	7 (33.33)	9 (42.86)
χ^2			0.353			4.051
P			0.552			0.044

Note: χ^2 is the statistical value of Chi-square test.

Table 4. Comparison of observation time before surgery, abdominal pain relief, first flatus and length of hospital stay between the two groups

Group	Observation time before surgery (d)	Abdominal pain relief time (d)	First flatus time (d)	Length of stay (d)
Ileus intubation + radiography group	1.22±0.34	1.13±0.56	2.87±0.78	6.36±0.76
Nasogastric intubation group	2.57±0.77	2.17±0.54	4.38±1.25	8.87±1.39
T	6.343	5.610	4.130	6.333
P	<0.001	<0.001	<0.001	<0.001

Note: Measurement data were processed using t test, and t is the statistical value.

Comparison of observation time before surgery, abdominal pain relief time, first flatus time and hospital stay

The observation time before surgery, abdominal pain relief time, first flatus time and length of hospital stay in the transnasal ileus intubation + radiography group were all shorter than those in the nasogastric intubation group, with statistically significant differences (all P<0.001). See **Table 4**; **Figures 1** and **2**.

Univariate analysis of factors influencing surgery timing for adhesive small bowel obstruction

Univariate analysis showed that the factors related to the need of surgical treatment for adhesive small bowel obstruction included white blood cell count, ascites and signs of peritoneal irritation. While the application of radiography catheterization, sex, age, and degree of intestinal dilatation were not related to the need of surgery. See **Table 5**. Furthermore, the above factors and observation time before surgery were taken as independent variables for Logistic regression analysis, and the timing of surgery for adhesive ileus was the dependent variable. It was found that ascites and observation time before surgery were the influencing factors of surgical timing in patients with adhesive small bowel obstruction. See **Table 6**.

Discussion

Small bowel obstruction is commonly seen after correction in the colorectum in adults, or in congenital intestinal abnormalities in children and after gynecological surgeries. Other common causes are intestinal autoinflammation, hernias, intra-abdominal abscesses and dry stool. [15]. Surgery can remove obstructions, alleviate abdominal distension and pain,

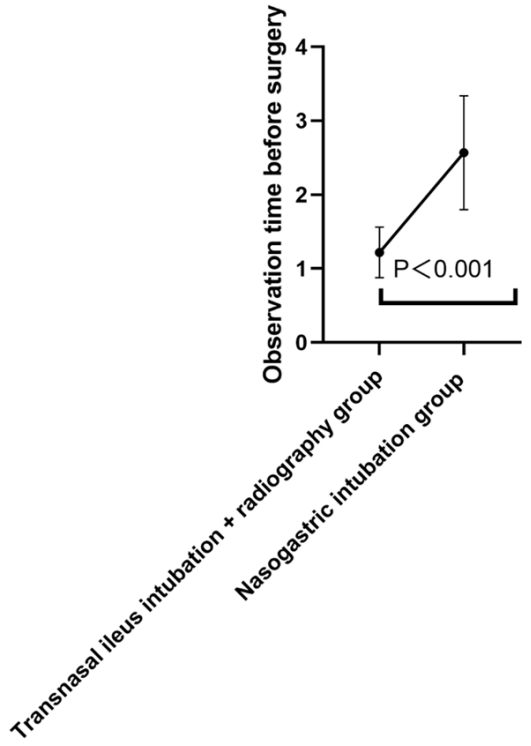

Figure 1. Comparison of observation time before surgery between the two groups.

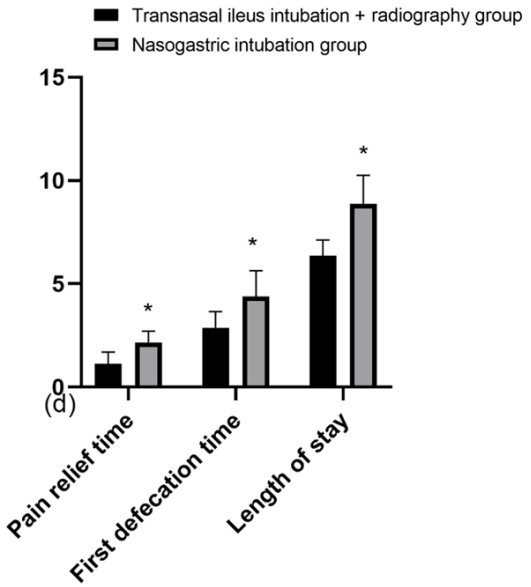

Figure 2. Comparison of abdominal pain relief time, first flatus time and length of hospital stay between the two groups. Compared with the transnasal ileus intubation + radiography group, *P<0.05.

and restore the intestinal peristalsis function, but studies have shown a high recurrence rate of bowel obstruction, because the surgery can increase abdominal cavity adhesion, which potentially aggravates the risk of recurrence [16, 17].

To date, conservative nasogastric intubation for drainage is mostly used for acute bowel obstruction. However, it is limited by the inability to timely evaluate the treatment effect, and the disease condition can only be accessed based on clinical manifestations and doctor's experience, which may be inaccurate and even lead to delayed treatment. The latest research has shown that the efficacy of transnasal ileus intubation for the conservative treatment of small bowel obstruction is good, with a response rate between 70% and 80% [18, 19]. Consistent with these results, this study found that the response rate of transnasal ileus tube was 72.93%, which was higher than that of the nasogastric intubation group, which preliminarily confirms the efficacy of transnasal ileus tube. Potentially the mechanisms could be related to how the transnasal ileus tube can effectively and quickly reach the obstruction site, which helps to relief the abdominal symptoms and reduce abdominal pressure because of the negative suction pressure. Meanwhile, it can relieve the blood circulation and edema of the intestinal wall in a short time, which is conducive to the recovery of intestinal function.

Scholars have found that bowel radiography could help identify the obstruction and help make accurate judgments about the disease condition, thereby shortening the observation time before surgery [20]. Also, it is believed that patients with certain manifestations in radiography should be actively treated by surgery. For instance, when the contrast agent deos not reach the colon within 24 h; when the symptoms were relieved after 24 h, but the contrast agent did not reach the colon for another 48 h of continuous observation; when an ineffective result was found 12 h after the repeated use of meglumine diatrizoate; and when an effective result was found within 24 h, but the conditions became aggravated within 48 h. The results of our study showed that the observation time before surgery was shorter in the transnasal ileus intubation + radiography group than that in the nasogastric intubation group, and Logistic regression analysis revealed that the observation time before surgery was an influencing factor of surgical timing in patients with adhesive small bowel obstruction, which can

Table 5. Univariate analysis of influencing factors of surgical timing in patients with adhesive small bowel obstruction

Item	Patients in need of surgery (n=36)	Patients responded to non-surgical treatment (n=97)	χ^2	P
Age			0.054	0.817
≤65 years old	17	48		
>65 years old	19	49		
Sex			0.169	0.681
Male	20	50		
Female	16	47		
White blood cell count			14.030	<0.01
>15.0 × 10^9	28	40		
≤15.0 × 10^9	8	57		
Ascites			4.024	0.045
Yes	22	76		
No	14	21		
Signs of peritoneal irritation			5.404	0.020
Yes	23	40		
No	13	57		
Dilatation of intestine >3 cm			0.137	0.711
Yes	18	52		
No	18	45		

Table 6. Logistic regression analysis of influencing factors of surgical timing in patients with adhesive small bowel obstruction

Item	Standardized β	OR	95% CI	P
White blood cell count	0.011	1.012	0.886-1.334	0.218
Ascites	1.355	3.878	1.034-4.553	0.001
Signs of peritoneal irritation	0.509	1.664	0.774-1.486	0.455
Operation observation time	1.021	2.776	1.218-3.443	0.002

support the previous conclusion that radiography could assist the judgement of disease condition and the determination of surgical timing [21]. Meanwhile, Logistic regression analysis showed that ascites was also a factor affecting the surgical timing, which may be related to the acute development of bowel obstruction leading to intestinal edema, resulting in ascites.

Recent research has shown that the contrast agent meglumine diatrizoate is also considered effective in the treatment because of its physical properties of high permeability. The osmotic pressure of meglumine diatrizoate is about 6 times to that of extracellular fluid, so this agent can promote the infiltration of extracellular fluid into the intestinal lumen along the gradient. In this case, a large amount of fluid can dilute the intestinal lumen contents, promote intestinal dilation, increase the gradient pressure of obstructed small intestine, and ultimately help the substance pass through the narrow segment [22, 23]. Therefore, meglumine diatrizoate has a certain therapeutic effect. This study showed no statistical difference in the response rate of non-surgical treatment between the two groups, but the response rate of the transnasal ileus intubation + radiography group was slightly higher than that of the nasogastric intubation group, which may be related to the limited sample size or patients' individual conditions. Meglumine diatrizoate effectively improved the local microenvironment in the abdominal cavity, relieved inflammation, reduced the pressure in the intestinal cavity, prepared the intestinal tract for surgery and helped postoperative functional recovery. The results of this study also showed that the postopera-

tive recovery (length of hospital stay and pain relief time) of the transnasal ileus intubation + radiography group was better than that of the nasogastric intubation group, which further confirmed the clinical effect of meglumine diatrizoate as an adjuvant treatment [24, 25].

Comparison of prognosis between the two groups showed that the incidence of postoperative complications in the two groups was not statistically significant, indicating that the combination of meglumine diatrizoate and transnasal ileus tube did not increase the complications, which is consistent with previous research [26]. However, the recurrence rate in the transnasal ileus intubation + radiography group was significantly lower than that in the nasogastric intubation group, which may be related to shorter observation time, early intervention and better intestinal preparation in the transnasal ileus intubation + radiography group. Our results confirmed previous conclusion that meglumine diatrizoate could reduce the recurrence rate after bowel obstruction surgery [27].

To sum up, transnasal ileus intubation is an effective treatment for small bowel obstruction. Radiography after transnasal ileus intubation helps determine the surgical timing for small bowel obstruction, shortens the postoperative recovery time and reduces the recurrence rate, so it is recommended in clinical practice. However, this is a single-centered retrospective study with a small sample size, so prospective multi-center studies with larger sample size are needed to further improve the conclusions. Additionally, future study could also focus on the mechanism of meglumine diatrizoate on intestinal inflammatory response.

Disclosure of conflict of interest

None.

Address correspondence to: Jiangnan Dong, Department of General Surgery, Gongli Hospital, No. 219 Miaopu Road, Pudong New Area, Shanghai 200135, China. Tel: +86-021-58858730-5195; E-mail: dongjiangnan001@126.com

References

[1] Tong JWV, Lingam P and Shelat VG. Adhesive small bowel obstruction-an update. Acute Med Surg 2020; 7: e587.

[2] D'Agostino R, Ali NS, Leshchinskiy S, Cherukuri AR and Tam JK. Small bowel obstruction and the Gastrografin challenge. Abdom Radiol (NY) 2018; 43: 2945-2954.

[3] Eeftinck Schattenkerk LD, Musters GD, Hamming G, Jonge WJD, van Heurn LE and Derikx JP. Adhesive small bowel obstruction following abdominal surgery in young children (≤3 years): a retrospective analysis of incidence and risk factors using multivariate cox regression. J Pediatr Surg 2022; 57: 55-60.

[4] Long B, Robertson J and Koyfman A. Emergency medicine evaluation and management of small bowel obstruction: evidence-based recommendations. J Emerg Med 2019; 56: 166-176.

[5] Ong AW and Myers SR. Early postoperative small bowel obstruction: a review. Am J Surg 2020; 219: 535-539.

[6] Di Saverio S, Catena F, Kelly MD, Tugnoli G and Ansaloni L. Severe adhesive small bowel obstruction. Front Med 2012; 6: 436-439.

[7] Ten Broek RP, Issa Y, van Santbrink EJ, Bouvy ND, Kruitwagen RF, Jeekel J, Bakkum EA, Rovers MM and van Goor H. Burden of adhesions in abdominal and pelvic surgery: systematic review and met-analysis. BMJ 2013; 347: f5588.

[8] Tabchouri N, Dussart D, Giger-Pabst U, Michot N, Marques F, Khalfallah M, Bucur P, Barbier L, Kraemer-Bucur A, Nayeri M, Thiery J, Bourbao-Tournois C, Bourlier P, Salamé E and Ouaïssi M. Only surgical treatment to be considered for adhesive small bowel obstruction: a new paradigm. Gastroenterol Res Pract 2018; 2018: 9628490.

[9] Tsai JM, Shoham M, Fernhoff NB, George BM, Marjon KD, McCracken MN, Kao KS, Sinha R, Volkmer AK, Miyanishi M, Seita J, Rinkevich Y and Weissman IL. Neutrophil and monocyte kinetics play critical roles in mouse peritoneal adhesion formation. Blood Adv 2019; 3: 2713-2721.

[10] Gu L, Zhu F, Xie T, Feng DY, Gong JF and Li N. Use of the water-soluble contrast medium gastrografin in treatment of adhesive small bowel obstruction in patients with and without chronic radiation enteropathy: a single-center retrospective study. Med Sci Monit 2021; 27: e930046.

[11] Paily A, Kotecha J, Sreedharan L and Kumar B. Resolution of adhesive small bowel obstruction with a protocol based on Gastrografin administration. J Med Life 2019; 12: 10-14.

[12] Weiss A, Sood D, Greenway SE and Tomassi M. Value of Gastrografin in adhesive small bowel obstruction. Langenbecks Arch Surg 2017; 402: 1233-1239.

[13] Van Loevezijn AA, Smithuis RHM and van den Bremer J. Gastrografin ALS prognostisch EN

therapeutisch medium Gastrografin as a prognostic and therapeutic medium; use for small bowel obstruction, but not for closed loop obstruction. Ned Tijdschr Geneeskd 2018 4; 162: D2408.
[14] Diamond M, Lee J and LeBedis CA. Small bowel obstruction and ischemia. Radiol Clin North Am 2019; 57: 689-703.
[15] Apfeld JC, Cooper JN, Gil LA, Kulaylat AN, Rubalcava NS, Lutz CM, Deans KJ, Minneci PC and Speck KE. Variability in the management of adhesive small bowel obstruction in children. J Pediatr Surg 2022; 57: 1509-1517.
[16] Behman R, Nathens AB, Mason S, Byrne JP, Hong NL, Pechlivanoglou P and Karanicolas P. Association of surgical intervention for adhesive small-bowel obstruction with the risk of recurrence. JAMA Surg 2019; 154: 413-420.
[17] Hwabejire JO, Tran DD and Fullum TM. Nonoperative management of adhesive small bowel obstruction: should there be a time limit after which surgery is performed? Am J Surg 2018; 215: 1068-1070.
[18] Cui H, Jiang X and Li H. Adhesive small-bowel obstruction treatment using internal intestinal splinting with a nasointestinal ileus tube. Minerva Chir 2015; 70: 327-330.
[19] Li DC, Li RH and Tian Q. Efficacy of intestinal decompression with long nasointestinal tube and selective contrast radiography in the treatment of small bowel obstruction in elderly patients. Minerva Chir 2016; 71: 85-90.
[20] Cohen RB, Olafson SN, Krupp J, Parsikia A, Kaplan MJ, Moran B and Leung PS. Timing of Gastrografin administration in the management of adhesive small bowel obstruction (ASBO): does it matter? Surgery 2021; 170: 596-602.
[21] Esaki M, Tamura Y, Ichijima R, Suzuki S, Iwamoto M, Minoda Y, Moriyama M and Gotoda T. Efficacy and timing of Gastrografin administration after ileus tube insertion in patients with adhesive small bowel obstruction. Arab J Gastroenterol 2022; 23: 45-51.
[22] Gu L, Ding C, Tian H, Yang B, Zhang XL, Hua Y, Gong JF and Li N. Use of Gastrografin in the management of faecal impaction in patients with severe chronic constipation: a randomized clinical trial. ANZ J Surg 2019; 89: 239-243.
[23] Fujikawa H, Kuwai T, Yamaguchi T, Miura R, Sumida Y, Takasago T, Miyasako Y, Nishimura T, Iio S, Imagawa H, Yamaguchi A, Kouno H and Kohno H. Gastric and enteric anisakiasis successfully treated with Gastrografin therapy: a case report. World J Gastrointest Endosc 2018; 10: 69-73.
[24] Köstenbauer JK. Managing adhesive small bowel obstruction with water-soluble contrast should be protocolized: a retrospective analysis. Surg J (N Y) 2018; 4: e123-e128.
[25] Cengarle A, Weber DG and Taib AG. Acute small bowel obstruction: one-year retrospective study of admissions to inner city royal perth hospital. ANZ J Surg 2020; 90: 1689-1693.
[26] Weiss A, Sood D, Greenway SE and Tomassi M. Value of Gastrografin in adhesive small bowel obstruction. Langenbecks Arch Surg 2017; 402: 1233-1239.
[27] Nishie H, Shimura T, Katano T, Iwai T, Itoh K, Ebi M, Mizuno Y, Togawa S, Shibata S, Yamada T, Mizushima T, Inagaki Y, Kitagawa M, Nojiri Y, Tanaka Y, Okamoto Y, Matoya S, Nagura Y, Inagaki Y, Koguchi H, Ono S, Ozeki K, Hayashi N, Takiguchi S and Kataoka H. Long-term outcomes of nasogastric tube with Gastrografin for adhesive small bowel obstruction. J Gastroenterol Hepatol 2022; 37: 111-116.