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Determining the etiology of small bowel obstruction in patients without intraabdominal operative history: a retrospective study

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Purpose: Most of the causes of small bowel obstruction (SBO) in patients without a history of abdominal surgery are unclear at initial assessment. This study was conducted to identify the etiology and clinical characteristics of SBO in virgin abdomens and discuss the proper management.

Methods: A retrospective review involving operative cases of SBO from a single institute, which had no history of abdominal surgery, was conducted between January 2010 and December 2020. Clinical information, including radiological, operative, and pathologic findings, was investigated to determine the etiology of SBO.

Results: A total of 55 patients were included in this study, with a median age of 57 years and male sex (63.6%) constituting the majority. The most frequently reported symptoms were abdominal pain and nausea or vomiting. Neoplasm as an underlying cause accounted for 34.5% of the cases, of which 25.5% were malignant cases. In patients aged ≥60 years (n=23), small bowel neoplasms were the underlying cause in 12 (52.2%), of whom 9 (39.1%) were malignant cases. Adhesions and Crohn disease were more frequent in patients aged <60 years. Coherence between preoperative computed tomography scans and intraoperative findings was found in 63.6% of the cases.

Conclusion: There were various causes of surgical cases of SBO in virgin abdomens. In older patients, hidden malignancy should be considered as a possible cause of SBO in a virgin abdomen. Patients with symptoms of recurrent bowel obstruction who have no history of prior abdominal surgery require thorough medical history and close follow-up.

Keywords: *Ileus; Intestinal obstruction; Neoplasms; Abdominal pain; Etiology*

INTRODUCTION

Small bowel obstruction (SBO) occurs in approximately 4.6% of patients after an intraabdominal surgery and gives rise to around 300,000 hospitalizations in a year in North America. Adhesions are the most prevalent cause of SBO, accounting for up to 70% of cases [1, 2]. There have been many discussions about SBO due to postoperative adhesions, for which nonoperative management has become the primary approach in patients with history of abdominal surgery [3, 4].

In patients with a "virgin abdomen," i.e., patients with no prior intraperitoneal surgery or procedures, abdominal wall hernia was the most frequent cause of SBO. Incarcerated hernias can occur in the inguinal, femoral, ventral, or umbilical regions, and can be noted on initial physical examinations [4]. Early surgical intervention for SBO has been the classic dogma when no hernia is detected in the virgin abdomen. These patients are more likely to have hidden malignancies; otherwise, they may have variant lesions that require prompt diagnosis and surgical treatment [4, 5].

On the other hand, a number of retrospective studies have proposed that most SBOs in the virgin abdomen more commonly have benign causes. They reported that 75% to 82% of patients

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could have been treated without surgery and avoided operative complications [6, 7]. Furthermore, radiological diagnosis has become more efficient in discovering malignant lesions due to technical advancement [8, 9].

A reliable method to manage SBO in a virgin abdomen has not formed a consensus because there is still limited proof of its etiology. Understanding the etiology of SBO in a virgin abdomen is important to decide on the appropriate surgical treatment and uncover the origin of obstruction. Thus, we focused on SBO cases, the causes of which at initial assessment are ambiguous due to the absence of any abdominal surgical history.

The purpose of this study was to determine the etiology of SBO in virgin abdomens and the clinical characteristics of these patients. This knowledge can be useful in predicting the cause of an SBO and developing an adequate, individualized management plan for each patient.

METHODS

A review of the operative cases of SBO without any history of abdominal surgery in a single institute (Ilsan Paik Hospital, Inje University College of Medicine, Korea), from January 2010 to December 2020 was performed retrospectively. Since the goal of this study was to determine the etiology of SBO in virgin abdomens, we only included patients who underwent surgical treatment for SBO and had the final diagnosis confirmed either through pathological or operative findings. The study was approved by the Institutional Review Board of Ilsan Paik Hospital (No. ISPAIK 2020-12-015) with a waiver for informed consent.

The surgical list that was managed by our general surgery department was used to identify patients who underwent surgery with SBO. Text search was performed on the list to identify the diagnosis and names of procedures that are relevant to the etiology of SBO. After identifying the operative cases for SBO, we excluded cases in which the causes of obstruction appeared to be obvious on preoperative imaging or physical examinations, such as postoperative adhesions, incarcerated abdominal wall hernia, and prediagnosed inflammatory disease. Patients were excluded if they underwent prior abdominal surgery, including appendectomy, cholecystectomy, cesarean section, and any laparotomy procedure performed for benign and malignant lesions. Patients without obstructive symptoms or evidence of bowel obstruction on imaging tests were also excluded. Bowel obstructive symptoms were defined as abdominal pain with nausea or vomiting, abdominal distension, and constipation. Imaging findings of SBO included obvious dilatation of the proximal small intestine, collapsed part distal to the obstructive lesion, prominent mucosal folds of the small intestine (valvulae conniventes), and air-fluid levels [10]. Other exclusion criteria were presence of small bowel neoplasms that were incidentally diagnosed without any bowel obstructive symptoms or signs of ileus on imaging studies, definitive peritoneal metastasis from other organs, paralytic ileus without any obstructive lesion, and SBO secondary to obvious colorectal malignancies. Patients who improved without surgical treatment and were not readmitted to the hospital due to recurrence of obstructive symptoms were also excluded from this study. In addition, those younger than 18 years were excluded from this study because the etiology of SBO in children was different from that in adults; most of the operative cases of SBO in children were due to congenital anomalies, intussusception, and incarcerated abdominal wall hernia.

Clinical characteristics, preoperative clinical course, laboratory, radiological, operative, and pathological findings, and follow-up data were examined using electronic medical records to determine the etiology of SBO. Pathological and operative findings were used to define the etiology of SBO. Clinical characteristics included age, sex, type of visit, number of previous visits or admissions, symptoms (abdominal pain, nausea/vomiting, constipation, diarrhea, gastrointestinal bleeding, unintentional weight loss [loss of >10% of body weight over 3 months], intermittent relief of pain, and fever), leukocyte count, initial vital signs, and medical and trauma history.

The etiologies of SBO were categorized as small bowel neoplasms (benign and malignant), adhesions, stricture or inflammation, intussusceptions, foreign bodies, internal hernia, mesenteric volvulus, and other special causes. If there were concomitant causes, we categorized it as the primary cause of the lesion. For example, internal hernia due to peritoneal adhesions, and intussusception due to a small bowel tumor were categorized as adhesions and small bowel tumors, respectively.

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics for Windows, ver. 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were reported as mean ± standard deviation. Differences between mean values were tested using the t-test. For analysis of categorical variables, the chi-square test or Fisher exact test were used. The differences observed were considered statistically significant with a P-value of < 0.05.

RESULTS

In a total of 55 patients, a greater number of male patients (63.6%) were included than female patients, with an overall median age of 57 years (range, 18–89 years). The most common presentations were abdominal pain (100%) and nausea/vomiting (34.6%). The clinical characteristics of the patients are summarized in Table 1.

The etiologies of SBO in the study group are shown in Table 2. Small bowel neoplasms were the underlying cause in 19 patients (34.5%) of which malignant neoplasms were found in 14 cases (25.5% of total, 73.7% of small bowel neoplasms). Other etiologies included adhesions (n = 11), stricture/abscess (n = 13), primary intussusception (n = 3), Crohn disease (n = 3), foreign body (n = 3), internal hernia (n = 3), mesenteric volvulus (n = 1), and

Table 1. Comparison of clinical information in different age subgroups

Variable	Total (n=55)	Old aged group (n=23)	Young aged group (n=32)	P-value (old vs. young age group)
Patients information				
No. of patients	55	23	32	
Age (yr)	54.8±19.0	73.1±8.7	41.7±12.3	<0.001
Male sex	35 (63.6)	14 (60.9)	21 (65.6)	0.718
The first onset of SBO (day)	85.4±269.2	156.9±398.4	34.0±84.1	0.158
The latest onset of SBO (day)	5.4±16.8	7.4±24.7	3.9±7.2	0.442
Intermittent relief of obstruction	25 (45.5)	13 (40.6)	17 (53.1)	0.803
No. of previous visits to the hospital due to SBO	0.7±1.2	0.7±1.4	0.6±1.0	0.729
No. of previous hospitalizations due to SBO	0.2±0.6	0.1±0.5	0.2±0.6	0.718
Admissions via ER	44 (80.0)	5 (21.7)	6 (18.8)	>0.999[a]
Symptoms and laboratory findings				
Fever	3 (5.5)	1 (4.3)	2 (6.3)	>0.999[a]
Abdominal pain	55 (100)	23 (100)	32 (100)	>0.999[a]
Nausea/vomiting	19 (34.5)	9 (39.1)	10 (31.3)	0.544
Constipation	8 (14.5)	6 (26.1)	2 (6.3)	0.057[a]
Diarrhea	8 (14.5)	5 (21.7)	3 (9.4)	0.257[a]
Melena/hematochezia	7 (12.7)	1 (4.3)	6 (18.8)	0.219[a]
Weight loss	2 (3.6)	2 (8.7)	0 (0)	0.170[a]
Serum WBC count (/μL)	10,240.2±4,262.9	10,206.1±4,298.6	10,264.7±4,305.9	0.960
History of patients				
Trauma history	7 (12.7)	2 (8.7)	5 (15.6)	0.686[a]
History of other malignancies	3 (5.5)	3 (13.0)	0 (0)	0.068[a]
Cardiovascular disease	17 (30.9)	14 (60.9)	3 (9.4)	<0.010
Diabetes mellitus	8 (14.6)	5 (21.7)	3 (9.4)	0.257[a]
Neurovascular disease	4 (7.3)	4 (17.4)	0 (0)	0.026[a]
Duration of admission (day)	14.0±9.8	15.0±10.5	13.3±9.4	0.516
ICU admission	5 (9.1)	1 (4.3)	4 (12.5)	0.387[a]
Emergency surgery	18 (32.7)	6 (26.1)	12 (37.5)	0.374
Malignancy	14 (25.5)	9 (39.1)	5 (15.6)	0.048
Types of SBO lesion				
Neoplasm[b]	15 (27.3)	10 (43.5)	5 (15.6)	0.022
Tumor-like lesion[c]	6 (10.9)	3 (13.0)	3 (9.4)	0.686[a]
Benign condition	34 (61.8)	10 (43.5)	24 (75.0)	0.018

Values are presented as number only, mean±standard deviation, or number (%).
Differences between mean values were tested with the t-test. For analysis of categorical variables, the chi-square test or Fisher exact test was used. P<0.05 was considered significant.
Old aged group, ≥60 years; young aged group, <60 years.
SBO, small bowel obstruction; ER, emergency room; WBC, white blood cell; ICU, intensive care unit.
[a]Fisher exact test was used. [b]Both benign and malignant masses that were associated with abnormal cell growth. [c]Benign cyst or an inflammatory polyp.

heterotrophic pancreas (n=2).

Table 2 shows the difference in etiologies between the 2 groups that were categorized based on patient age. In the older age group (≥60 years, n=23), small bowel neoplasms were the most common, which was present in 12 cases (52.2%), of which malignant cases were 9 (39.1%). Adhesion (n=7, 21.9%) and Crohn disease

Table 2. Etiology of small bowel obstruction (SBO) in virgin abdomen

Variable	Old aged group (n = 23)	Young aged group (n = 32)	Total (n = 55)
SBO due to neoplasms	12 (52.2)[a]	7 (21.9)	19 (34.5)
Malignant	9 (39.1)[a]	5 (15.6)	14 (25.5)
Benign	3 (13.0)	2 (6.3)	5 (9.1)
Adhesions	4 (17.4)	7 (21.9)	11 (20)
Stricture/Inflammation/abscess	2 (8.7)	11 (34.4)	13 (23.6)
Crohn disease	0 (0)	3 (9.4)	3 (5.5)
Intestinal tuberculosis	0 (0)	1 (3.1)	1 (1.8)
Primary intussusception	1 (4.3)	2 (6.3)	3 (5.5)
Foreign body	0 (0)	3 (9.4)	3 (5.5)
Internal hernia	2 (8.7)	1 (3.1)	3 (5.5)
Heterotrophic pancreas	1 (4.3)	1 (3.1)	2 (3.6)
Mesenteric volvulus	1 (4.3)	0 (0)	1 (1.8)
Total	23 (100)	32 (100)	55 (100)

Values are presented as number (%).
Old aged group, ≥60 years; young aged group, <60 years.
[a]One case of malignant tumors was SBO due to unknown descending colon cancer with omental invasion.

(n = 3, 9.4%) were more common in the younger age group (< 60 years, n = 32). As shown in Table 1, small bowel malignancy was more prevalent in the older age group than in the young age group (n = 9, 39.1% vs. n = 5, 15.6%; P = 0.048).

Table 3 shows the differences between patients with benign causes (benign group, n = 41) and malignant neoplasms (malignant group, n = 14). In the malignant group, constipation was more common than in the benign group, presenting in 35.7% and 7.3% respectively (P = 0.02). In the benign group, patients tended to be hospitalized more often before surgery. The number of previous admissions was 0.17 ± 0.59 in the benign group (P = 0.037). The rate of emergent surgeries was higher (n = 18, 43.9%) in the benign group (P < 0.01).

The mean age of 14 patients diagnosed with malignancies was 68.1 ± 11.2 years (data of patients diagnosed with malignancy-associated with SBO are shown in Supplementary Table 1) Of these patients, 3 had small bowel lymphomas, 1 had small bowel adenocarcinomas, 2 had small bowel neuroendocrine tumors, 2 had high-risk gastrointestinal stromal tumors (GISTs), and 5 had low-risk GISTs. Small bowel GISTs with low risk were regarded as malignant lesions because of their malignancy potency. Three of the 5 patients, who were diagnosed with low-grade GISTs, had hematochezia or melena with intermittent abdominal cramping pain.

Ten patients were diagnosed with benign tumors and tumor-like lesions including, 2 benign cysts, an inflammatory polyp, an inflammatory fibroid tumor, and an ileal lipoma. Four cases were associated with small bowel intussusception due to a tumor.

Three patients were diagnosed with Crohn disease after surgery. One patient had a pelvic abscess with an ileal fistula due to Crohn disease. The other 2 patients had SBOs due to ileal strictures, whose diagnoses were confirmed pathologically. All the 3 patients underwent small bowel resection and anastomosis.

There were SBO cases related to a history of abdominal trauma. It was found that these patients had adhesions, strictures, and ischemic changes intraoperatively, which were considered to be caused by abdominal wall trauma. In our study, trauma history included in-car or out-car accidents, falls, and other crashing injuries that can cause blunt trauma to the abdominal wall. Six patients had a history of abdominal trauma (10.9%), of whom 2 SBO patients had a history of car or bicycle accidents 1 or 2 months prior to their presentation of SBO symptoms. None of the patients had bowel obstructive symptoms immediately after the accident. On average, abdominal pain started and was exacerbated over 2 months after the accident.

Three patients had SBO caused by foreign bodies and underwent surgery. Among these patients, 1 had a 7 cm-sized bezoar in the small bowel removed by an open enterotomy. Ileal fish bones were found in 2 other cases, with no presence of perforations or abscesses, which were removed by laparoscopy-assisted enterotomy with an incision of approximately 3 cm.

Preoperative abdominal computed tomography (CT) scans were performed on all 55 patients in this study. CT diagnosis was compared with the final diagnosis that was confirmed by operative or pathological results. The results of abdominal CT diagnosis were congruent with the final diagnosis in 63.6% of patients (Table 4).

The majority of surgery (37 cases, 67.3%) was small bowel resection and anastomosis. 17 cases were done by laparoscopic approach. The detailed types of surgery were shown in Supplementary Table 2.

Table 3. Comparison of malignant and benign subgroups

Variable	Malignant	Benign	P-value
Patients information			
No. of patients	14	41	
Age (yr)	68.1±11.6	50.3±19.0	<0.010
Male sex	9 (64.3)	26 (63.4)	0.953
The first onset of SBO (day)	40.6±94.4	100.7±306.6	0.726
The latest onset of SBO (day)	11.8±31.3	3.1±6.4	0.350
Intermittent relief of obstruction	8 (57.1)	17 (41.5)	0.309
No. of previous visits to the hospital due to SBO	1.0±1.4	0.6±1.1	0.987
No. of previous hospitalizations due to SBO	0.1±0.5	0.2±0.6	0.037
Admissions via ER	8 (57.1)	36 (87.8)	0.022[a]
Symptoms and laboratory findings			
Abdominal pain	14 (100)	41 (100)	>0.999
Nausea/vomiting	4 (28.6)	15 (36.6)	0.749
Constipation	5 (35.7)	3 (7.3)	0.020[a]
Diarrhea	0 (0)	8 (19.5)	0.098[a]
Melena/hematochezia	4 (28.6)	3 (7.3)	0.061[a]
Weight loss	2 (14.3)	0 (0)	0.061[a]
Serum WBC count (/μL)	8,445.7±3,249.1	10,852.9±4,426.1	0.247
History of patients			
Trauma history	1 (7.1)	6 (14.6)	0.664[a]
Other malignancy	2 (14.3)	1 (2.4)	0.156[a]
Cardiovascular disease	9 (64.3)	8 (19.5)	<0.010[a]
Diabetes mellitus	2 (14.3)	6 (14.6)	>0.999[a]
Neurovascular disease	3 (21.4)	1 (2.4)	0.047[a]
Duration of admission (day)	14.3±5.6	13.9±11.0	0.612
ICU admission	1 (7.1)	4 (9.8)	>0.999[a]
Emergency surgery	0 (0)	18 (43.9)	<0.010[a]

Values are presented as number only, mean±standard deviation, or number (%).
Differences between mean values were tested with the t-test. For analysis of categorical variables, the chi-square test or Fisher exact test was used. P<0.05 was considered significant.
SBO, small bowel obstruction; ER, emergency room; WBC, white blood cell; ICU, intensive care unit.
[a]Fisher exact test was used.

DISCUSSION

The presence of a hidden malignancy is taken into account when deciding on a surgical intervention to manage SBO in a virgin abdomen, especially if the cause of obstruction is unclear in the preoperative radiological findings. After investigating 55 patients with virgin abdomens, we found that small bowel neoplasm (36.4%) was the most common cause of SBO, with malignant neoplasms accounting for 25.5% of the cases. Previous studies have reported various rates of malignancy in SBO patients with virgin abdomens, ranging from 3.0% to 37.5% [3]. One such study reported that a combined rate of benign and malignant neoplasms in the small bowel and mesentery accounted for 13% of SBO patients with virgin abdomens [6].

Several studies that have discussed the nonoperative treatment of SBO reported that the rate of surgical laparotomies showed no difference between patients with and without previous abdominal surgery [8, 9]. Ng et al. [9] and Collom et al. [11] reported the rate of small bowel neoplasms as 3.0% to 4.2% and the most common cause of SBO as adhesions. Approximately 40% to 49% of patients with virgin abdomens are treated conservatively with gastrografin [9, 11].

Despite the lower rate of operative exploration for malignancies in virgin abdomens with SBO, we found that the malignant rate

Table 4. Diagnostic consistency of abdomen computed tomography (CT) scan

Diagnosis	No. of diagnosis	CT diagnosis	
		Consistent	Inconsistent
Total	55	35 (63.6)	20 (36.4)
Small bowel neoplasm	18	16	2
Malignant neoplasm	6		
Benign neoplasm	10		
Stricture	1		
Heterotrophic pancreas	1		
Stricture/abscess	12	5	7
Stricture/abscess	5		
Crohn disease	2		
Tuberculosis enteritis	1		
Adhesion	4		
Malignant tumor	2		
Other malignancy	1		
Adhesion	7	5	2
Adhesions	5		
Stricture	1		
Internal hernia	1		
Intussusception	5	4	1
Intussusception	3		
Malignant tumor	1		
Stricture	1		
Internal hernia	4	1	3
Internal hernia	1		
Stricture/abscess	2		
Adhesion	1		
Foreign body	3	3	0
Mesenteric volvulus	1	1	0
Paralytic ileus	4	0	4
Stricture/inflammation	2		
Adhesion	1		
Heterotrophic pancreas	1		
Ischemic/thrombus	1	0	1
Internal hernia	1		

Values are presented as number only or number (%).

was slightly higher than that reported in previous studies, which was most likely due to the inclusion of only those patients who underwent surgery for SBO. Moreover, we included more elderly patients, who had a higher rate of neoplasms and malignancy (52.2% and 39.1%, respectively). Considering these results, suspecting hidden malignancies should be of importance when evaluating older age patients before deciding to conservatively treat the SBO in virgin abdomens. Even though SBOs in virgin abdomens are most likely to have a benign cause, it is worth noting that we should always be cautious of relying on the interpretation of radiological imaging when suspecting an underlying malignancy. If nonoperative treatment is favored, regular follow-ups and a detailed review of personal and family history should be carried out [8].

Benign lesions that caused SBO in this study included 2 benign cysts, an inflammatory polyp, an inflammatory fibroid tumor, and an ileal lipoma. Only preoperative CT findings revealed intussusception in 3 of these cases. Unlike in children, adult intussusceptions are frequently associated with neoplasms or other pathologic lesions. Azar and Berger [12] reported that 94% of adult intussusceptions were related to pathological lesions, and 48% of the intestinal lesions were malignant. In our study, 5 out of 40 (12.5%) benign lesions and 2 of 15 (13.3%) malignant neoplasms were associated with small bowel intussusception. Pathological, radiological, and operative findings of the patients diagnosed with malignancies in this study are shown in Supplementary Table 1. One patient with small bowel lymphoma showed ileocecal intussusception on abdominal CT. Another patient had mechanical ileus with jejunal obstruction due to descending colon cancer with omental invasion, which was initially thought to be jejunal tuberculosis.

All patients with SBO in this study experienced abdominal pain, out of which 45% had self-relieved intermittent abdominal pain. It was previously reported that the rate of obstruction in patients with small bowel malignancy as the first manifestation was 5% to 38% [13]. Although primary tumors have been responsible for 1.5% of SBOs, intermittent partial obstruction has been regarded as the most characteristic evidence of small bowel malignancies. Treatment of an unnoticed small bowel malignancy can be delayed for 4 to 9 months on an average while before it grows large enough to induce a mass effect and cause partial obstruction [14].

The incidence of SBO due to Crohn disease was reported to be 7% to 16% [14-16] and Miller et al. [14] found that Crohn disease was the second most common cause of SBO (7%), followed by adhesions. Our study included 3 patients who were diagnosed with Crohn disease with a mean age of 33.7 years. One patient was a 21-year-old man who had an abrupt onset abdominal pain 1 hour before he came to the emergency room. His abdominal CT revealed SBO and jejunal intussusception and he underwent laparoscopy-assisted small bowel resection and anastomosis. Creeping fat signs were found intraoperatively (Fig. 1) and a focal ulcer with active ileitis was found on pathological testing, both of which made us suspect the diagnosis to be Crohn disease.

Small bowel injury after blunt abdominal trauma is rare, accounting for less than 1% of blunt trauma admissions [17]. Approximately 10.9% of SBO in virgin abdomens appeared to be induced by adhesions or ischemic injuries associated with abdominal wall trauma. Two out of 6 SBO patients had histories of ab-

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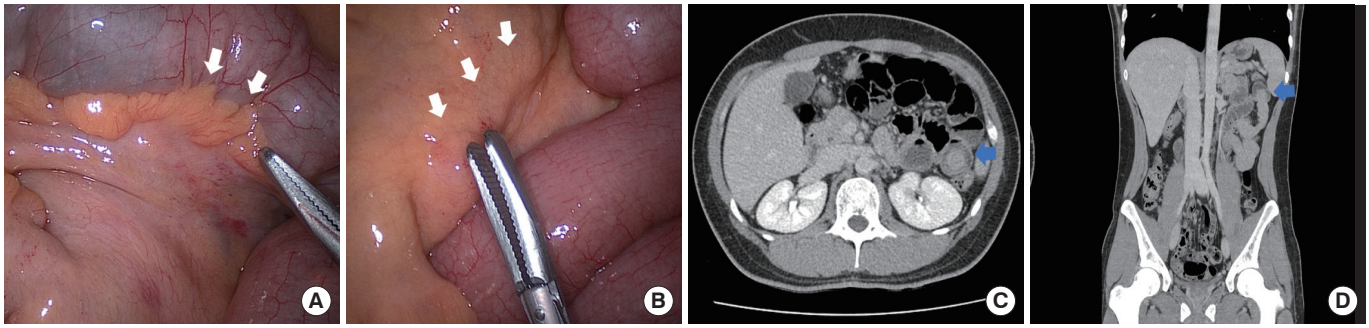

Fig. 1. The operative findings of a 21 years-old male patient with small bowel obstruction diagnosed with Crohn disease. (A) Creeping fat sign and (B) mesenteric thickening due to fibrofatty proliferation of the mesenteric tissue adjacent to chronic inflammation of bowel loops (white arrows). (C, D) The abdomen computed tomography scan shows targetoid small bowel (blue arrows) which is intussusception.

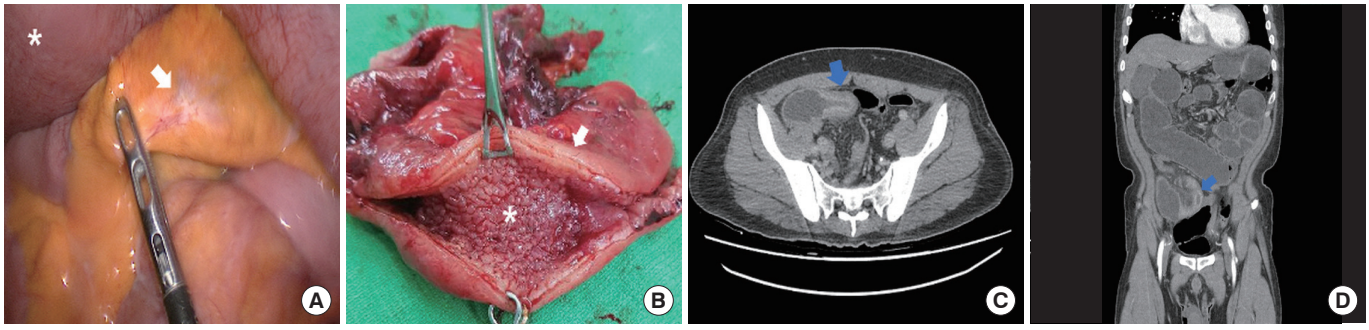

Fig. 2. The operative findings of a 48-year-old male patient who had small bowel obstruction after abdominal blunt trauma history. (A) The intraoperative finding. The fibrotic change in mesentery was caused by trauma (white arrows) and proximal bowel distension (asterisk). The distal part of the injured bowel was collapsed. (B) Gross finding of the specimen after the small bowel resection. Bowel wall thickening (white arrows) and segmental stenosis (asterisk) were associated with ischemic changes that were caused by a tear of the mesenteric vessel. (C, D) The abdomen computed tomography scan shows small bowel ileus and abrupt segmental stricture in small bowel adjacent to terminal ileum (blue arrows).

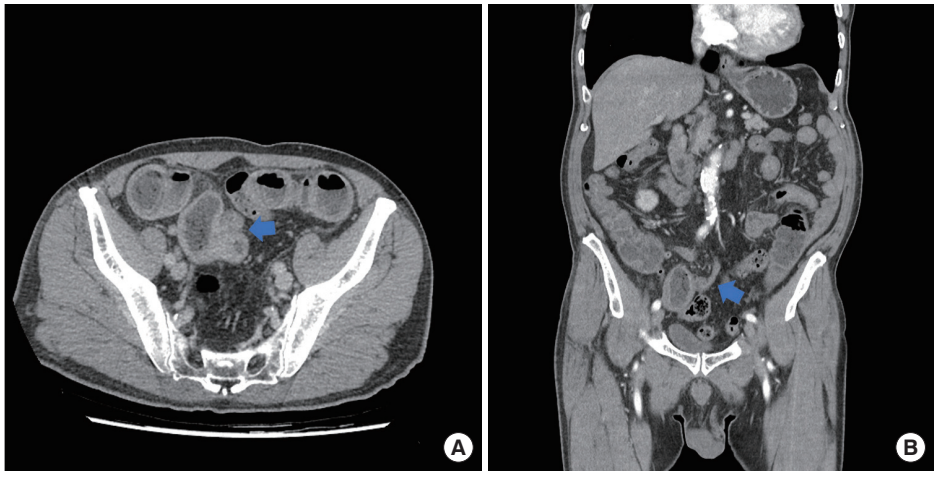

Fig. 3. The abdomen CT findings of an 80-year-old male patient who had recurrent SBO without any surgical history. Initial CT scan shows segmental stricture of small bowel and mild distension of proximal small intestine without mass-like lesions (blue arrows) in both axial veiw (A) and coronal veiw (B). This patient was finally diagnosed with small bowel adenocarcinoma postoperatively.

dominal blunt trauma due to in-car accidents and had experienced intermittent abdominal pain for 2 months which worsened over time. An 80-year-old man, who had a history of falling from a persimmon tree during his childhood, had SBO with adhesions and internal hernia due to unknown causes. Another patient, who was a 48-year-old man, had a history of abdominal injury from a bicycle handle 2 months prior to experiencing SBO. Ischemic ileitis due to mesenteric vessel injury was diagnosed and the patient underwent laparoscopy-assisted small bowel resection and anastomosis. Intraoperative findings showed a segmental stricture of the ileum (Fig. 2).

Gallstone ileus is a rare etiology of SBO; only 1%–4% of gallstones may cause bowel obstruction. Most gallstone ileus occurs in the ileum (60.5%) and can spontaneously resolve in 1.3% of cases. Obstruction in other intestinal organs is also possible in the jejunum (16.1%), stomach (14.2%), colon (4.1%), and duodenum (3.5%) [18].

Strajina et al. [8] reported an accuracy of 76% (32 of 42) of CT scans in diagnosing SBO without prior abdominal surgery. Similarly, our study reported consistency of 63.6% (35 of 55) of preoperative CT findings with the final diagnosis. Considering the occasional inaccuracy of CT scans, even when a CT scan does not show a mass-like lesion in the small bowel, the possibility of malignancy should still be considered. According to the results of this study, SBO followed by a lesion associated with stricture or intussusception and malignancy cannot be excluded. There was a case of an 80-year-old male patient who had recurrent SBO without any surgical history. His initial CT scan only showed short segmental stricture of small bowel and mild distension of proximal small intestine (Fig. 3). His symptoms were relieved several times after conservative treatment. This patient was finally diagnosed with small bowel adenocarcinoma postoperatively.

This study has several limitations. First, this was a single-center retrospective study with limited sample size. Although the cases in this series have been collected over 10 years, small bowel diseases, especially malignancies, are not common; hence, the sample size is limited. Moreover, we excluded all patients who had SBO and whose symptoms were relieved by conservative treatment alone to accurately determine the origin of small bowel pathology. Since we included only surgical cases, other treatment options for SBO in the virgin abdomen have not been discussed. In this study, we attempted to confirm the diagnosis and etiology of the SBOs of the patients. However, it was not possible to compare conservative and operative management of SBO in virgin abdomens. Further studies that are multi-centered, with a large number of patients and long-term follow-up data should be carried out to explore the etiology and management of SBO in virgin abdomens.

In conclusion, this review focuses on surgical cases of SBO in virgin abdomens, which are rarely studied in the literature. We found that neoplasms were the most common cause of SBO in patients with a virgin abdomen undergoing surgery, with a malignancy rate of 25.5%. This result highlights the importance of suspecting neoplasms and malignancies as underlying causes in a patient without prior abdominal surgical history experiencing recurrent bowel obstructive symptoms from an unknown cause. It should also be noted that the possibility of malignancy is especially higher in older patients with SBO. In younger patients, benign etiologies, such as inflammatory bowel disease, are more common. Thus, thorough history taking may be important. If these patients are planned for conservative treatment instead of surgical treatment, close follow-up is recommended. Diagnostic laparoscopy should be considered instead of radiological imaging alone for recurrent bowel obstruction without a definite cause.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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SUPPLEMENTARY MATERIALS

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