Predictive Factors for Surgical Intervention in Patients over the Age of 80 with Adhesive Small-Bowel Obstruction

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Abstract Adhesive small-bowel obstruction (SBO) remains a common cause of admission to surgical wards around the world. Given the growing elderly population, the number of elderly patients with adhesive SBO can be expected to increase substantially. Timely and appropriate treatment would improve morbidity and mortality rates in elderly patients with adhesive SBO. However, accurately determining which patients should undergo surgical treatment during the hospitalization remains difficult. The aim of this study was to identify predictive factors for surgical intervention in patients aged over 80 years presenting with SBO due to postoperative ad-

hesions. A clinical and radiological data for the assessment of patients presenting with adhesive SBO were collected. A logistic regression model was applied to identify risk factors that would predict the need of surgical intervention. A total of 21 patients (13 males, 8 females) were treated during a 3.5-year period. The mean age was 85.5 ± 4.7 years, ranging from 80 to 97 years. There is no significant difference in age (group 1 87.6 ± 5.9 years vs. group 2 84.8 ± 4.3 years, $p=0.262$) between two groups. Serious coexisting diseases were noted in 13 (61.9 %, 13/21) patients. Primary hypertension, cardiac diseases, and diabetes mellitus were common coexisting conditions. However, there is no significant difference in comorbidities (40 vs. 68.8 %, $p=0.325$) between group 1 and group 2. Adhesive SBO was successfully treated with conservative treatment in 16 patients (76.2 %, 16/21, group 2), whereas conservative treatment failed in 5 patients (23.8 %, 5/21, group 1), who subsequently underwent laparotomy. Postoperative complication rate was 14.3 % (wound infection, 1/5) and mortality was 0 % (0/5) in group 1. One patient death was recorded in group 2 (1/16, 6.3 %). The overall mean hospital stay was 10.0 ± 5.9 days (range 3–27 days). Group 1 had a longer hospital stay than group 2. However, the difference did not reach the significant level (12.8 ± 8.2 vs. 9.1 ± 5.9 days, $p=0.274$). On univariate analysis, the need for surgical intervention was significantly associated with granulocyte percentage (2.768, 0.961–7.975, $p=0.059$), CT findings of free intraabdominal fluid (28.000, 1.988–394.405, $p=0.014$), and level of albumin (0.265, 0.073–0.970, $p=0.045$). On multivariate analysis, the predictive factor was free intraabdominal fluid (28.000, 1.988–394.405, $p=0.014$). Conservative treatment remains a major consideration in patients over the age of 80. Although major cases of adhesive SBO are successfully treated with conservative methods, some fail to respond, and the independent risk factor for surgical indication is free intraabdominal fluid.

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Keywords Small-bowel obstruction · Surgery · Risk factors · Adhesion · The elderly

Abbreviations

SBO Small-bowel obstruction

CT Computed tomography

Background

Small-bowel obstruction (SBO) remains a common cause of admission to surgical wards around the world. The etiologies of SBO include the following: (1) endoluminal obstruction (biliary ileus, phytobezoar, foreign body, etc.), (2) intrinsic lesions (Crohn's disease, lymphoma, etc.), (3) extrinsic obstruction (adhesions, hernia, carcinomatosis, etc.), and (4) functional cause (postoperative ileus, medications, etc.). Among these causes, postoperative adhesion is the leading cause of SBO and accounts for 74 % of small-bowel obstructions [1]. Adhesive SBO is a major cause of morbidity and financial expenditure in hospitals. Lots of studies have been performed to yield a method of preventing postoperative adhesions [2, 3]. However, there is no proven method to prevent formation of adhesions postoperatively. Appropriate treatment of adhesive SBO remains a common clinical challenge. Given the growing elderly population, the number of elderly patients with adhesive SBO can be expected to increase substantially. In one review of 405 patients with SBO, 53.7 % of the 41 patients with strangulation were older than 70 years [4]. Timely and appropriate treatment would improve morbidity and mortality rates in elderly patients with adhesive SBO. However, accurately determining which patients should undergo surgical treatment during the hospitalization remains difficult. The aim of the present study was to identify predictive factors for surgical intervention in patients aged over 80 years presenting with SBO due to postoperative adhesions.

Methods

The clinical records of patients who received treatment for adhesive SBO from January 2009 to July 2012 in the Department of Colorectal Surgery, Changhai Hospital, were reviewed. Inclusion criteria were previous abdominal surgery, >80 years, and definition of obstruction with the triad of pain, vomiting, and absence of gas and feces. Patients with other causes of obstruction, perforated bowel, <80 years, a known history of ascites, abdominal injury within 1 month, and patients or family that refuse operation were excluded. Informed consent for publication was obtained from all patients. The project has been performed with the approval of ethics

committee, Changhai Hospital, Shanghai, China. Our study is in compliance with the Helsinki Declaration.

Patients were grouped according to whether they needed surgical treatment (group 1, with 5 patients) or whether they could be treated nonoperatively (group 2, with 16 patients). Conservative treatment consisted of gastrointestinal decompression, intravenous fluid resuscitation, antibiotics using, and correction of electrolyte levels. Data recorded included the following: demographic data, comorbidities, details of previous abdominal operations, time from onset of symptom to hospital admission, admission vital signs, laboratory results, signs of abdominal X-ray, and signs of computed tomography (CT). Operation was performed if conservative treatment was judged to have failed, based on no improvement of obstruction signs or on the development of signs of intestinal strangulation. The length of hospital stay, complications, and mortality were recorded.

Logistic regression analysis was used to identify risk factors for surgical indication. Variables significant at $p < 0.10$ by univariate analysis were subjected to stepwise logistic regression analysis to identify independent risk factors ($p < 0.05$) for surgical indication. Associations of age, morbidity, and duration of hospital stay were compared between two groups using the chi-squared and Fisher's exact tests. All statistical analyses were performed using SPSS Version 15.0 (SPSS, Inc., Chicago, IL).

Results and Discussion

A total of 21 patients (13 males, 8 females) were treated during a 3.5-year period. The mean age was 85.5 ± 4.7 years,

Table 1 Characteristics of 21 patients over 80 years of age with SBO

Characteristics	No. of patients (%)
Median age, year (range)	84.0 (80–97)
Gender	21
Male	13 (61.9)
Female	8 (38.1)
Comorbidities	21
0	8 (38.1)
1	9 (42.9)
2	3 (14.3)
3	1 (4.7)
Treatment	21
Conservative	16 (76.2)
Surgery	5 (23.8)
Procedure	5
Partial resection of small intestine	4 (80.0)
Lysis of adhesions only	1 (20.0)

Table 2 Details of 21 patients over 80 years of age with adhesive SBO

No.	Age	Gender	Comorbidity	Previous abdominal surgery (nature; outcome)	Time 1 (years)	Time 2 (days)	Clinical data		Albumin level	CT findings					Result		
							p	V		T	WBC	CO	FF	ME		WT	JS
1	83	Male	None	Appendectomy (appendicitis; well)	30	4	No	No	No	28	6.87	No	No	No	No	S	Well
2	90	Male	Neurologic disorder	Gastroectomy (gastric cardiovascular disease cancer; well)	40	2	Yes	No	Yes	23	8.66	No	Yes	No	No	S	Well
3	84	Female	Cardiovascular disease	Abdominoperectomy (rectal cancer; well)	3	1	Yes	No	Yes	19	15.5	No	Yes	No	No	S	Well
4	97	Male	None	Reduction of volvulus of intestine (volvulus of small intestine, well)	32	1	Yes	Yes	Yes	29	10.2	No	Yes	Yes	No	S	Well
5	84	Male	None	Gastroectomy (gastric cancer; well)	6	7	Yes	Yes	Yes	31	9.96	No	Yes	No	No	S	Well
6	90	Female	Cardiovascular disease	Appendectomy (Appendicitis; well)	30	4	Yes	No	Yes	26	3.01	No	No	No	No	C	Died
7	83	Male	Cardiovascular disease	Gastroectomy (gastric cancer; well)	6	3	Yes	No	Yes	38	7.08	No	No	No	No	C	Well
8	82	Female	Peptic ulcer	Cholecystectomy (cholecystitis; well)	2	2	Yes	Yes	Yes	27	5.37	No	No	Yes	No	C	Well
9	90	Male	Neurologic disorder	Cholecystectomy cardiovascular disease (cholecystitis; well)	10	3	No	No	Yes	44	6.25	No	No	No	No	C	Well
10	93	Male	Neurologic disorder	Appendectomy cardiovascular disease (appendicitis; well)	18	10	Yes	Yes	Yes	34	8.09	No	No	No	No	C	Well
11	90	Female	Cardiovascular disease	Gastroectomy (gastric metabolic disorder cancer; well)	2	5	Yes	Yes	Yes	31	6.66	No	No	No	No	C	Well
12	82	Male	Metabolic disorder	Gastroectomy (gastric cancer; well)	21	10	Yes	No	Yes	33	6.59	No	No	No	No	C	Well
13	82	Female	None	Cholecystectomy (cholecystitis; well)	19	2	Yes	Yes	Yes	29	4.39	No	No	No	No	C	Well
14	81	Male	None	Appendectomy (perforated appendicitis; well)	40	2	Yes	Yes	Yes	43	5.09	No	No	No	No	C	Well
15	80	Female	None	Partial resection of small intestine (abdominal tuberculosis; well)	40	4	Yes	No	Yes	24	2.84	No	No	No	No	C	Well
16	87	Male	None	Right hemi-colectomy (ascending colon cancer; well)	30	1	Yes	Yes	Yes	26	3.97	No	Yes	No	No	C	Well
17	85	Female	Neurologic disorder	Hysterectomy cardiovascular disease (hysteromyoma; well)	40	1	Yes	No	Yes	36	7.83	No	No	No	No	C	Well
18	80	Male	None	Gastroectomy (gastric cancer; well)	1	2	Yes	No	Yes	35	8.85	No	No	No	No	C	Well
19	82	Male	Cardiovascular disease	Hartmann's procedure (rectal cancer; well)	1	1	Yes	No	Yes	32	5.32	No	No	No	No	C	Well
20	89	Female	Cardiovascular disease	F cholecystectomy (cholecystitis; well)	22	1	Yes	Yes	Yes	44	4.76	No	No	No	No	C	Well
21	80	Male	Cardiovascular disease	Appendectomy (perforated appendicitis; well)	8	6	Yes	No	Yes	35	12.18	No	No	No	No	C	Well

WBC white blood cell, *Time 1* time from last operation to diagnosis, *Time 2* time from first sign to admission, *CO* complete obstruction, *FF* free intraabdominal fluid, *ME* mesenteric edema, *WT* small-bowel wall thickening, *JS* junctional syndrome, *S* surgical treatment, *C* conservative treatment

ranging from 80 to 97 years. There is no significant difference in age (group 1 87.6 ± 5.9 years vs. group 2 84.8 ± 4.3 years, $p=0.262$) between two groups. Serious coexisting diseases were noted in 13 (61.9 %, 13/21) patients. Primary hypertension, cardiac diseases, and diabetes mellitus were common coexisting conditions. However, there is no significant difference in comorbidities (40 vs. 68.8 %, $p=0.325$) between group 1 and group 2.

Adhesive SBO was successfully treated with conservative treatment in 16 patients (76.2 %, 16/21, group 2), whereas conservative treatment failed in 5 patients (23.8 %, 5/21, group 1), who subsequently underwent laparotomy. Four patients underwent small-bowel resection with primary anastomosis. Lysis of adhesions was performed in 1 patient. Table 1 shows the demographic data, comorbidities, and treatment.

Postoperative complication rate was 14.3 % (wound infection, 1/5) and mortality was 0 % (0/5) in group 1. One patient death was recorded in group 2 (1/16, 6.3 %). Sepsis was responsible for the death of this patient. The overall mean hospital stay was 10.0 ± 5.9 days (range 3–27 days). Group 1 had a longer hospital stay than group 2. However, the difference did not reach the significant level (12.8 ± 8.2 vs. 9.1 ± 5.9 days, $p=0.274$).

Univariate associations of the clinical and radiological findings with the need for surgical treatment are summarized in Table 2. On univariate analysis, the need for surgical treatment was significantly associated with granulocyte, hypoalbuminemia, and CT findings of free intraabdominal fluid. On multivariate analysis, the clinical finding significantly associated with the need for surgical treatment was free intraabdominal fluid (Tables 3 and 4). Patients with free intraabdominal fluid were 28 times more likely to require eventual surgical treatment.

Table 3 Univariate associations with the need for operative exploration

Parameter	Odds ratio (95 % CI)	<i>p</i> value
Age	1.132 (0.913–1.403)	0.258
Sex	3.111 (0.281–34.419)	0.355
Comorbidities	0.707 (0.240–2.085)	0.530
Time from onset to admission	0.947 (0.636–1.408)	0.787
Abdominal pain	0.267 (0.014–5.267)	0.385
Vomiting	1.111 (0.142–8.680)	0.920
Laboratory results		
White blood cell	7.366 (0.666–81.468)	0.103
Granulocyte percentage	2.768 (0.961–7.975)	0.059
Albumin	0.265 (0.073–0.970)	0.045
CT findings		
Free intraabdominal fluid	28.000 (1.988–394.405)	0.014
Mesenteric edema	3.750 (0.190–74.065)	0.385

Table 4 Multivariate associations with the need for operative exploration

Parameter	Odds ratio (95 % CI)	<i>p</i> value
Intraperitoneal free fluid	28.000 (1.988–394.405)	0.014

Adhesive SBO is a worldwide problem and account for 74 % of small-bowel obstructions [1]. It is characterized by the presence of abdominal pain, vomiting, and distention and absence of gas and feces, in conjunction of confirmatory imaging. The risk of strangulation with adhesive SBO is relatively low as compared with incarcerated hernia and small-bowel volvulus. Close and careful clinical evaluation, in conjunction with laboratory and radiologic studies, will usually dictate the proper course of treatment in any given case [5]. Most of the patients with adhesive SBO respond to conservative treatment. However, surgical intervention may be required in 20 to 30 % of patients who develop serious complications such as strangulation, which can develop when surgery is delayed for more than 48 h or do not respond to conservative treatment. However, laparotomy is associated with disruption to the visceral peritoneum, which predisposes the patients to more adhesions and results in further small-bowel obstruction. Moreover, about 10 to 30 % of patients suffer recurrent bowel obstruction after the initial open adhesiolysis and require repeat surgery [6, 7]. Therefore, conservative treatment, using gastrointestinal decompression and fluid resuscitation with close and frequent clinical reassessment, has proven to be successful in a substantial percentage of selected patients with adhesive SBO.

Despite advances in therapeutic methods, adhesive SBO that affects patients over 80 years of age is still a challenging problem for surgeons. Fevang et al. have suggested that older age, independent of comorbid conditions, is a predictive factor for higher complications and death in patients undergoing surgical correction of SBO [8]. Reliable predictors of SBO may help surgeons to avoid unnecessary laparotomy and decrease associated morbidity and mortality in these patients.

Previous retrospective studies have suggested that conservative treatment can be successful in 65 to 80 % of cases of partial SBO [9]. Some authors have even suggested a 37 % resolution rate in patients with complete obstructions [10]. In our study of patients aged >80 years, we noted a 76.2 % success rate of conservative treatment. It remains a major consideration in patients with adhesive SBO older than 80 years of age.

Although our study has been shown to be successful in greater than 70 % of patients with adhesive SBO, surgical treatment may still be required in some patients because of strangulation or the failure of conservative management.

Proper predictive factors would assist surgeons in predicting which patients with SBO should undergo surgical treatment but also to decreasing the morbidity and mortality [11]. After univariate analysis, we found three signs (increased granulocyte percentage, hypoalbuminemia, and free intraabdominal fluid) that offered predictive value for the need for surgical treatment in our patients. Interestingly, none of the classic signs, including complete obstruction or presence of CT signs of ischemia (mesenteric edema and small-bowel wall thickening), were predictive of need for surgical treatment. In addition, leukocytosis alone does not correlate with the need of operation in our patients. Leukocytosis should, therefore, not be used as a major criterion influencing conservative versus surgical treatment decisions in SBO patients older than 80 years of age.

Multivariate analysis revealed that independent operation-related risk factor is free intraabdominal fluid. Previous study has demonstrated a correlation of free intraabdominal fluid with the need for surgical intervention, corroborating our findings and correlating with our clinical experience [12]. Another interesting finding of our study was hypoalbuminemia appeared to be a risk factor for surgical treatment. In univariate analysis, hypoalbuminemia is positively associated with the need for surgical treatment. Although after multivariate analysis for potential independent risk factors, hypoalbuminemia no longer showed a significant association with surgical treatment. Hypoalbuminemia was not an independent risk factor for surgical treatment, but it might be a good predictor. We believe that future study will confirm our findings.

Because physiological reserve is significantly diminished in the elderly, cardiovascular, pulmonary, endocrine, and renal comorbidities are more common in elderly patients. Furthermore, aged patients are usually frail, do not want to come to hospital and often wait for long before coming to see doctors, and rapidly get metabolic troubles with dehydration, renal failure, and cardiac failure. According with previous studies, postoperative prognosis was poor for elderly patients with acute abdomen especially advanced aged patients [13, 14]. Because of the above reasons, adequate diagnostic measures and decision-making should be required to prevent postoperative complications and to improve the prognosis in elderly patients with adhesive SBO.

The current study had some limitations. First, the study was not randomized in design. Second, the study had a relatively small number of our patients. The strength of the study is that it is the first time to identify predictive factors for surgical intervention in patients aged over 80 years presenting with SBO due to postoperative adhesions. This will hopefully aid in clarifying the literature in the future, assist in the development of appropriate surgical strategies, and stimulate discussion in this area.

Conclusions

In conclusion, conservative treatment remains a major consideration in patients older than 80 years of age with adhesive SBO, provided that there is no suspicion of an ischemic bowel on admission. Although major cases of SBO are successfully treated with conservative methods, some fail to respond, and the independent risk factors for surgical indication is free intraabdominal fluid.

Conflict of Interest The authors have no competing interests.

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