

# Reoperation for Small Bowel Obstruction—How Critical Is the Timing?

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## ABSTRACT

The timing of reoperation for small bowel obstruction is a topic of significant debate. Any patient with evidence of strangulation should undergo urgent surgical intervention. However, predicting strangulation can be difficult. Because of this, previous authors have recommended everything from emergency operation for all patients presenting with small bowel obstruction to periods of observation that extend up to 14 days. Over the past century, the primary etiology of small bowel obstruction has shifted from hernias to postoperative adhesive disease, leading to a shift in the management paradigm. To manage small bowel obstruction successfully today, the clinician must distinguish the patient requiring urgent operation from those who benefit from nonoperative management. Furthermore, the clinician must be able to determine the appropriate length of time for conservative management. In this article we review the significant body of literature on this topic including the diagnostic workup and timing of potential operative intervention in the patient with small bowel obstruction.

**KEYWORDS:** Bowel, obstruction, reoperation, reoperative, timing

**Objectives:** Upon completion of this article, the reader should be able to summarize the management of small bowel obstruction in the reoperative setting.

It has been demonstrated that 12.4 to 17% of patients develop bowel obstruction within 2 years of an initial abdominal operation.<sup>1</sup> The high incidence of postoperative bowel obstruction ensures that most busy abdominal surgeons deal with this issue on a nearly daily basis. The timing of reoperation for small bowel obstruction (SBO) is a point of significant debate. Some surgeons have advocated urgent laparotomy for most, if not all, cases of SBO.<sup>2,3</sup> Other authors state that a 24-hour period of nonsurgical management is acceptable in the stable patient without evidence of bowel ischemia.<sup>4</sup> Still others state that nonoperative management can be performed safely for 48 hours<sup>5,6</sup> or even as long as 14 days.<sup>7</sup> In this article we review postoperative SBOs,

when to reoperate, and what outcomes can be expected with nonoperative versus operative management.

## ETIOLOGY OF SMALL BOWEL OBSTRUCTION

When evaluating the patient with SBO, it is important to consider the etiology of the obstruction. The management strategies for the three most common causes of SBO—adhesions, neoplasm, and hernias—vary considerably. Therefore, any discussion of SBO in the postoperative setting should be framed in terms of the specific cause of obstruction. Although historically hernias accounted for the majority of SBOs, currently the

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most common cause of SBO is postoperative adhesions. Studies have shown that in the United States, 49 to 67% of obstructions are secondary to adhesions, 13 to 16.2% are secondary to neoplasms, and 6 to 5% are secondary to hernia.<sup>6,8</sup> Given that any patient with bowel ischemia needs an urgent operation, it is important to note that the incidence of strangulation differs with etiology: strangulation was present in 28% of SBO cases caused by hernia, 8% of cases caused by adhesions, and only 4% of cases caused by malignancy.<sup>8</sup>

### PREDICTING STRANGULATION

When deciding upon timing for an operation for SBO, the surgeon must first define which patients are candidates for nonoperative management and which need emergent surgical intervention. Approximately 6 to 13% of patients with SBO present with bowel strangulation.<sup>5,8,9</sup> Most surgeons would agree that any patient with fever, tachycardia, or peritonitis is likely to have strangulation or perforation and should have an immediate operation. That being said, strangulation of the bowel can occur without specific signs or symptoms. The physician must remember that no test has been shown to be a true indicator or predictor of strangulation. No single sign, symptom, laboratory value, or any combination of them can reliably predict strangulation.<sup>10</sup> Furthermore, the physical examination, as performed by senior surgeons, has a sensitivity of 48% and a specificity of 83% in predicting preoperatively which patients have bowel strangulation. Therefore, when a course of nonoperative management has been chosen, frequent reexamination and close observation are mandatory to recognize any changes in condition.

White blood cell count (WBC), although often considered useful in the evaluation of the surgical abdomen, has been shown to have little if any value in the workup of SBO. The difference in WBC in a patient with strangulated bowel and a patient with simple obstruction has been shown to be as little as 2000/mm<sup>3</sup>.<sup>8</sup> In addition, leukocytosis alone does not correlate with the need for operation.<sup>6</sup> In terms of patients who went to surgery, regardless of bowel strangulation, the WBC averaged 12,000/mm<sup>3</sup> in the surgically treated

group and 10,200/mm<sup>3</sup> in the medically managed group.<sup>11</sup> Overall, the absolute leukocyte count in patients with strangulation was not significantly elevated and a normal leukocyte count should never be relied upon to "rule out" bowel strangulation.

Two other laboratory values that are not often considered but may be of importance in predicting bowel strangulation are lactate and amylase. Lactate, which was checked in only 16% of patients presenting with SBO, was abnormal in 86% of strangulated cases as compared with only 4% with simple SBO.<sup>8</sup> Amylase, which was obtained in 80% of patients presenting with SBO, was elevated in 55% of strangulated cases compared with only 5% of nonstrangulated cases.<sup>8</sup> Although these data appear quite promising, retrospective chart review revealed that clinical evidence of strangulation was always present when these studies were abnormal.

Despite its difficulty, early recognition of patients with bowel strangulation is critical in minimizing morbidity. In a retrospective review of 314 operations for SBO, a clearly higher incidence of complications was noted in patients with bowel strangulation who had a delay in surgical management.<sup>8</sup> In patients with bowel strangulation, complications occurred in 36% of the patients taken immediately to surgery compared with a 100% complication rate among those undergoing operation after a delay of 4 to 24 hours. Despite the surgical axiom "the sun should never rise and fall on a bowel obstruction," a linear relationship between mortality and delay in surgery could not be demonstrated. What has been demonstrated is that in patients with SBO secondary to hernia, mortality was associated with an average of twice the duration of prehospital symptoms. In patients with SBO secondary to adhesions or malignancy, there was no statistically significant difference in the average duration of symptoms.<sup>8</sup> The data concerning hernia-related SBO are fairly clear: hernia-related SBOs have a higher rate of strangulation and prolonged strangulation leads to worsening outcomes for patients. Any patient presenting with SBO and a new nonreducible hernia should have urgent operative exploration.

A review of the SBO literature over the past half-century is summarized in Tables 1 and 2. An immediately obvious trend is the decrease in mortality over the

**Table 1 Previous Clinical Reports on Small Bowel Obstruction of Any Cause**

Author	Year	Total Cases	No. Operated on (%)	Strangulation (%)	Mortality (%)
Silen <sup>12</sup>	1962	480	316 (66)	23	10.5
Lo <sup>3</sup>	1966	150	145 (97)	25	24.7
Stewardson <sup>26</sup>	1978	238	112 (47)	11	5.5
Bizer <sup>16</sup>	1981	405	267 (66)	10	6.7
McEntee <sup>27</sup>	1987	236	154 (65)	NR	11
Brolin <sup>6</sup>	1987	342	163 (48)	8	7
Asbun <sup>28</sup>	1989	105	58 (55)	5	3.8

NR, data not recorded.

**Table 2 Previous Clinical Reports on Small Bowel Obstruction Secondary to Adhesions**

Author	Year	Total Cases	No. Operated on (%)	Strangulation (%)	Mortality (%)
Becker <sup>29</sup>	1952	412	289 (70)	21	11.8
Hofstetter <sup>30</sup>	1981	52	31 (60)	8	1.9
Wolfson <sup>31</sup>	1985	127	48 (38)	5	1.5
Tanphiphat <sup>32</sup>	1987	321	194 (60)	NR	1
Seror <sup>10</sup>	1993	297	80 (27)	11	1.7
Cox <sup>5</sup>	1993	144	59 (41)	13	3.5

NR, data not recorded.

past 50 years when considering SBO from any cause (Table 1). This may be related to an increased incidence of SBO secondary to adhesions or advances in critical care medicine. Table 2 is remarkable for the overall low mortality associated with adhesional SBO, although only one study prior to 1981 is listed.

### COMPLETE VERSUS PARTIAL BOWEL OBSTRUCTION

Classic surgical teaching has been that patients with evidence of complete bowel obstruction should be candidates for early operation as opposed to patients with partial bowel obstruction. As we review the timing of reoperation for SBO, it becomes important to evaluate critically the concept of complete obstruction. Is complete obstruction really a true indication for immediate operative intervention? Complete obstruction is suspected in patients with a history of obstipation who have no evidence of gas distal to the obstruction on abdominal plain films. However, this definition may be impractical because patients with an early complete bowel obstruction continue to evacuate stool and gas distal to the obstruction and have evidence of gas on abdominal plain films.<sup>10</sup> In addition, gas may be introduced into the rectum by digital rectal examination or other procedures.<sup>6</sup> Some authors have even questioned the utility of plain abdominal radiographs in the workup of SBO, noting that in 17 to 8% of strangulated SBO cases the abdominal radiographs were interpreted as normal.<sup>8,12</sup>

The debate over complete and partial obstruction on abdominal radiographs is supported by retrospective data on both sides. A review of 297 admissions with adhesional SBO in which the nonoperative approach was routinely utilized for patients with both complete and partial obstruction showed no significant difference between the two groups in terms of the rate of bowel strangulation, rate of surgery, morbidity, or mortality.<sup>10</sup> On the other hand, Brodin et al<sup>6</sup> gathered retrospective data on 342 admissions with the diagnosis of SBO. Only 67% of these patients had SBO secondary to adhesions; the remainder of the patients had SBO secondary to hernia, malignancy, Crohn's disease, and several other diagnoses. In their review, the radiographic distinction

between partial and complete obstruction was the most reliable determinant of need for operative treatment. Eighty-four percent of patients with complete obstruction required operation compared with only 19% of patients with partial obstruction. Ninety-one percent of the postoperative complications occurred in patients with radiographic evidence of complete obstruction.

The great discrepancy between these two retrospective reviews may be directly related to the fact that the first focused on adhesional SBO and the second focused on SBO from any cause. As noted previously, the etiology of SBO is extremely important in predicting strangulation. Although the idea of a complete obstruction sounds like a compelling indication for rapid operative intervention, in the postoperative patient with adhesional SBO, the data do not necessarily support immediate operation.

### RADIOGRAPHIC EVIDENCE OF SMALL BOWEL OBSTRUCTION

Upper gastrointestinal contrast studies can be extremely useful in determining which patients with bowel obstruction ultimately require surgery. Examinations with water-soluble contrast material have been prospectively evaluated in the management of SBO. In one particular study from the University of Hong Kong,<sup>13</sup> 51 patients presenting with SBO were given water-soluble contrast material through the nasogastric tube within 24 hours of hospital admission. Any patient with an obvious indication for operation was excluded from the study. A single supine abdominal radiograph was taken 4 hours later. The surgeons were "blinded" to the results of the study and did not take the information into account while managing their patients. The results were interpreted as "significant obstruction" if contrast failed to reach the cecum within 4 hours or if there was a clear cutoff of the contrast in the gastrointestinal tract. Seventeen of 19 patients with significant obstruction required surgery, whereas only 1 of 32 patients with insignificant obstruction on radiographs required surgery. The authors have shown that this simple test, with a sensitivity of 94% and a specificity of 94% in predicting surgical intervention, may be the single most accurate diagnostic tool available.

There is a new body of literature showing that water-soluble contrast studies may have a therapeutic benefit as well as a diagnostic one in patients presenting with SBO. One such randomized, prospective, blinded study compared patients with adhesive SBO in two groups: one receiving water-soluble contrast material and the other receiving placebo.<sup>14</sup> No further radiographs were taken. The two groups did not differ in terms of operative intervention (four per group); however, the contrast group had resolution of SBO an average 9 hours sooner, equating to one less day in the hospital. This study shows that water-soluble contrast studies may facilitate nonoperative management in selected patients with SBO.

Several papers have attempted to assess the diagnostic accuracy of computed tomography (CT) in identification of bowel ischemia in patients presenting with SBO. Data from 15 of these studies were combined to develop aggregate performance characteristics for CT diagnosis of ischemia.<sup>15</sup> Overall, CT scan had a sensitivity of 83% and a specificity of 92%. However, there are no standard criteria for the diagnosis of ischemic bowel in SBO on CT scan. As with every laboratory and radiographic modality used to evaluate the patient presenting with SBO, the real value of CT may be seen when it is used in conjunction with other assessment techniques.

### **ADVANCED AGE AND STRANGULATION**

One additional factor that should be considered when evaluating the patient with SBO is age of the patient. Patients with advanced age have significantly higher rates of strangulation and mortality. In one review of 405 patients with SBO,<sup>16</sup> 53.7% of the 41 patients with strangulation were older than 70 years. In a Mayo Clinic review of 289 patients with SBO, 50% of reported deaths occurred in patients in the eighth or ninth decade of life.<sup>8</sup> In a separate review that included 77 patients with adhesive SBO over the age of 65, the authors noted a 28.5% mortality rate.<sup>17</sup> This mortality risk in older patients should be considered when deciding between early operation and observation in elderly patients with SBO.

### **DURATION OF NONOPERATIVE MANAGEMENT**

There are no prospective, randomized trials concerning the optimal duration of nonoperative management of SBO. In addition, most large retrospective reviews do not make mention of the specific timing of nonoperative management involved. What follows is a review of three important retrospective studies that included data concerning the duration of nonoperative management and the outcomes that were observed.

Cox et al<sup>5</sup> reviewed 144 patient admissions to determine the appropriate length of time for nonoperative management of patients with adhesive SBO. The mortality rate in the entire series was 3.5% and the overall incidence of strangulation was 13%. Their retrospective analysis revealed that nonoperative treatment of adhesive SBO was successful in 69% of cases. All of these successful cases had signs of SBO resolution within 48 hours of admission (including passage of flatus, reduced abdominal distention, colonic gas on abdominal radiography, or normal barium follow-through). There were no deaths in the group having an initial period of nonoperative treatment. No patient was observed longer than 5 days. The authors recommend exploratory laparotomy in any patient without signs of SBO resolution after 48 hours of nonoperative management. Furthermore, they recommend that patients having a trial of nonoperative treatment have close observation for signs of strangulation and undergo urgent laparotomy should these signs develop.

In a retrospective review of 297 patient admissions, Seror et al<sup>10</sup> set out to determine the optimal length of time to observe patients with postoperative adhesive SBO. Patients with early postoperative bowel obstruction were excluded. The mortality rate in the entire series was 1.7% and the overall incidence of strangulation was 11%. Patients were managed nonoperatively for a period of 12 hours to 25 days (median: 2 days). This study is remarkable for how long some patients were managed nonoperatively: 5 days or more in 25% of the patients and more than 10 days in 12%. A prolonged delay of surgical intervention in these patients did not result in an increased incidence of bowel strangulation or mortality, although the authors did not comment on the incidence of postoperative complications. The authors demonstrated an overall 73% success rate with nonoperative management and showed that conservative treatment extending beyond 5 days was never successful. They concluded that a conservative trial of up to 5 days duration offers a safe and reasonable opportunity for spontaneous resolution of obstruction, but it is unjustified for a period longer than 5 days. It is important to note that the vast majority of their nonoperatively managed patients had resolution of symptoms within 48 hours.

Brolin et al<sup>6</sup> performed a retrospective review of 342 patient admissions with SBO secondary to a multitude of causes, not simply limited to the population of postoperative patients. The mortality rate in the entire series was 7.7% and the overall incidence of strangulation was 9%. Of the 64 patients who had operation within 24 hours of admission, postoperative complications developed in 6 patients (9%) compared with 39 of 99 patients (39%) who had operation more than 24 hours after admission. Despite this difference in postoperative morbidity, there was no correlation between the timing of

operation and *mortality* from strangulated obstruction. Nonoperative intervention was successful in 66% of patients. Ninety-five percent of patients successfully treated nonoperatively showed signs of clinical or radiographic improvement within the first 24 hours of treatment. The authors recommended that trials of nonoperative tube decompression for partial obstruction not exceed 48 hours.

In summary, nonoperative management of adhesional SBO is safe and carries low mortality. Observation of this group of patients longer than 48 hours without evidence of resolution of SBO is usually futile. Delayed treatment of strangulated small bowel results in increased postoperative morbidity without a demonstrable increase in postoperative mortality. When evaluating SBO from any cause, as compared with simple adhesional SBO, the mortality is increased.

### **OUTCOMES OF NONOPERATIVE MANAGEMENT OF SMALL BOWEL OBSTRUCTION**

A review of outcomes of nonoperative management of SBO shows mixed results. In a retrospective review of 329 patients treated for SBO, the nonoperative group had a mortality rate of 2.8% compared with the surgically treated cohort mortality of 2.1%.<sup>18</sup> The incidence of recurrent SBO was significantly higher in the nonoperatively managed group of patients—40.5% versus 26.8% in the surgical group. The time interval to recurrent SBO was significantly shorter in the nonoperatively managed group—153 compared with 411 days. Overall, the nonoperatively managed patients had a significantly shorter hospital stay than the operatively managed patients.

A retrospective review of 410 patients with SBO yielded similar results.<sup>9</sup> The authors found that the overall recurrence rate of SBO was similar between nonoperatively and operatively treated patients (34% versus 32%); however, patients treated conservatively tended to have earlier recurrence than those treated surgically (0.7 versus 2 years). Conservatively treated patients also had fewer inpatient hospital days (4 versus 12 days).<sup>9</sup>

### **MALIGNANT SMALL BOWEL OBSTRUCTION**

Patients with SBO secondary to malignancy may tolerate a longer period of nonoperative management than patients with other causes of SBO. In a review of reoperative surgery in 54 patients with a known history of malignancy, timing of the reoperative surgery did not correlate with postoperative complications.<sup>19</sup> Six of 14 patients operated on within 24 hours of admission experienced complications, compared with 12 of 23 patients operated on after an average 7-day trial of nasogastric tube decompression.<sup>19</sup> This correlates with

the observation that only 4% of patients with malignant SBO have irreversible gangrenous changes.<sup>8</sup> Regardless of the low incidence of bowel ischemia, surgery for malignant obstruction has a relatively high in-hospital mortality rate that has been reported as 21 to 28%.<sup>8,19</sup> One series even reported a hospital mortality rate of 64% for malignant obstruction.<sup>6</sup> Therefore, a trial of tube decompression appears to be warranted in patients without signs of intestinal ischemia who have a probable malignant obstruction.

When evaluating the patient with a history of malignancy, it is important to remember that the patient may not have an SBO secondary to malignant obstruction. Several factors are important to consider when evaluating the patient with possible malignant SBO. The time interval from the diagnosis of malignancy to the development of SBO can be suggestive of the etiology of obstruction. In a review of SBO in patients with a history of cancer, SBO related to recurrent cancer occurred significantly earlier ( $21 \pm 5$  months) than SBO from benign causes ( $61 \pm 18$  months).<sup>19</sup> The authors concluded that patients who present with bowel obstruction shortly after the diagnosis of malignancy should be considered at high risk for malignant obstruction.

Any patient presenting with SBO and a known abdominal cancer recurrence is likely to have malignant SBO. A retrospective review of 120 laparotomies for SBO in patients after colon resection revealed that benign adhesions were responsible for the obstruction in 82.6% of patients with a history of adenocarcinoma of the colon without known recurrence. However, of the patients who did have known recurrence, only 30.1% had a benign cause for their obstruction.<sup>20</sup> Clearly, known abdominal recurrence increases the likelihood of malignant SBO and should prompt more prolonged nonoperative management because of the low incidence of strangulation and the high surgical mortality.

Patients undergoing repeated surgery for recurrent malignant bowel obstruction have a very low likelihood of successful palliation. According to a review of 10 patients at Memorial Sloan-Kettering with a history of recurrent ovarian cancer who had an average of 2.7 prior laparotomies, successful palliation, defined as the ability to tolerate a low-residue or regular diet at least 60 days postoperatively, was achieved in only 3 patients.<sup>21</sup> The authors suggested that alternative management approaches, such as percutaneous endoscopic gastrostomy (PEG) tube placement, should be considered in this group of patients.

### **THE EARLY POSTOPERATIVE SMALL BOWEL OBSTRUCTION—A SPECIAL CIRCUMSTANCE**

Early postoperative SBO can occur for a variety of reasons including adhesions, internal hernias, volvulus,

abscesses, or edema at anastomotic sites.<sup>22</sup> Making the decision to reoperate on these patients is difficult given that the classic signs and symptoms of bowel necrosis (fever, peritonitis, leukocytosis) are not unusual in any postoperative patient. Several authors have suggested that operations predisposing to adhesions causing SBO usually involve pelvic dissection,<sup>5,22</sup> but this observation is not helpful in ruling out bowel necrosis. Retrospective reviews of postoperative SBO have shown expected outcomes: length of stay and time to return of bowel obstruction are significantly longer in operatively treated patients.<sup>22</sup> Early postoperative SBO represents a very small proportion of all patients with bowel obstruction. In a review of 1001 cases of SBO,<sup>23</sup> only 30 patients had early postoperative SBO. The authors identified only one patient who had strangulated bowel and determined that nonoperative management of postoperative SBO in the stable patient is warranted given the low incidence of strangulation in this group. In one of the largest reviews of early postoperative SBO,<sup>7</sup> which included 101 patients, no evidence of strangulated bowel was found in any patient. Based on the low incidence of bowel ischemia, the authors recommended 10 to 14 days of nonoperative management in this group of patients.

Prior to laparoscopy, retrospective reviews had demonstrated that the type of operation did not correlate significantly with the clinical or operative course of patients with SBO.<sup>10</sup> However, evidence is gathering that the management rules for early postlaparoscopic SBO are considerably different. Laparoscopy is typically performed in patients with few or no preoperative adhesions; in addition, laparoscopy is thought to stimulate fewer postoperative adhesions. Therefore, immediate postlaparoscopic SBO is less likely to be related to adhesions and therefore less likely to undergo successful nonoperative management. In a 6-year retrospective review<sup>24</sup> of three Chicago-area teaching hospitals, five cases of early postlaparoscopic bowel obstruction were identified. All of these patients were initially managed nonoperatively, and all of these patients ultimately required surgery. In every case, the SBO was caused by small bowel incarceration in a peritoneal defect created during surgery.

A separate review of 24 cases of postlaparoscopic bowel obstruction revealed that adhesions do have a role.<sup>25</sup> Obstruction was secondary to adhesions or bands in 12 cases and intestinal incarceration in 11 cases. However, very early postoperative bowel obstruction was often due to intestinal incarceration in trocar sites and abdominal wall defects after hernia repair. The median interval to reoperation was significantly shorter for incarceration (8 days) than for adhesions (25 days) or bands (22.5 days). In contrast to the approach for early SBO after laparotomy, prompt operative intervention for postlaparoscopic SBO is recommended.

## CONCLUSIONS

The timing of reoperation for SBO is critical. A delay in surgery for patients with bowel strangulation increases the postoperative complications significantly; however, there is no perfect test for predicting bowel strangulation. The diagnosis of bowel strangulation remains a surgical art and should be based on a global evaluation of the patient's condition, radiologic studies, and close observation for any changes. In patients who initially have no evidence of bowel ischemia, nonoperative management can be initiated, generally for 48 hours. A limited, 4-hour upper gastrointestinal contrast study may be extremely useful in predicting which patients to manage nonoperatively, and the contrast material may even be therapeutic. If the patient has no sign of resolution of the obstruction within 48 hours, operative intervention is usually indicated. Special circumstances include patients with a history of abdominal malignancy and patients who are still in the very early postoperative period. Patients with known recurrence of abdominal cancer have an extremely high mortality rate that is unaffected by early operation. An extended period of nonoperative management in the patient with malignant bowel obstruction seems justified. The early postlaparotomy SBO has an extremely low incidence of strangulation and may be managed nonoperatively for periods of 10 to 14 days. The early postlaparoscopic bowel obstruction is in a category of its own and usually warrants early exploration because of the high incidence of port-site incarcerated hernia.

## DISCLOSURE

The authors have no conflicts to disclose relative to this article.

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