

Evaluation and management of small-bowel obstruction: An Eastern Association for the Surgery of Trauma practice management guideline

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- BACKGROUND:** Small-bowel obstruction (SBO) represents as many as 16% of surgical admissions and more than 300,000 operations annually in the United States. The optimal strategies for the diagnosis and management of SBO continue to evolve secondary to advances in imaging techniques, critical care, and surgical techniques. This updated systematic literature review was developed by the Eastern Association for the Surgery of Trauma to provide up-to-date evidence-based recommendations for SBO.
- METHODS:** A search of the National Library of Medicine MEDLINE database was performed using PubMed interface for articles published from 2007 to 2011.
- RESULTS:** The search identified 53 new articles that were then combined with the 131 studies previously reviewed by the 2007 guidelines. The updated guidelines were then presented at the 2012 annual EAST meeting.
- CONCLUSION:** Level I evidence now exists to recommend the use of computed tomographic scan, especially multidetector computed tomography with multiplanar reconstructions, in the evaluation of patients with SBO because it can provide incremental clinically relevant information over plain films that may lead to changes in management. Patients with evidence of generalized peritonitis, other evidence of clinical deterioration, such as fever, leukocytosis, tachycardia, metabolic acidosis, and continuous pain, or patients with evidence of ischemia on imaging should undergo timely exploration. The remainder of patients can safely undergo initial nonoperative management for both partial and complete SBO. Water-soluble contrast studies should be considered in patients who do not clinically resolve after 48 to 72 hours for both diagnostic and potential therapeutic purposes. Laparoscopic treatment of SBO has been demonstrated to be a viable alternative to laparotomy in selected cases. (*J Trauma Acute Care Surg.* 2012;73: S362–S369. Copyright © 2012 by Lippincott Williams & Wilkins)
- KEY WORDS:** Small-bowel obstruction; practice management guidelines; laparoscopy; surgery; diagnosis.

STATEMENT OF THE PROBLEM

Although small-bowel obstruction (SBO) has been recognized since the time of Hippocrates, surgical therapy for

SBO did not become commonly accepted until the advent of anesthesia, antisepsis, and safer surgical techniques in the late 1800s.¹ At the same time, the increased prevalence of abdominal and pelvic surgery created a new source of SBO—postoperative adhesions. Adhesions are currently the leading cause of SBO in industrialized countries (~70%), followed by malignancy, inflammatory bowel disease, and hernias. SBO accounts for as many as 12% to 16% of surgical admissions and more than 300,000 operations annually in the United States. This represents more than 2.3 billion dollars in health care expenditures.^{2–4}

Over the centuries, the management of SBO has evolved. Early treatments included bloodletting and ingestion of heavy metals. Advancements brought intestinal tube decompression and operative interventions. In 2007, the Eastern Association for the Surgery of Trauma (EAST) developed modern guidelines for the management of SBO that were subsequently published in the *Journal of Trauma* in 2008.¹ The guidelines offered 12 evidence-based recommendations for the diagnosis and management of SBO based on a systematic review of the English literature published between 1991 and 2006. However, optimal strategies are in constant flux secondary to advances in imaging techniques, critical care, and surgical techniques. For example, in the 5-year interim period, multiple

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studies have further evaluated the role of computed tomographic (CT) scans in the diagnosis and management of SBO, as well as the increasing use and role of laparoscopy in the treatment of SBO. This update to the practice management guidelines was therefore developed, presented, and discussed at the 2012 EAST Annual Meeting.

PROCESS

A computerized search of the National Library of Medicine MEDLINE database was undertaken using the PubMed Entrez interface for English language citations during the period of 2007 through 2011 using the primary search strategy:

intestinal obstruction[mh] AND intestine, small[mh] AND humans[mh] NOT
(case reports[pt] OR letter[pt] OR comment[pt] OR news[pt])

The primary search identified 259 articles that met our criteria. After the exclusion of review and pediatric and inflammatory bowel disease articles, 53 new articles were identified. These articles detailed both prospective and retrospective studies examining adult patients with suspected or proven SBO. These articles were added to the 131 previous studies reviewed in the 2007 practice management guidelines (Appendix, Supplemental Digital Content 1, <http://links.lww.com/TA/A200.77-91.93-160>). A group of 10 acute care surgeons collaborated to produce this practice management guidelines update. Each article was reviewed and graded according to the level of evidence (Table 1) by at least two surgeons. The correlation between the evidence and the level of recommendations as defined by EAST is as follows:

Level 1: This recommendation is convincingly justifiable based on the available scientific information alone. It is usually based on Class I data; however, strong Class II evidence may form the basis for a Level 1 recommendation especially if the issue does not lend itself to testing in a randomized format. Conversely, weak or contradictory Class I data may not be able to support a Level 1 recommendation.

Level 2: This recommendation is reasonably justifiable by available scientific evidence and strongly supported by expert critical care opinion. It is usually supported by Class II data or a preponderance of Class III evidence.

Level 3: This recommendation is supported by available data, but adequate scientific evidence is lacking. It is generally supported by Class III data. This type of recommendation is useful for educational purposes and in guiding future studies.

TABLE 1. Grading of Scientific Evidence Based on the EAST Criteria

Class I	Prospective, randomized, controlled trials
Class II	Clinical studies in which the data were collected prospectively and retrospective analyses that were based on clearly reliable data. Types of studies so classified include observational studies, cohort studies, prevalence studies, and case-control studies.
Class III	Studies based on retrospectively collected data. Evidence used in this class includes clinical series, database or registry review, large series of case reviews, and expert opinion.

RECOMMENDATIONS

Diagnosis

1. CT scan of abdomen and pelvis should be considered in all patients with SBO because it can provide incremental information over plain films in differentiating grade, severity, and etiology of SBOs that may lead to changes in management. Level 1.
2. Water-soluble contrast study should be considered in patients who fail to improve after 48 hours of nonoperative management because a normal contrast study can rule out operative SBO. Level 2.
3. If available, multidetector CT scanner and multiplanar reconstruction should be used because they aid in the diagnosis and localization of SBOs. Level 3.
4. Magnetic resonance imaging (MRI) and ultrasound are potential alternatives to computed tomography but may have several logistical limitations. Level 3.
5. CT scan should be considered to aid in the diagnosis of small-bowel volvulus. Findings include multiple transition points, posterior location, and the “whirl” sign. Level 3.

Management

1. Patients with SBO and generalized peritonitis on physical examination or with other evidence of clinical deterioration such as fever, leukocytosis, tachycardia, metabolic acidosis, and continuous pain should undergo timely surgical exploration. Level 1.
2. Patients without the previously mentioned clinical picture can safely undergo initial nonoperative management for both partial and complete SBO, although complete obstruction has a higher level of failure. Level 1.
3. CT findings consistent with bowel ischemia should suggest a low threshold for operative intervention. Level 2.
4. Laparoscopic treatment of SBO is a viable alternative to laparotomy in selected cases. When successful, it may be associated with decreased morbidity and a shorter length of stay. Level 2.
5. Water-soluble contrast should be considered in the setting of partial SBO that has not resolved in 48 hours because it can improve bowel function (time to bowel movement), decrease length of stay, and is both therapeutic and diagnostic. Level 2.
6. Patients without resolution of the SBO by days 3 to 5 of nonoperative management should undergo water-soluble contrast study or surgery. Level 3.
7. Patients with SBO should generally be admitted to a surgical service because this has been shown to be associated with a shorter length of stay, less hospital charges, and lower mortality compared with admission to a medical service. Level 3.

SCIENTIFIC FOUNDATION

The evaluation of patients with suspected SBO endeavors not only to confirm the diagnosis but also to determine the need for and timing of surgery. The workup should distinguish mechanical obstruction from ileus, determine the cause of the obstruction, and differentiate partial (low-grade)

from complete (high-grade) obstructions. In addition, the patient should be assessed for signs of bowel ischemia.

An appropriate history and physical examination should be performed. Specific historical elements that should be discerned include previous abdominal operations, radiation, and other abdominal disorders (inflammatory bowel disease, neoplasm, etc.) that may cause SBO. The physical examination should include an evaluation for signs of systemic toxicity, a thorough abdominal examination, and an evaluation for potential external hernias. Laboratory studies should be performed to evaluate for the presence of metabolic derangements, acidosis, or leukocytosis. These may suggest that bowel ischemia is present, although the specificity is low.

Plain Radiography

Radiologic evaluation has traditionally started with a three-view abdominal radiograph series (upright chest radiograph, upright and supine abdominal radiographs) to confirm the diagnosis of SBO. Although there is Class III evidence to suggest that plain films and CT scans have similar sensitivity for detection of high-grade obstruction (86 vs. 82%), there is also data to suggest that plain films are less sensitive in the setting of partial bowel obstruction.⁵ The overall sensitivity of abdominal radiographs for the detection of SBO ranges from 59% to 93% but is dependent on the radiologist's experience.⁵⁻⁷ Small-bowel ileus and large-bowel obstruction may also mimic SBO findings in traditional planar radiographs. In addition, plain radiographs are nondiagnostic or nonspecific in many cases.⁸ Plain films, however, currently remain part of the initial diagnostic evaluation because of their widespread availability, low cost, and ability to follow disease progression serially.

Computed Tomography

CT scans have been shown in Class II and III studies to be superior to plain film radiography in the overall diagnosis of SBO. They can also provide additional information that alters patient management. CT scans have been shown to be 83% to 94% accurate at diagnosing obstruction.^{6,9} Findings consistent with SBO on CT scan include

1. a transition point with dilation of bowel proximally and decompression distally;
2. a decompressed colon; and
3. failure of intraluminal contrast to pass beyond the transition point.

CT scans can determine not only the level of obstruction (93%) but also the cause (80–91%) in most patients.^{6,9,10} There are also Class II data to suggest that CT is 85% to 100% sensitive in detection of bowel ischemia.⁹⁻¹³ CT findings suggestive of ischemia include

1. reduced bowel wall enhancement;
2. wall thickening;
3. mesenteric venous congestion;
4. mesenteric fluid;
5. unusual course of the mesenteric vasculature; and
6. ascites.

CT scans can also be used for the detection of small-bowel volvulus; predictors include multiple transition points, posterior location of transition point, and the presence of the whirl sign.¹⁴ "Whirl sign" refers to a "characteristic swirl of the mesenteric fat and soft tissue attenuations with adjacent loops of small bowel surrounding rotated intestinal vessels."⁹² Multidetector helical CT and multiplanar reformats may aid in the diagnosis of SBO by allowing visualization of the loops of bowel in multiple planes.^{15,16}

Ultrasound and MRI

Class II and III data have demonstrated that ultrasound findings can diagnose SBO with accuracy comparable to plain films.^{6,17-20} In addition, it can detect free fluid that may suggest the presence of ischemia.²¹ Although experience with using ultrasound findings for diagnosing SBO is currently not widespread, the technique can be easily learned.²⁰

Half-Fourier Acquisition Single-shot Turbo-spin Echo (HASTE) MRI has been shown in Class II and III studies to diagnose SBO with a high reported sensitivity (95%), specificity (100%), and accuracy at determining the level of obstruction (73%).²²⁻²⁶ However, MRI may not be available at all centers (especially at night), has a longer scan time, and may not be as reliable in identifying the cause of obstruction.

Contrast Studies and Enteroclysis

Contrast examination of the small bowel can be helpful particularly in identifying cases of low-grade or partial SBO that can be difficult to detect on CT scan.^{27,28} Fluoroscopic, CT, and MRI enteroclysis techniques have all been used but have not been compared directly with themselves to determine which is superior in SBO patients. Both nonionic low-osmolar-weight contrast and barium can be used.²⁹ Contrast studies can be used in conjunction with CT for equivocal cases of SBO with an increased combined sensitivity and specificity.³⁰ Water-soluble contrast studies can accurately predict the need for surgery and reduce the need for operation and shorten hospital stay.³¹⁻³⁴ Although more labor intensive than CT scanning, contrast studies may offer greater sensitivity in the detection of intraluminal or mural etiologies of obstruction.

Initial Management: Operative Versus Nonoperative

Early operative management should be pursued in patients with suspected bowel strangulation because this is associated with an increased morbidity and mortality. Clinical indicators, which include fever, leukocytosis, tachycardia, continuous pain, metabolic acidosis, peritonitis, and the systemic inflammatory response syndrome (SIRS), correctly identify bowel ischemia in approximately 40% to 50% of cases.³⁵⁻³⁷ The addition of imaging studies will identify most patients who need early operative intervention (70–96%).³⁸⁻⁴⁰

The initial management of patients with complete SBO remains controversial. Although complete SBO is associated with a higher requirement for small-bowel resection (31%) in some series,⁴¹ others have demonstrated that nonoperative management is still successful in 41% to 73% of patients with complete obstruction.⁴²⁻⁴⁴

Operative management of both partial and complete SBO is associated with lower reoccurrence rates and longer disease-free interval when compared with nonoperative management.⁴⁵⁻⁴⁸

Patients without clinical or radiologic signs and symptoms of bowel ischemia can safely undergo initial nonoperative management. Progression to bowel ischemia in the setting of partial SBO is unlikely to occur with nonoperative management (3-6%),³⁵ but patients need to be monitored with serial abdominal examinations and laboratory studies. Nonoperative management is overall successful in 65% to 80% of patients, especially in the setting of partial SBO and early postoperative period SBO.^{42,43,49,50} Most patients improve within 2 to 5 days after initiation of therapy.^{35,50} Failure to regain bowel function after 5 days suggests the need for an operation.

Hypertonic Contrast in Partial SBO

In patients who do not have resolution of SBO within 48 hours of admission, Class I and II data support performing contrast studies before operative intervention to differentiate complete from partial SBO.⁵¹⁻⁵³ For patients with a partial SBO, the water-soluble contrast study may itself be therapeutic because it causes a shift of fluid into the intestinal lumen, thus increasing the pressure gradient across the site of obstruction. This may speed the return of bowel function and decrease the overall length of stay.^{51,52,54-58}

Operative Approach: Open Versus Laparoscopic

A preponderance of Class III studies has demonstrated that laparoscopic surgery for SBO is a safe and acceptable alternative to open surgery. Although previously reserved only for simple SBO, current literature supports the use of laparoscopy in complex SBO with dilated bowel and multiple previous abdominal operations.^{59,60} The appropriate setting not only depends on the patient but also on the surgeon's experience. A meta-analysis of 29 studies and 2005 patients reported a conversion rate of 29% and an enterotomy rate of 7%.⁶¹ Patients with a single-band adhesive obstruction have a higher success rate.^{59,62-64} Successful laparoscopic surgery is associated with an earlier recovery of bowel function and a shorter length of stay.^{62,65-67}

Adjuncts

Antibiotics

Broad-spectrum antibiotics are sometimes administered because of concerns that bacterial translocation may occur in the setting of SBO; however, there are only limited data to support or refute this practice.⁶⁸

Prevention

Although a number of agents have been studied for the prevention of SBO through a reduction of postoperative adhesions, currently, the most promising technology is bioresorbable membranes. Several products are available on the market, including sodium hyaluronate-based carboxymethylcellulose (Seprafilm). The available data supporting its use are mixed at best. Two prospective trials in patients undergoing intestinal resection or gastrectomy, respectively, showed no significant

difference in SBO with the use of Seprafilm, although in the intestinal resection study, the Seprafilm group had a lower rate of SBO that required reoperation.^{69,70} Other retrospective trials have reported a decreased incidence of SBO with the use of Seprafilm.⁷¹⁻⁷⁴ Placing Seprafilm near an anastomosis should be done with trepidation because it has been associated with higher rates of anastomotic leak.⁷⁵

Admitting Service

There are Class III data to suggest that patients with SBO admitted to a surgical service have shorter length of stay, less hospital charges, shorter time to surgery, and lower mortality than patients admitted to medical service.⁷⁶ This may be confounded by a number of factors. Patients who are unable to tolerate or are unwilling to undergo an operation can be considered for admission to a medical service.

SUMMARY

Evaluation and management of SBO continue to evolve with advances in medical technology and techniques. Since the publication of the EAST practice management guideline on SBO in 2008, there has been increased support for the use of CT scans to confirm the diagnosis of SBO and assist in determining the initial clinical management. Minimally invasive surgery is being used with increasing frequency and in more complex cases. In the current era of cost containment and regulatory agencies analysis of outcomes, further studies are needed to better delineate the expected short- and long-term outcomes after both nonoperative and operative management of SBO.

AUTHORSHIP

A.A.M. and D.C.J. performed the literature search. All authors participated in review of the available literature, data analysis and development of the recommendations. A.A.M., D.C.J., and G.L.P. wrote the manuscript. All authors participated in critical revisions.

DISCLOSURE

The authors declare no conflicts of interest.

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