

**Comparison of Laparoscopic Versus Open Surgery for Emergency Small-Bowel Obstruction: A Systematic Review**

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**Type of Publication:** Review Article

**Conflicts of Interest:** Nil

**Abstract**

**Background:** Emergency small-bowel obstruction (SBO) remains a frequent cause of acute surgical admission. When non-operative management fails or bowel ischemia, strangulation, or perforation is suspected, operative treatment is required. Open laparotomy has traditionally been the standard approach, whereas laparoscopy offers the potential advantages of reduced abdominal-wall trauma, fewer wound complications, faster gastrointestinal recovery, and shorter hospitalization. Concerns remain regarding limited working space, distended bowel, iatrogenic enterotomy, conversion to laparotomy, and patient selection. This systematic review compared laparoscopic and open surgery for emergency SBO.

**Methods:** A systematic review was structured according to PRISMA 2020 principles. MEDLINE/PubMed, Embase, Scopus, Web of Science, and the Cochrane Library were searched from January 2000 through 30 June 2026. Comparative studies enrolling adults undergoing emergency surgery for SBO were eligible when laparoscopic or laparoscopy-first treatment was directly compared with open surgery. Primary outcomes were postoperative morbidity, mortality, length of hospital stay, iatrogenic bowel injury, and conversion. Secondary outcomes included operative time, bowel resection, return of gastrointestinal function, reoperation, readmission, and recurrent SBO. Risk of bias was assessed using RoB 2 for randomized trials and ROBINS-I for observational studies. Because of

substantial clinical heterogeneity, findings were synthesized narratively.

**Results:** The search dataset identified 1,984 records, including 1,919 database records and 65 records through citation searching. After removal of 427 duplicates, 1,557 records were screened. Of 143 reports sought for retrieval, six were unavailable; 137 full texts were assessed and 116 excluded, leaving 21 studies for qualitative synthesis. The evidence was dominated by adhesive SBO. The LASSO randomized trial demonstrated a shorter postoperative stay after laparoscopy than open surgery (4.2 vs 5.5 days;  $p=0.013$ ), while 30-day complications did not differ significantly. Approximately one quarter of laparoscopic procedures required conversion. Large observational datasets generally favored laparoscopy, with shorter hospitalization and lower morbidity, but selection bias was substantial. Long-term randomized follow-up demonstrated no significant advantage for recurrent SBO, incisional hernia, or quality of life.

**Conclusions:** A laparoscopic-first approach can provide meaningful short-term benefits in appropriately selected patients requiring emergency surgery for SBO, particularly those with suspected single-band adhesive obstruction, limited prior abdominal surgery, and hemodynamic stability. However, apparent advantages in observational studies are strongly influenced by selection bias. Open surgery remains appropriate for diffuse dense adhesions, severe bowel distension, suspected complex ischemia or perforation, and cases in which safe laparoscopic progress cannot be achieved. A low threshold for conversion is essential.

**Keywords:** Small-Bowel Obstruction, Adhesive Small-Bowel Obstruction, Laparoscopy, Laparotomy,

Adhesiolysis, Emergency Surgery, Bowel Obstruction, Conversion

## Introduction

Small-bowel obstruction is one of the most common causes of emergency surgical admission and is associated with substantial morbidity, resource utilization, and risk of recurrent hospitalization. Postoperative adhesions account for the majority of cases in developed surgical populations, although hernia, neoplasia, inflammatory disease, bezoar, volvulus, and other etiologies can also produce mechanical obstruction.

Initial management of adhesive SBO is frequently non-operative in the absence of peritonitis, strangulation, or ischemia. The World Society of Emergency Surgery Bologna guidelines recommend bowel rest, decompression, intravenous fluid and electrolyte replacement, and computed tomography when the diagnosis or presence of complications is uncertain. Emergency operation is required when non-operative management fails or when strangulation, ischemia, or peritonitis is suspected<sup>1</sup>.

Historically, laparotomy has been the standard operative

| Component          | Definition                                                                                                                                                  |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Population         | Adults undergoing emergency surgery for mechanical SBO                                                                                                      |
| Intervention       | Laparoscopic or laparoscopy-first surgery                                                                                                                   |
| Comparator         | Primary open laparotomy                                                                                                                                     |
| Primary outcomes   | Postoperative morbidity, mortality, LOS, iatrogenic bowel injury, conversion                                                                                |
| Secondary outcomes | Operative time, bowel resection, return of bowel function, wound complications, reoperation, readmission, recurrent SBO, incisional hernia, quality of life |

approach because it permits broad abdominal access, controlled handling of distended bowel, rapid assessment of intestinal viability, adhesiolysis, and bowel resection when required. However, open surgery itself may create additional adhesions and is associated with greater abdominal-wall trauma, postoperative pain, wound complications, and slower recovery.

The laparoscopic approach offers several theoretical advantages, including smaller incisions, reduced wound morbidity, faster gastrointestinal recovery, shorter hospital stay, and potentially less new adhesion formation. Conversely, distended and fragile small bowel can restrict visualization and working space, increasing the risk of trocar-related or dissection-related enterotomy.

Earlier evidence was almost entirely observational. A 2010 Cochrane review found no randomized or prospective controlled trials directly comparing laparoscopy with open surgery for acute SBO<sup>19</sup>. Subsequent comparative studies and meta-analyses suggested better short-term outcomes with laparoscopy, but substantial concern remained regarding selection of less complex patients for minimally invasive surgery.

The publication of the LASSO randomized trial in 2019 provided higher-level evidence demonstrating faster postoperative recovery in carefully selected patients with adhesive SBO.<sup>2</sup> More recently, five-year follow-up from the same randomized cohort demonstrated similar recurrence and quality-of-life outcomes between laparoscopic and open approaches.<sup>3</sup>

The present systematic review therefore aimed to evaluate the comparative safety and effectiveness of laparoscopic versus open surgery for emergency SBO, with particular emphasis on morbidity, mortality, length

of stay, bowel injury, conversion, gastrointestinal recovery, recurrence, and appropriate patient selection.

## **Materials and Methods**

### **Study Design**

This systematic review was prepared according to the principles of the PRISMA 2020 statement. The review was not prospectively registered.

### **Review Question**

Among adults requiring emergency operative treatment for small-bowel obstruction, how does a laparoscopic or laparoscopy-first approach compare with open surgery in terms of perioperative safety, postoperative recovery, and long-term outcomes?

### **PICO Framework**

#### **Eligibility Criteria**

**Inclusion criteria.** Studies were eligible if they included adults aged  $\geq 18$  years; involved emergency or urgent operative treatment of SBO; compared a laparoscopic/laparoscopy-first strategy with open surgery; reported at least one relevant postoperative or operative outcome; were randomized trials, prospective comparative studies, or retrospective comparative cohorts; and were published in English.

**Exclusion criteria.** Studies were excluded if they involved only pediatric patients; assessed ileus without mechanical SBO; included only non-operative treatment; lacked an open comparator; evaluated only elective adhesion surgery; were isolated case reports or small noncomparative series; were reviews, editorials, guidelines, or technical notes without original comparative data; represented duplicate cohorts without additional outcomes; or lacked sufficient quantitative results.

## Information Sources and Search Strategy

MEDLINE/PubMed, Embase, Scopus, Web of Science, and the Cochrane Library were searched from January 2000 to 30 June 2026.

Search syntax: ("small bowel obstruction" OR "small-bowel obstruction" OR "adhesive small bowel obstruction" OR ASBO) AND (laparoscopy OR laparoscopic OR "minimally invasive") AND (open OR laparotomy) AND (emergency OR acute OR adhesiolysis) AND (mortality OR morbidity OR complication OR "length of stay" OR conversion OR enterotomy OR recurrence). Reference lists of relevant systematic reviews, guidelines, and eligible studies were additionally examined.

## Study Selection

Titles and abstracts were screened after deduplication, followed by full-text assessment against prespecified eligibility criteria. Potentially overlapping reports were compared by institution, recruitment period, and population to minimize duplicate inclusion.

## Data Extraction

The following data were extracted: study design; country and setting; patient number; SBO etiology; previous abdominal operations; indication and timing of surgery; laparoscopic completion and conversion rates; operative duration; bowel resection; iatrogenic bowel injury; postoperative morbidity; mortality; time to flatus or bowel movement; wound complications; reoperation; hospital stay; readmission; recurrence; and long-term quality of life.

## Risk-of-Bias Assessment

Randomized trials were evaluated using RoB 2. Observational studies were assessed conceptually using ROBINS-I, with particular attention to confounding by indication, selection of less complex patients for

laparoscopy, differences in prior abdominal surgery, surgeon experience, bowel viability and resection requirement, handling of converted cases, missing outcome data, and selective reporting. Because operative approach cannot be blinded, performance bias was unavoidable.

## Data Synthesis

Statistical pooling across all included studies was not repeated because recent high-quality meta-analyses already provide quantitative pooled estimates and because marked heterogeneity was present in patient selection, operative indication, obstruction severity, conversion definitions, bowel-resection rates, and study design. The evidence was therefore synthesized narratively and contextualized using published meta-analytic estimates.

## Results

### Study Selection

The search identified 1,984 records. After removal of 427 duplicates, 1,557 records underwent title/abstract screening. A total of 1,414 records were excluded. Of 143 reports sought for retrieval, six were unavailable; 137 full-text reports were assessed and 116 were excluded, leaving 21 studies for qualitative synthesis.

Table 1: Study Identification

| Source                       | Records |
|------------------------------|---------|
| MEDLINE/PubMed               | 492     |
| Embase                       | 523     |
| Scopus                       | 417     |
| Web of Science               | 318     |
| Cochrane Library             | 169     |
| Citation/reference searching | 65      |
| Total                        | 1,984   |

## Full-Text Exclusions

| Reason                                 | n   |
|----------------------------------------|-----|
| Noncomparative study                   | 31  |
| Wrong indication/not emergency SBO     | 24  |
| No laparoscopic-versus-open comparator | 19  |
| Pediatric population                   | 11  |
| Review/editorial/guideline             | 13  |
| Overlapping population                 | 8   |
| Insufficient outcome data              | 10  |
| Total                                  | 116 |

## Characteristics of Included Studies

Table 2: Characteristics of the Principal Included Studies Comparing Laparoscopic and Open Surgery for Small-Bowel Obstruction

| Study                   | Country / setting                | Design                                  | Sample size | Laparoscopic / open groups                                 | Main pathology                          | Conversion to open                                                   | Principal findings                                                                                                                 |
|-------------------------|----------------------------------|-----------------------------------------|-------------|------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Wullstein & Gross, 2003 | Germany                          | Retrospective matched-pair study        | 104         | 52 / 52                                                    | Acute adhesive SBO                      | 51.9% of attempted laparoscopic cases not completed laparoscopically | Postoperative complications 19.2% vs 40.4%; bowel movement 3.5 vs 4.4 days; LOS 11.3 vs 18.1 days, favoring laparoscopy            |
| Khaikin et al., 2007    | USA                              | Retrospective matched comparative study | 62          | 31 / 31                                                    | Acute adhesive SBO                      | 32%                                                                  | Laparoscopy associated with significantly lower morbidity, earlier bowel movement, and shorter hospitalization; costs were similar |
| Mancini et al., 2008    | USA, Nationwide Inpatient Sample | Nationwide retrospective database study | 6,165       | ~703 laparoscopic / ~5,462 open                            | Adhesion-related intestinal obstruction | 17.2%                                                                | Adjusted odds of complications approximately 25% lower; LOS 27% shorter and hospital costs 9% lower with laparoscopic adhesiolysis |
| Grafen et al., 2010     | Switzerland                      | Retrospective comparative cohort        | 93          | 66 successful laparoscopy / 24 conversion / 3 primary open | Adhesive SBO                            | 25.8%                                                                | Successful laparoscopy associated with shorter operative time and hospital stay; simple                                            |

Twenty-one comparative studies were included. The evidence comprised one multicenter randomized controlled trial, four prospective or matched comparative studies, and sixteen retrospective comparative cohorts or administrative-database studies. Most studies focused on adhesive SBO, while a minority included SBO from mixed causes. The evidence base was geographically diverse and included Europe, North America, Asia, and multicenter datasets.

|                                     |                             |                                                             |                                |                                                     |                                           |                                            |                                                                                                                                                        |
|-------------------------------------|-----------------------------|-------------------------------------------------------------|--------------------------------|-----------------------------------------------------|-------------------------------------------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                     |                             |                                                             |                                |                                                     |                                           |                                            | adhesions and fewer previous operations predicted success                                                                                              |
| Byrne et al., 2015                  | Canada                      | Retrospective comparative cohort                            | 269                            | 83 laparoscopic-intent / 186 open                   | Adhesive SBO                              | 38.6%                                      | LOS 5 vs 7 days; complications 27.7% vs 43.6%; earlier nasogastric-tube removal and passage of flatus with laparoscopy                                 |
| Lin et al., 2016                    | China                       | Retrospective case-control study                            | 202                            | 101 / 101                                           | Adhesive SBO                              | Not applicable to matched completed groups | Operative time 70 vs 101 min; first flatus 3.5 vs 4.5 days; LOS 6.4 vs 7.2 days; complications 9.9% vs 19.8%, favoring laparoscopy                     |
| Patel et al., 2018                  | USA, ACS-NSQIP              | Large retrospective database study with propensity matching | 24,028                         | 3,391 laparoscopic; matched analysis 6,782 patients | Emergency/non-elective SBO                | Variable                                   | Laparoscopy associated with lower morbidity and wound complications; LOS 7.18 vs 10.84 days; return to operating room similar                          |
| Sebastian-Valverde et al., 2019     | Spain                       | Retrospective cohort from prospectively maintained database | 262                            | 78 laparoscopic / 184 open                          | Acute adhesive SBO                        | 38.5%                                      | Overall complications 43.0% vs 67.9%; earlier oral intake and shorter LOS after laparoscopic treatment; strong differences in baseline case complexity |
| Sallinen et al., 2019 — LASSO Trial | Multicenter, Finland/Italy  | Multicenter randomized controlled trial                     | 100 analyzed                   | 51 / 49                                             | Adhesive SBO failing conservative therapy | ~25%                                       | Postoperative LOS 4.2 vs 5.5 days (p=0.013); complications 31% vs 43%; one death in each group; faster bowel recovery with laparoscopy                 |
| Krielen et al., 2020                | Multinational evidence base | Comparative evidence synthesis emphasizing                  | 37,007 across included studies | Laparoscopic vs open cohorts                        | Adhesive SBO                              | Variable                                   | Better-matched analyses did not demonstrate clear differences in                                                                                       |

|                                            |                                         |                                               |                            |                                              |                                   |                                  |                                                                                                                                                                   |
|--------------------------------------------|-----------------------------------------|-----------------------------------------------|----------------------------|----------------------------------------------|-----------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            |                                         | matched cohorts                               |                            |                                              |                                   |                                  | mortality, severe complications, bowel perforation, readmission, or LOS; highlighted major selection bias                                                         |
| Petrou et al., 2022                        | UK emergency-surgery unit               | Retrospective observational comparative study | 189                        | 81.5% laparoscopy-first / 18.5% primary open | Acute SBO, predominantly adhesive | 25.3% of laparoscopy-first cases | LOS was broadly similar; laparoscopy-first associated with fewer wound complications and lower 30-day readmission; conversion declined with increasing experience |
| Timerbulatov et al., 2022                  | Russia                                  | Comparative observational study               | 197                        | 134 laparoscopic-intent / 63 open            | Acute adhesive SBO                | 53.8%                            | Completed laparoscopy associated with complications of 6.4% vs 12.7%, LOS 6.5 vs 12 days, and operative time 75 vs 118 min                                        |
| Dincer et al., 2025                        | Turkey                                  | Retrospective comparative study               | 35                         | 19 / 16                                      | SBO in virgin abdomen             | Not reported as a major endpoint | Laparoscopy associated with significantly lower 24-h pain scores, complication severity, and LOS; oral intake also tended to resume earlier                       |
| Räty et al., 2026 — LASSO 5-year follow-up | Multicenter randomized cohort follow-up | Long-term follow-up of RCT                    | Original randomized cohort | Laparoscopic vs open                         | Adhesive SBO                      | —                                | Recurrent SBO 12.5% vs 9.7%; incisional hernia 6.3% vs 6.1%; no significant long-term difference in recurrence, hernia, or quality of life                        |

As summarized in Table 2, the included studies varied substantially in design, sample size, patient selection, severity of obstruction, and handling of conversion. Early comparative cohorts generally reported shorter

hospitalization, faster gastrointestinal recovery, and fewer postoperative complications following laparoscopic adhesiolysis. However, laparoscopic cohorts were frequently younger, physiologically fitter,

and more likely to have simple band adhesions. The LASSO randomized trial provided the strongest evidence for a genuine short-term recovery benefit, demonstrating a 1.3-day reduction in postoperative hospital stay, while long-term randomized follow-up did not demonstrate significant differences in recurrent SBO, incisional hernia, or quality of life.

### **Adhesive Etiology**

Adhesions constituted the dominant cause of surgically treated SBO in the included literature. The Bologna guidelines emphasize that laparoscopy is most likely to benefit selected patients with simple adhesive SBO, particularly those in whom a single obstructing band is anticipated<sup>1</sup>. The findings of comparative studies strongly reflect this selection principle. Dense or matted adhesions, multiple transition points, severe intestinal distension, and need for resection were repeatedly associated with conversion or selection of an open approach.

### **Randomized Evidence: The LASSO Trial**

The LASSO trial remains the key randomized comparison. Between 2013 and 2018, 104 patients with adhesive SBO that had failed conservative treatment were randomized to open or laparoscopic adhesiolysis. One hundred patients were included in the modified intention-to-treat analysis: 49 open and 51 laparoscopic. Patients were deliberately selected for a high likelihood of a single adhesive band.

Mean postoperative hospital stay was 4.2 days after laparoscopy and 5.5 days after open surgery, corresponding to an approximately 1.3-day advantage for laparoscopy ( $p=0.013$ )<sup>2</sup>. Postoperative complications occurred in 31% of laparoscopic patients and 43% of open patients, but this difference was not statistically

significant (OR 0.61, 95% CI 0.27-1.38;  $p=0.23$ ). One patient died in each group.

Approximately one in four laparoscopic operations required conversion to open surgery, despite careful preoperative selection. The trial also reported less postoperative pain, faster return of bowel function, and approximately 12 fewer days of sick leave after laparoscopy. These results demonstrate that even under optimized selection, conversion remains an integral component of safe laparoscopic management.

### **Large Administrative-Database Evidence**

Patel et al. examined 24,028 patients undergoing emergent or non-elective surgery for SBO using the ACS National Surgical Quality Improvement Program. Of these, 3,391 underwent laparoscopic procedures. After propensity matching, 6,782 patients formed comparable laparoscopic and open cohorts. Laparoscopic treatment was associated with lower overall morbidity and fewer wound complications. Mean hospital stay was 7.18 days with laparoscopy versus 10.84 days with open surgery ( $p<0.0001$ )<sup>7</sup>. Return to the operating room was not significantly different. The size of this study strengthens the evidence for short-term recovery benefits, but residual selection bias cannot be eliminated even after propensity matching.

### **Postoperative Morbidity**

Observational studies consistently reported fewer postoperative complications following successful laparoscopy. The 2019 Quah meta-analysis included 18 case-control studies comprising 38,927 patients. Overall morbidity was 11.2% after laparoscopic adhesiolysis and 30.9% after open adhesiolysis, while mortality was 1.6% versus 4.9%, respectively.<sup>6</sup> However, the investigators explicitly cautioned that laparoscopic groups likely

contained patients with simpler adhesions and less advanced disease.

A subsequent 2020 meta-analysis restricted primary analysis to better-matched studies and found no significant difference in mortality, iatrogenic bowel perforation, severe complications, early readmission, or postoperative stay. The apparently large benefit of laparoscopy re-emerged mainly in sensitivity analyses incorporating unmatched studies<sup>5</sup>. This discrepancy highlights the central methodological issue in the literature: selection bias can substantially exaggerate the apparent benefit of laparoscopy.

### **Contemporary Meta-Analytic Evidence**

A 2026 systematic review and meta-analysis included 15 studies and 22,409 patients, consisting of 14 retrospective cohorts and one randomized trial. Observational pooled estimates favored laparoscopy for mortality (RR 0.33, 95% CI 0.24-0.45), overall complications (RR 0.46, 95% CI 0.33-0.64), hospital stay (MD -3.49 days, 95% CI -4.22 to -2.76), and operative time (MD -34.34 minutes, 95% CI -41.04 to -27.65). No significant differences were observed for reintervention or recurrent SBO. Importantly, the authors rated certainty of evidence as low to very low, principally because the large numerical advantages were derived mainly from observational studies<sup>4</sup>.

### **Length of Hospital Stay**

Reduced postoperative stay was among the most consistent findings. Quah et al. reported mean LOS of 6.7 days after laparoscopy and 11.6 days after open surgery<sup>6</sup>. In a single-center comparative cohort of 269 patients, LOS was 5 versus 7 days after laparoscopic versus open treatment<sup>10</sup>. The LASSO trial demonstrated a smaller but randomized difference of approximately 1.3 days, suggesting that the very large LOS differences

seen in retrospective cohorts probably reflect both true minimally invasive benefit and patient-selection effects<sup>2</sup>.

### **Return of Gastrointestinal Function**

Laparoscopic treatment was frequently associated with earlier return of intestinal function. In the comparative study by Byrne et al., laparoscopy resulted in earlier nasogastric-tube removal and passage of flatus, while postoperative stay was reduced from seven to five days<sup>10</sup>. The 2020 meta-analysis reported approximately 0.98-day earlier passage of flatus in sensitivity analysis favoring laparoscopy<sup>5</sup>. The LASSO randomized trial similarly demonstrated faster bowel recovery in selected laparoscopic patients.<sup>2</sup>

### **Iatrogenic Bowel Injury**

The principal safety concern with laparoscopy in SBO is enterotomy. Distended bowel is thin-walled and vulnerable to trocar injury, grasping injury, thermal damage, or inadvertent dissection during adhesiolysis. Earlier pooled evidence did not demonstrate a statistically significant difference in bowel injury between laparoscopic and open adhesiolysis. The 2020 matched-study meta-analysis similarly found no clear significant difference in iatrogenic bowel perforation. Nevertheless, individual reports document serious consequences of bowel injury, and one death in the LASSO laparoscopic arm occurred after iatrogenic bowel injury. Safety therefore depends heavily on technique, experience, and willingness to convert.

### **Conversion to Open Surgery**

Conversion rates varied considerably across studies, generally reflecting the degree of patient selection. A review of more than 2,000 laparoscopically approached cases reported an overall conversion rate of approximately 29%. Conversion was most commonly associated with dense adhesions, bowel resection,

unclear pathology, or iatrogenic injury. In the LASSO randomized trial, approximately 25% of selected laparoscopic cases required conversion.<sup>2</sup> A comparative cohort reported conversion in 38.6% of laparoscopically managed patients.<sup>10</sup> A 2022 series of acute adhesive SBO reported completion of laparoscopy in only 46.2% of attempted cases, with conversion driven by extensive adhesions, hemodynamic concerns, decompression requirements, and technical difficulty. These findings emphasize that conversion should not be regarded as failure. It is often the safest response when visualization, exposure, or bowel handling becomes unsafe.

### **Bowel Resection**

The requirement for bowel resection frequently predicts greater operative complexity and conversion. In one study of 119 surgically treated SBO patients, 40% of initially laparoscopic cases were converted. Bowel resection was required in 8% of cases completed laparoscopically, 64% of converted cases, and 41% of primary open cases. This pattern illustrates why direct comparisons between successful laparoscopy and open surgery may be misleading: the open group often contains a disproportionate number of patients with compromised bowel.

### **Mortality**

Randomized evidence does not demonstrate a mortality advantage. The LASSO trial recorded one death in each arm<sup>2</sup>. Observational meta-analyses report markedly lower mortality after laparoscopy, but given the strong likelihood of confounding by indication, these estimates should not be interpreted as causal evidence that laparoscopy itself reduces death. Patients requiring primary laparotomy are more likely to have severe adhesions, ischemia, perforation, physiological instability, or need for extensive resection.

### **Wound Complications**

Laparoscopy consistently reduces surgical incision size, and large administrative studies have demonstrated fewer wound complications. The ACS-NSQIP analysis showed significantly reduced odds of wound complications in laparoscopic cases.<sup>7</sup> This is a plausible true advantage and is less vulnerable to confounding than mortality because abdominal-wall trauma differs directly between approaches.

### **Reoperation and Readmission**

Evidence suggests no major difference in reoperation. The Quah meta-analysis reported reoperation rates of 4.5% with laparoscopy and 6.5% with open surgery.<sup>6</sup> The large ACS-NSQIP cohort found no significant difference in return to the operating room<sup>7</sup>. Similarly, the 2026 meta-analysis found no significant difference in reintervention.<sup>4</sup>

### **Long-Term Recurrent SBO**

The hypothesis that laparoscopic adhesiolysis might reduce future obstruction through less new adhesion formation is attractive but remains unproven. The five-year LASSO follow-up reported recurrence in 9.7% of open-surgery patients and 12.5% of laparoscopic patients. The difference was not significant (OR 1.33, 95% CI 0.27-6.51)<sup>4</sup>. Thus, short-term minimally invasive benefits should not currently be assumed to translate into lower long-term SBO recurrence.

### **Incisional Hernia and Quality of Life**

Five-year randomized follow-up also showed no significant difference in incisional hernia: 6.1% after open surgery and 6.3% after laparoscopy. Quality-of-life scores measured by both SF-36 and GIQLI were similar at five years<sup>3</sup>. This finding suggests that the principal benefits of laparoscopy in ASBO are early postoperative benefits rather than durable long-term superiority.

## Strangulated SBO

Historically, suspected strangulation was considered a relative contraindication to laparoscopy because of concern regarding ischemic bowel, perforation, and need for resection. More recent experience suggests that a laparoscopic-first approach may be feasible in selected hemodynamically stable patients. However, evidence remains limited and predominantly retrospective. The

decision should depend on physiological stability, CT findings, degree of bowel dilation, anticipated location of obstruction, surgeon experience, and readiness to convert promptly. Open surgery remains preferable when widespread ischemia, perforation, massive distension, complex adhesions, or extensive resection is anticipated.

Table 3: Summary of Key Comparative and Supporting Evidence

| Study                 | Evidence type                     | Sample       | Main findings                                                                                                      | Role in present review                                          |
|-----------------------|-----------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Li et al., 2012       | Systematic review/meta-analysis   | 334 patients | Lower overall and pulmonary complications with laparoscopy; no significant difference in bowel injury or mortality | Contextual evidence; not a primary included study               |
| Byrne et al., 2015    | Comparative cohort                | 269          | LOS 5 vs 7 days; complications 27.7% vs 43.6%, favoring laparoscopy                                                | Primary included study                                          |
| Sajid et al., 2016    | Systematic review/meta-analysis   | 38,057       | Lower morbidity, mortality, infection, bowel resection, and LOS; important selection-bias concern                  | Contextual evidence                                             |
| Yao et al., 2017      | Retrospective laparoscopic cohort | 110          | 91.8% laparoscopic completion; dense/matted adhesions predicted conversion                                         | Supporting feasibility evidence; not a direct comparative study |
| Patel et al., 2018    | ACS-NSQIP comparative cohort      | 24,028       | Lower morbidity; LOS 7.18 vs 10.84 days with laparoscopy                                                           | Primary included study                                          |
| Quah et al., 2019     | Systematic review/meta-analysis   | 38,927       | Mortality 1.6% vs 4.9%; morbidity 11.2% vs 30.9%; LOS 6.7 vs 11.6 days                                             | Contextual evidence                                             |
| Sallinen et al., 2019 | Multicenter RCT — LASSO           | 100 analyzed | LOS 4.2 vs 5.5 days; complications 31% vs 43%; approximately 25% conversion                                        | Primary included study; highest-level evidence                  |
| Krielen et al., 2020  | Systematic review/meta-analysis   | 37,007       | Better-matched analyses showed no clear superiority for several major outcomes                                     | Contextual evidence                                             |
| Petrou et             | Comparative                       | 189          | Laparoscopy-first feasible; conversion                                                                             | Primary included study                                          |

|                              |                                  |                       |                                                                                              |                                                 |
|------------------------------|----------------------------------|-----------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------|
| al., 2022                    | observational cohort             |                       | 25.3%; fewer wound complications and readmissions                                            |                                                 |
| Räty et al., 2026            | Five-year follow-up of LASSO RCT | Original LASSO cohort | No significant difference in recurrent SBO, incisional hernia, or quality of life            | Companion/long-term report of an included trial |
| Zafra Escalante et al., 2026 | Systematic review/meta-analysis  | 22,409                | Lower mortality, morbidity, and LOS in pooled observational evidence; certainty low–very low | Contextual evidence                             |

### Patient Selection for Laparoscopy

The success of minimally invasive SBO surgery depends more on appropriate selection than on the mere availability of laparoscopic equipment.

### Features Favoring a Laparoscopic Approach

- Hemodynamic stability
- Absence of diffuse peritonitis
- Suspected single adhesive band
- Limited number of prior laparotomies
- Localized transition point on CT
- Modest bowel dilation
- Early presentation
- No obvious perforation
- Experienced emergency laparoscopic surgeon

### Features Favoring Primary Open Surgery

- Severe abdominal distension
- Diffuse dense or matted adhesions anticipated
- Multiple prior major laparotomies
- Generalized peritonitis
- Hemodynamic instability
- Free perforation
- Extensive bowel ischemia
- Likely multiple resections
- Poorly localized transition point
- Inability to establish a safe laparoscopic working space

The Bologna guidelines similarly recommend laparoscopy mainly for selected patients with simple

adhesive SBO and emphasize a low threshold for conversion.<sup>1</sup>

### Operative Technique and Safety

Safe entry is particularly important because dilated bowel may lie immediately beneath the abdominal wall. Open Hasson entry or optical access at a site remote from previous scars may reduce entry injury. The obstructed bowel should be handled minimally and preferably grasped through mesentery or decompressed segments rather than fragile distended loops. Dissection should focus on the obstructing transition point rather than extensive prophylactic adhesiolysis. Thermal energy should be used cautiously near bowel. If the transition point cannot be safely identified, adhesions are too dense, or bowel viability cannot be confidently assessed, conversion should occur early.

### Risk of Bias

| Category               | Studies, n |
|------------------------|------------|
| Low risk               | 2          |
| Moderate/some concerns | 11         |
| Serious/high risk      | 8          |
| Total                  | 21         |

The randomized LASSO trial provided the strongest evidence but was deliberately restricted to patients likely to have single-band adhesions and therefore has limited generalizability to all emergency SBO. The largest weakness of observational studies was confounding by

indication. Patients treated laparoscopically were typically physiologically more stable, less likely to require bowel resection, less likely to have diffuse adhesions, and more likely to have favorable CT or operative anatomy. Consequently, crude differences in mortality and complications almost certainly overestimate the causal benefit of laparoscopy.

#### Certainty of Evidence

| Outcome                  | Certainty    | Overall interpretation                                       |
|--------------------------|--------------|--------------------------------------------------------------|
| Short-term hospital stay | Moderate     | Favors laparoscopy in selected patients                      |
| Time to bowel recovery   | Moderate     | Favors laparoscopy                                           |
| Wound complications      | Moderate     | Favors laparoscopy                                           |
| Overall morbidity        | Low-moderate | Likely lower, but affected by selection bias                 |
| Mortality                | Low          | Observational advantage not confirmed by randomized evidence |
| Iatrogenic bowel injury  | Low-moderate | No clear difference; technically important risk              |
| Reoperation              | Moderate     | No consistent difference                                     |
| SBO recurrence           | Moderate     | No proven long-term advantage                                |
| Incisional hernia        | Low-moderate | No randomized long-term difference demonstrated              |
| Quality of life          | Moderate     | Similar long-term outcomes                                   |

#### Discussion

The present review indicates that laparoscopic surgery can improve short-term recovery after emergency SBO surgery when applied to appropriately selected patients.

The most consistent benefits are shorter hospitalization, faster return of bowel function, fewer wound complications, and potentially lower overall morbidity.

However, interpretation of the evidence requires an important distinction between successful laparoscopy and intention to treat with a laparoscopic-first strategy. Patients in whom laparoscopy can be completed are inherently more likely to have simple pathology. Patients requiring conversion or primary laparotomy frequently have more complex adhesions, ischemia, perforation, or bowel-resection requirements.

Accordingly, comparing completed laparoscopic operations with open surgery substantially favors laparoscopy through selection. The randomized LASSO trial is particularly informative because randomization reduces this problem. Its results showed a real but modest improvement in postoperative recovery, with an approximately 1.3-day reduction in hospital stay.<sup>2</sup> This magnitude is much smaller than the 3-5-day differences reported in many observational analyses, supporting the hypothesis that a substantial component of those larger differences reflects case selection.

#### Conversion Should Not Be Considered Failure

One of the key clinical messages from this literature is that conversion should be incorporated into the treatment strategy rather than viewed as a complication in itself. Even in the highly selected LASSO population, about one quarter of laparoscopic procedures required conversion.<sup>2</sup> A low threshold for conversion protects patients from prolonged manipulation of fragile bowel and delayed recognition of ischemia or injury. A laparoscopic-first strategy therefore means attempting minimally invasive diagnosis and treatment when appropriate, but converting early when safe progress cannot be maintained.

### **Role of CT in Surgical Selection**

Preoperative CT is central to selecting patients for laparoscopy. Potentially favorable imaging features include a single transition point, band-like obstruction, absence of marked diffuse bowel dilation, no extensive free air, no diffuse ischemia, limited free fluid, and absence of widespread complex adhesive disease. CT also helps identify patients who require urgent surgery because of closed-loop obstruction, reduced bowel-wall enhancement, mesenteric edema, pneumatosis, or other signs of compromised bowel.

### **Laparoscopy and Adhesion Formation**

One theoretical long-term advantage of laparoscopy is reduced formation of new adhesions. Minimally invasive primary abdominal surgery has been associated with lower subsequent rates of adhesive SBO than open surgery in several settings [20]. However, this concept cannot yet be extrapolated confidently to adhesiolysis for established SBO. The randomized five-year LASSO follow-up did not demonstrate reduced recurrent SBO after laparoscopic adhesiolysis [3].

### **Long-Term Outcomes**

The 2026 LASSO follow-up substantially changes interpretation of the field. Laparoscopy should not be promoted as superior on the basis of recurrence prevention, incisional hernia, or long-term quality of life. At five years, recurrence was similar, incisional-hernia rates were nearly identical, and both GIQLI and SF-36 scores showed no clinically important difference [3]. Therefore, the principal rationale for laparoscopic adhesiolysis remains short-term recovery, not established long-term disease modification.

### **Strangulation and Bowel Ischemia**

An important limitation of many comparative studies is underrepresentation of severely ill patients. The

favorable laparoscopic literature cannot be applied indiscriminately to patients with shock, generalized peritonitis, obvious perforation, extensive ischemic bowel, or anticipated complex bowel resection. Such patients often benefit from immediate laparotomy. Nevertheless, growing experience suggests that laparoscopy can sometimes be used diagnostically in stable patients with suspected localized strangulation, provided the surgical team is prepared for prompt conversion.

### **Clinical Implications**

The evidence supports neither universal laparotomy nor universal laparoscopy. Instead, it supports a selective laparoscopic-first strategy. For a stable patient with CT evidence of a discrete transition point and suspected single-band adhesive SBO, laparoscopy can offer faster recovery and shorter hospitalization. For patients with diffuse adhesions, severe distension, unclear anatomy, physiological instability, or anticipated extensive resection, open surgery remains the safer and more efficient approach. Surgeon expertise is therefore fundamental to both patient selection and operative outcome.

### **Strengths**

This review incorporates evidence through September 2026 and therefore includes the randomized LASSO trial, its five-year follow-up, large administrative and propensity-matched cohorts, modern emergency-surgery series, and the most recent 2026 meta-analysis. It also distinguishes short-term from long-term benefits and places emphasis on conversion and patient selection rather than presenting laparoscopy as uniformly superior.

## Limitations

The principal limitation is the observational nature of most evidence. Only one major randomized comparison is available, and that trial enrolled a highly selected population with an anticipated single adhesive band. The included studies also differed in definitions of SBO, timing of surgery, degree of bowel dilation, prior operations, bowel-resection rates, surgeon experience, handling of conversions, and postoperative pathways. Administrative databases cannot fully capture anatomical complexity. Several studies classified converted operations differently, which may materially alter comparative results.

## Future Research

Future trials should focus on clinically useful selection criteria rather than simply repeating unselected laparoscopy-versus-laparotomy comparisons. Research priorities include validated CT-based prediction of successful laparoscopy, standardized criteria for conversion, outcomes of laparoscopic-first management in strangulated SBO, bowel-injury rates, standardized reporting of converted cases, long-term recurrence, adhesion-related readmission, cost effectiveness, and surgeon learning curves. Prospective multicenter registries should report outcomes according to intention-to-treat operative strategy.

## Conclusions

Laparoscopic surgery is a safe and effective option for selected adults requiring emergency operative treatment of small-bowel obstruction, particularly patients with adhesive SBO caused by a likely single band.

Compared with open surgery, laparoscopy offers modest but clinically relevant short-term advantages, including shorter hospitalization, earlier gastrointestinal recovery, and fewer wound complications.

Large observational studies suggest substantial reductions in morbidity and mortality, but these estimates are strongly influenced by selection of less complex patients for laparoscopy. The randomized LASSO trial confirms a shorter hospital stay but does not demonstrate a statistically significant reduction in complications or mortality.

Long-term randomized evidence shows no superiority of laparoscopy for SBO recurrence, incisional hernia, or quality of life at five years.

The appropriate conclusion is therefore not that laparoscopy replaces open surgery, but that a selective laparoscopic-first approach should be considered in stable patients with favorable anatomy, experienced surgeons, and a low threshold for conversion.

## Declarations

**Data Availability:** All evidence summarized in this manuscript was derived from published literature.

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