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Systematic review

Predictors of Failure of Non-Operative Management in Adults with Adhesive Small Bowel Obstruction; A systematic review

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Abstract

Background: Adhesive small bowel obstruction (ASBO) is a frequent emergency after abdominal surgery. Non-operative management (NOM) resolves many uncomplicated episodes, whereas delayed recognition of failure exposes patients to prolonged obstruction, bowel ischemia, resection, and greater resource use. In this systematic review we analyzed patient, clinical, laboratory, imaging, and early-response predictors of NOM failure in adults with ASBO. **Methods:** A PRISMA-aligned search framework covered PubMed, Scopus, Web of Science Core Collection, and the Cochrane Library through August 2026. Eligible studies enrolled adults with adhesive or postoperative SBO who received initial conservative treatment and reported subsequent operative intervention or another explicit

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definition of failure. Predictors were analyzed qualitatively because protocols, thresholds, and statistical models differed. **Results:** We include sixteen original studies published from 2008 to 2026. Repeated imaging predictors included absent small-bowel feces sign, mesenteric haziness or fluid, free intraperitoneal fluid, high-grade or complete obstruction, transition-point or beak-related signs, and greater bowel dilatation. Older age, guarding, fever, comorbidity burden, prior open operations, elevated lactate, C-reactive protein, creatine phosphokinase, and neutrophil-based indices were significant in selected cohorts. Previous successfully treated ASBO episodes were protective in some datasets. Failure of water-soluble contrast progression and persistent high decompression output provided dynamic information. **Conclusion:** NOM failure is best anticipated through combined clinical and CT assessment supplemented by laboratory and early-response data rather than reliance on a single admission variable.

Keywords: adhesive small bowel obstruction; non-operative management; conservative treatment; treatment failure; computed tomography

Introduction

Adhesive small bowel obstruction (ASBO) is a major postoperative surgical emergency, and international guidance supports an initial non-operative strategy for stable patients without peritonitis, strangulation, or intestinal ischemia (1). A large systematic review of abdominal and pelvic surgery estimated a 2% incidence of ASBO after surgery and found adhesions responsible for 56% of small-bowel obstructions with an established cause (2). SBO produces a spectrum ranging from self-limited mechanical obstruction to closed-loop compromise, ischemia, perforation, sepsis, and death, making accurate early triage central to emergency surgical care (3). Contemporary management separates uncomplicated adhesive obstruction, where bowel rest and decompression achieve resolution (4).

Initial NOM combines nil per os, nasogastric or long-tube decompression when indicated, intravenous fluid and electrolyte replacement, serial examination, and cross-sectional imaging (1,4). Water-soluble contrast protocols add a dynamic test of intestinal transit, and the Cochrane evidence base established colonic contrast progression as a

strong marker of spontaneous resolution (5). A later meta-analysis reported 92% sensitivity and 93% specificity for water-soluble contrast in predicting non-operative resolution (6). Operative treatment reduces subsequent recurrence in selected populations, whereas surgery introduces perioperative morbidity and adhesion-related consequences (7).

The principal clinical difficulty is not identifying obvious ischemia, since those patients leave the NOM pathway early; it is recognizing apparently uncomplicated ASBO that is unlikely to resolve before deterioration or prolonged delay occurs (1,3). A systematic review in broader SBO populations found strong associations between surgery and peritoneal free fluid, high-grade obstruction, mesenteric inflammation, abdominal distension, and peritonism, with odds ratios ranging from 2.43 to 3.97. That evidence included heterogeneous SBO etiologies and studies of operative need rather than failure after a defined conservative trial, limiting direct application to adhesive disease alone (8). Adhesive-specific failure prediction therefore requires synthesis of studies in which conservative management was actually initiated and its outcome was observed (1,8).

This review aimed to identify and organize patient-related, previous-surgery, clinical, laboratory, radiographic, CT, and early-treatment-response predictors associated with failure of NOM in adults with ASBO. A secondary objective was to compare isolated predictors with multivariable scores and externally validated models, emphasizing findings reproduced across independent cohorts.

Methods

Design and reporting

This systematic-review manuscript was structured according to PRISMA 2020 principles for identification, screening, eligibility assessment, transparent study selection, and narrative synthesis. The review question was framed around adults with adhesive or postoperative SBO who entered an initial conservative-treatment pathway, candidate prognostic factors measured before or during that pathway, and failure of NOM as the outcome.

Information sources and search strategy

PubMed, Scopus, Web of Science Core Collection, and the Cochrane Library were specified from database inception through August 2026. The core search combined terms for “small bowel obstruction” or “SBO,” “adhesion” or “adhesive” or “postoperative,” “non-operative” or “conservative” or “medical management” or “Gastrografin” or “water-soluble contrast,” and “failure” or “predictor” or “operation” or “surgery” or “resolution.” Controlled vocabulary was combined with free-text terms in PubMed, while title, abstract, and keyword fields were adapted for Scopus and Web of Science.

Eligibility criteria

Studies were eligible when they enrolled adults aged 18 years or older with ASBO, postoperative adhesive SBO, or an adhesive subgroup reported separately; initiated NOM in the analyzed population; and evaluated at least one predictor in relation to subsequent conservative-treatment failure. Failure was defined primarily as operative intervention after an initial conservative trial during the index admission, or within a prespecified short follow-up interval when explicitly reported. Cohort studies, prospective observational studies, randomized trials with prognostic analyses, and model-development or validation studies were eligible. Studies were excluded for pediatric-only populations, non-adhesive obstruction without separable data, malignancy, hernia, inflammatory stricture, immediate-surgery cohorts without an initial NOM subgroup, case reports, narrative reviews, and reports lacking an interpretable management outcome.

Study selection, extraction, and appraisal

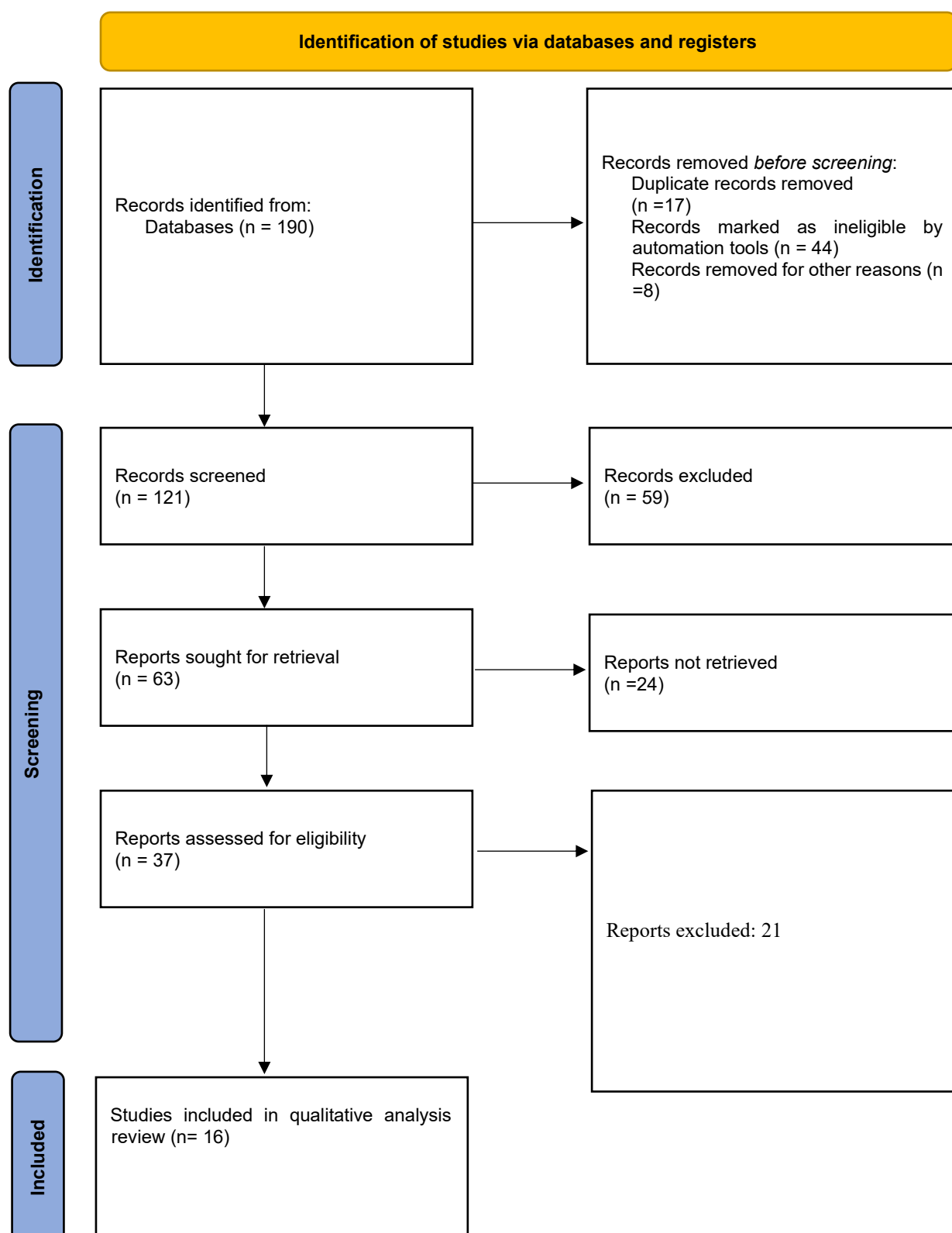
Titles and abstracts were assessed against the prespecified criteria, followed by full-text eligibility assessment; ambiguous reports were rechecked before inclusion. Extracted variables comprised author, year, design, sample size, NOM protocol, failure definition, failure frequency, candidate predictors, adjusted effect estimates, discrimination statistics, and validation status. Prognostic-factor studies were appraised across domains represented in QUIPS, prediction models across PROBAST domains, and the randomized contrast study across standard randomized-trial bias domains.

For multivariable studies, adjusted odds ratios, confidence intervals, and model performance were prioritized over unadjusted associations. When studies reported success rather than failure, associations were interpreted in the inverse direction without recalculating unpublished effect estimates.

Synthesis

Quantitative pooling was not performed because predictor definitions, imaging terminology, timing of measurement, NOM protocols, thresholds, and model structures were clinically heterogeneous. Findings were grouped into patient, clinical examination, laboratory, CT or radiographic, and dynamic-response domains, and consistency across independent cohorts was emphasized.

Fig 1: PRISMA flow chart



Results

In a 53 adults treated with long-tube decompression, complete obstruction without colonic air and creatine phosphokinase levels of at least 130 IU/L were associated with treatment failure, and 14 patients ultimately underwent laparotomy (9). In a prospective cohort of 128 patients initially managed conservatively, 37 subsequently required surgery; high-grade obstruction, the presence of a transition zone, and an abnormal mesenteric vascular course were identified as predictors of operative intervention, with abnormal vascular course producing a risk estimate of 7.1 (10). A predictive model derived from 154 patients and validated in an additional 96 incorporated age of at least 65 years, ascites, and gastrointestinal drainage exceeding 500 mL on day 3, while the low-risk category in the validation cohort achieved a 100% negative predictive value for surgery (11).

Among 159 patients receiving conservative management, 46 experienced treatment failure, with multiple beak signs, whirl or C/U-loop morphology, and high-grade obstruction associated with failure, whereas fewer than two beak signs and anterior parietal adhesion independently favored successful non-operative management (12). In 235 Gastrografin-treated episodes, conservative management was successful in 84.2%, while 15.8% required surgery; age above 65 years, at least two previous laparotomies, and previous surgery for ASBO were associated with poor response to treatment (13). Among 187 episodes of ASBO following colorectal surgery, 16 conservative-treatment failures were recorded, and age above 75 years emerged as the only independent patient-related predictor, while the water-soluble contrast

protocol demonstrated 99% specificity and 98% negative predictive value for identifying cases unlikely to require surgery (14). In a randomized study involving 52 patients, having undergone more than one previous laparotomy was the only factor independently associated with failure of conservative management in multivariable analysis (15).

In a 189 patients with non-strangulated ASBO, 45 experienced failure of conservative management, and absence of the small-bowel feces sign, mesenteric haziness, and moderate mesenteric fluid were independently associated with failure, with odds ratios ranging from 4.89 to 13.55 (16). A prediction score derived from 171 patients incorporated a Charlson Comorbidity Index of at least 4, distal obstruction, and a bowel-to-abdominal-diameter ratio above 0.34, with higher scores remaining associated with substantial operative risk during prospective validation (17). In a multicenter cohort of 218 patients initially treated non-operatively across 15 centers, 56 experienced treatment failure; an Angers CT score of at least 5 was associated with failure, whereas a previous episode of ASBO was associated with a greater likelihood of successful conservative treatment (18).

Among 360 patients analyzed after exclusion of those undergoing surgery within the first 24 hours, absence of the small-bowel feces sign was associated with increased odds of operative intervention, and each additional day before surgery was associated with a 20% increase in the odds of bowel resection (19). In another cohort of 106 patients, 47 experienced failure of conservative treatment, with the fat-notch sign and beak sign

identified as independent CT predictors of failure (20). A prospectively developed and externally validated NOFA model incorporated the neutrophil–leukocyte ratio, number of previous SBO episodes, guarding, mesenteric changes with free fluid, closed-loop obstruction, and the feces sign; external validation demonstrated an AUROC of 0.751 with stable calibration (21).

The presence of a transition point, higher serum lactate, and previous open abdominal surgery were independently associated with failure of medical treatment, whereas multiple previous ASBO episodes successfully managed non-operatively were associated with treatment success (22). In a cohort of 510 adults, including 54 cases of conservative-management failure, older age, higher C-reactive protein levels, fever, and greater maximum bowel diameter were identified as independent risk factors for failure (23). Among 336 patients with postoperative ASBO, conservative

management was successful in 63.4%, while vomiting, abdominal distension, guarding or rebound tenderness, a longer interval since previous surgery, a gasless colon, and larger air-fluid levels were negatively associated with successful conservative treatment (24).

CT variables formed the most reproducible domain, especially obstruction severity, transition or beak morphology, mesenteric inflammatory change or fluid, bowel dilatation, and absence of the feces sign (10,12,16-24). Surgical history had heterogeneous direction: multiple laparotomies or open surgery increased failure in several cohorts, while previous ASBO episodes that had resolved medically favored success in others (13,15,18,22). Laboratory predictors were study-specific—CPK, lactate, CRP, and neutrophil-based measures—whereas dynamic response through tube output or contrast transit directly reflected whether obstruction was resolving after treatment began (9,11,13-15,21-23).

Table 1. Characteristics and main findings of the included original studies

Study	Design and analyzed cohort	NOM outcome	Main predictors of failure or surgery
Tanaka et al., 2008 (9)	Retrospective; n=53; long-tube decompression	14 surgery; 39 success	Complete SBO/no colonic air; CPK $\geq$ 130 IU/L
Hwang et al., 2009 (10)	Prospective; n=128; all initially conservative	37 surgery	High-grade SBO; transition zone; abnormal mesenteric vascular course
Komatsu et al., 2010 (11)	Derivation n=154; validation n=96	Risk model for operation	Age $\geq$ 65; ascites; drainage >500 mL on day 3
Millet et al., 2014 (12)	Retrospective CT study; n=159	46 failure; 113 success	$\geq$ 2 beak signs, whirl/C-U loop, high-grade obstruction; anterior parietal adhesion favored success

Study	Design and analyzed cohort	NOM outcome	Main predictors of failure or surgery
Bueno-Lledó et al., 2016 (13)	Prospectively collected Gastrografin cohort; 235 episodes	84.2% success; 15.8% surgery as reported	Age >65; ≥2 laparotomies; previous operation for ASBO
Miquel et al., 2017 (14)	Post-colorectal ASBO; 187 episodes	16 failure; 171 success	Age >75; absent colonic contrast at 24 h strongly marked complete obstruction
Khorshidi et al., 2019 (15)	Randomized; n=52	Success 80.8% Gastrografin vs 50% saline	>1 previous laparotomy
Kim et al., 2021 (16)	Retrospective CT study; n=189	45 failure; 144 success	Absent feces sign; mesenteric haziness; moderate mesenteric fluid
Maraux et al., 2022 (17)	Retrospective derivation n=171 plus prospective validation	98/171 derivation success	Charlson ≥4; distal obstruction; bowel/abdominal diameter ratio >0.34
Paisant et al., 2023 (18)	Prospective, 15 centers; n=218 initial NOM	56 failure; 162 success	Angers CT score ≥5; previous ASBO episode protective
van Veen et al., 2023 (19)	Retrospective; n=360 after excluding surgery <24 h	44.4% operative conversion	Absent feces sign; delay increased resection odds
Desiato et al., 2025 (20)	Retrospective; n=106	47 failure; 59 success	Fat-notch sign; beak sign
Räty et al., 2025 (21)	Prospective multicentre development/external validation	NOFA model derived and externally validated	NLR, prior SBOs, guarding, mesenteric change/free fluid, closed loop, feces sign
Bertona et al., 2026 (22)	Retrospective; n=225	100 failure; 125 success	Transition point, lactate, previous open surgery; prior successful ASBO episodes protective
Shen et al., 2026 (23)	Retrospective; n=510	54 failure; 456 success	Age, CRP, fever, maximum dilated bowel diameter
Fikre et al., 2026 (24)	Retrospective multicentre cross-sectional; n=336	63.4% success	Vomiting, distension, guarding/rebound, longer postsurgical interval, gasless colon, air-fluid levels

Table 2. Predictor domains and consistency of evidence

Predictor domain	Findings associated with NOM failure
Obstruction severity	Complete/high-grade obstruction (9,10,12); larger bowel diameter or diameter ratio (17,23)
Transition-zone morphology	Transition zone/point (10,22); multiple beak signs (12); beak and fat-notch signs (20)
Mesentery/peritoneal cavity	Ascites (11); mesenteric haziness/fluid (16); composite mesenteric change/free fluid (21)
Small-bowel feces sign	Absence associated with failure (16,19,21)
Prior surgery/ASBO history	Multiple laparotomies/open surgery increased risk (13,15,22); previous successfully treated ASBO episodes favored success (18,22)
Clinical examination	Guarding (21,24), fever (23), distension/vomiting (24), comorbidity burden (17)
Laboratory markers	CPK (9), NLR (21), lactate (22), CRP (23)
Early treatment response	Drainage >500 mL on day 3 (11); absent/delayed colonic contrast progression (13,14)

Discussion

The main finding is that failure of NOM in adhesive SBO is most associated with the morphology and physiologic severity of obstruction on imaging rather than with routine symptoms or admission laboratory testing alone. High-grade or complete obstruction, mesenteric inflammatory change or fluid, transition or beak morphology, greater bowel dilatation, and absence of the small-bowel feces sign recur across independent cohorts and multivariable models. This pattern agrees with the broader SBO meta-analysis by Eze et al., where peritoneal free fluid, high-grade obstruction, and mesenteric inflammation were strongly associated with surgery, with pooled odds ratios of 3.24, 3.58, and 2.61 (8). The adhesive-only evidence adds specificity by showing that transition morphology and absent feces sign remain informative in cohorts explicitly entering conservative treatment.

Dynamic assessment is important because ASBO evolves after admission and the initial CT captures one time point (1,5,6). The Cochrane review identified colonic passage of water-soluble contrast as a strong marker of conservative resolution, and the later meta-analysis reported 92% sensitivity and 93% specificity for this outcome (5,6). The Gastrografin cohorts reinforce this relationship, particularly the 99% specificity and 98% negative predictive value reported by Miquel et al. for their protocol after colorectal surgery (13,14). Persistent gastrointestinal drainage above 500 mL on day 3 in the Komatsu model offers a parallel physiologic signal of unresolved obstruction despite decompression (11).

Patient-level predictors were less consistent, age and surgical history (11,13-15,18,22-24). Older age entered several models, including Komatsu, Bueno-

Lledó, Miquel, and Shen, while Charlson comorbidity burden also contributed to the Maraux score (11,13,14,17,23). Surgical history showed two distinct directions: multiple laparotomies or prior open surgery increased failure risk, whereas repeated previous ASBO episodes successfully treated without surgery predicted current success in Paisant and Bertona (13,15,18,22). This distinction suggests that operative adhesion burden and previous obstruction phenotype represent different prognostic constructs (13,15,18,22).

Laboratory markers add context rather than a stable stand-alone rule (9,21-23). CPK was significant in Tanaka, lactate in Bertona, CRP and fever in Shen, and the neutrophil-leukocyte ratio contributed to the externally validated NOFA model (9,21-23). Multivariable approaches therefore provide a stronger framework by integrating independent dimensions of obstruction severity, host response, and history (17,18,21). NOFA has a methodological advantage because external validation preserved an AUROC of 0.751 with stable calibration, whereas many earlier scores were derived in single centers or had limited validation (17,18,21).

Clinical use requires balancing timely surgery against unnecessary adhesiolysis (1,7). Bologna guidance supports NOM for uncomplicated ASBO and regards approximately 72 hours as a generally safe trial in stable patients under serial assessment for peritonitis, strangulation, ischemia, or deterioration (1). The evidence supports risk-adjusted observation within that period, with earlier senior surgical reassessment when several adverse CT features, persistent decompression output, absent contrast progression, rising inflammatory or perfusion markers, or worsening examination findings cluster together (21-24). Van Veen et al.

reported 20% higher odds of bowel resection for each additional day before surgery among patients ultimately operated on, emphasizing the consequences of prolonged observation after spontaneous resolution becomes unlikely (19).

The included studies remains limited by predominantly retrospective single-center designs, variable definitions of failure, heterogeneous conservative protocols, inconsistent imaging terminology, and limited external validation. Prospective multicentre evidence is concentrated in the Angers and NOFA investigations, while the randomized Gastrografin study was small. These differences prevent a defensible adhesive-specific pooled effect for many predictors, consistent with heterogeneity documented in the wider SBO prognostic literature. Despite these constraints, convergence across CT findings, contrast transit, serial response, and newer validated models supports a coherent multidomain framework for adults entering NOM.

Conclusion

Failure of non-operative management in adult ASBO is associated most consistently with CT evidence of severe or persistent mechanical obstruction, especially high-grade obstruction, transition or beak morphology, mesenteric inflammatory change or fluid, bowel dilatation, and absence of the small-bowel feces sign. Older age, guarding, fever, comorbidity, prior open operations, lactate, CRP, and neutrophil-based indices provide additional context. Early response to decompression and water-soluble contrast progression adds time-dependent prognostic information. No single predictor adequately defines failure across

populations. A combined clinical, laboratory, imaging, and dynamic-response approach offers the most defensible basis for risk stratification and timely operative reassessment.

List of Abbreviations

- ASBO, Adhesive small bowel obstruction
- AUROC, Area under the receiver operating characteristic curve
- CI, Confidence interval
- CPK, Creatine phosphokinase
- CRP, C-reactive protein
- CT, Computed tomography
- NLR, Neutrophil–leukocyte ratio
- NOM, Non-operative management
- NOFA, Non-operative failure model
- NPV, Negative predictive value
- OR, Odds ratio
- PPV, Positive predictive value
- PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses
- PROBAST, Prediction model Risk Of Bias ASsessment Tool
- QUIPS, Quality In Prognosis Studies
- SBO, Small bowel obstruction
- WSC, Water-soluble contrast

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