RESEARCH PAPER

Predictive Factors for Failure of Non-Operative Management in Patients with Adhesive Small Bowel Obstruction at Dr. Soetomo General Hospital

Niko Kristianto[1]*, Edwin Danardono[2], and Denny Septarendra[2]

[1]Departement of Surgery, Faculty of Medicine, Airlangga University / dr. Soetomo Hospital, Surabaya, Indonesia
[2]Division of Digestive Surgery, Departement of surgery, Faculty of Medicine, Airlangga University / dr. Soetomo Hospital, Surabaya, Indonesia

ABSTRACT

Background: Adhesive small bowel obstruction (ASBO) remains a common surgical emergency. Although non-operative management (NOM) is recommended in uncomplicated cases, delayed recognition of intestinal ischemia may increase morbidity. Practical predictors of NOM failure are needed to guide timely surgical decision-making.

Objective: To evaluate the association between age, comorbid diabetes mellitus (DM), and infection markers (body temperature, white blood cell count, and C-reactive protein) with NOM failure in ASBO patients at RSUD Dr. Soetomo.

Methods: A retrospective cohort study was conducted using medical records of ASBO patients treated with NOM in the Department of Surgery, RSUD Dr. Soetomo, Surabaya, from January to December 2024. Variables included age (<60 vs ≥60 years), comorbid DM, body temperature after initial stabilization, WBC, CRP, and NOM outcome (successful vs failed). Group comparisons were performed using Chi-square and Mann–Whitney tests. Receiver operating characteristic (ROC) analysis was used to determine optimal cut-off values for significant continuous variables.

Results: Forty-eight patients were included (56.3% female), with 75.0% aged <60 years. NOM failed in 22 patients (45.8%). Higher body temperature was significantly associated with NOM failure (p=0.022), with an ROC-derived cut-off >37.3°C (AUC 0.693; OR 12.00). CRP was also significantly associated with NOM failure (p=0.001), with a cut-off >11.73 mg/dL (AUC 0.787; OR 20.44). Age (p=0.316), comorbid DM (p=0.094), and WBC (p=0.336) were not significantly associated with NOM failure.

Conclusion: Body temperature >37.3°C and CRP >11.73 mg/dL were associated with higher NOM failure in ASBO..

Keywords: adhesive small bowel obstruction; non-operative management; C-reactive protein; body temperature; predictors; failure.

How to cite this article: Kristianto N, Danardono E, Septarendra D; Predictive Factors for Failure of Non-Operative Management in Patients with Adhesive Small Bowel Obstruction at Dr. Soetomo General Hospital..Int J Drug Deliv Technol. 2026;16(1s): 650-655; DOI: 10.25258/ijddt.16. 650-655

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

Small bowel obstruction (SBO) is one of the most common surgical emergencies presenting to the emergency department and accounts for approximately 20% of operative interventions in patients with acute abdominal pain. SBO is associated with substantial morbidity and mortality, with reported deaths reaching up to 30,000 annually.[1]

Postoperative adhesions remain the leading cause of SBO. Other etiologies include Crohn's disease (7%), neoplasms (5–10%), hernias (2%), and radiation-induced enteritis (1%). At least 60% of SBO cases are classified as adhesive small bowel obstruction (ASBO). ASBO may occur after any abdominal operation, most frequently following appendectomy and colorectal surgery.[2] Ellis et al. reported that among 29,790 patients with a history of a single abdominal or pelvic surgery, 34.6% required hospital readmission due to adhesions, with an average of 2.1 admissions.[3] Notably, SBO may also occur in patients without prior abdominal surgery, accounting for approximately 10% of cases.[1]

The management of SBO shifted after evidence demonstrated that non-operative management (NOM) could achieve favorable outcomes in selected patients.[1] Contemporary ASBO care is generally based on clinical assessment, laboratory evaluation, and CT imaging. While NOM has become the preferred initial approach in uncomplicated cases, a subset of patients will fail conservative treatment. Delayed surgery in these patients increases the risk of ischemia and worsens outcomes.[4]

Previous studies suggest that age, comorbidities (e.g., diabetes mellitus, renal failure, and cardiovascular disease), inflammatory markers (CRP, WBC, lactate), and CT findings may help identify patients at risk of NOM failure.[5] CT imaging has been reported to predict strangulation with an accuracy of up to 90%.[6] However, no practical predictor is widely used in routine clinical practice, creating a dilemma between unnecessary early surgery and harmful delay in operative intervention.

Therefore, this study aims to evaluate the association between age, comorbidities, and elevated infection markers (temperature, WBC, and CRP) and failure of non-operative management in patients with ASBO.

METHOD

This study employed a retrospective cohort analytic design to evaluate the association between age, diabetes mellitus

**Author for Correspondence: febamv06@gmail.com*

(DM) comorbidity, and elevated infection markers (body temperature, white blood cell count [WBC], and C-reactive protein [CRP]) with failure of non-operative management (NOM) among patients with adhesive small bowel obstruction (ASBO). The study was conducted at the Department of Surgery, Dr. Soetomo General Hospital, Surabaya. The target population included all patients diagnosed with ASBO who presented between January and December 2024.

All patients diagnosed with ASBO who underwent NOM during the study period were eligible for inclusion. Participants were selected through consecutive sampling based on medical record review, using predefined inclusion and exclusion criteria. Patients were included if they were diagnosed with ASBO and treated with NOM in the Department of Surgery and if ASBO was attributed to a prior history of abdominal surgery. Patients were excluded if medical records indicated additional factors that could contribute to or worsen adhesions beyond surgical history, including radiotherapy, primary peritonitis, endometriosis, or congenital disease. Patients were also excluded if another primary disease was identified as the main diagnosis rather than ASBO.

The minimum required sample size was calculated using a cohort study formula with a type I error of 5% ($\alpha = 0.05$) and a type II error of 20% ($\beta = 0.20$). Because the proportion of ASBO patients with positive prognostic variables was unknown, the proportion parameter (r) was set at 0.5. Based on this calculation, the minimum sample size required was 29 participants.

The study variables included age, DM comorbidity, body temperature, WBC, CRP, and treatment outcome. Age was categorized into <60 years and ≥60 years, based on the Indonesian Ministry of Health (2020) definition of older adults. DM comorbidity was defined as a documented diagnosis of diabetes mellitus, regardless of whether the patient was receiving routine treatment. Body temperature was recorded after rehydration and stabilization in the emergency department, while WBC and CRP levels were obtained at initial presentation to the emergency department. The study outcome was defined as NOM success or failure. NOM was considered failed if obstructive symptoms did not improve within 72 hours, nasogastric tube output exceeded 500 mL/day on day 3, or if signs of peritonitis or intestinal ischemia developed.

Eligible cases were identified from hospital medical records. Baseline demographic characteristics and study variables were extracted and recorded using a standardized data collection form. Clinical course and treatment outcomes were subsequently reviewed. Statistical analysis was performed using SPSS version 25. Nominal variables were analyzed using the Chi-square test or Fisher's exact test, as appropriate. Numerical variables were tested for normality; normally distributed variables were compared using the independent samples t-test, while non-normally distributed variables were analyzed using the Mann–Whitney U test. For numerical variables that were categorized for further analysis, optimal cut-off values were determined using receiver operating characteristic (ROC) analysis.

RESULTS

Baseline Characteristics

A total of 48 patients with adhesive small bowel obstruction (ASBO) treated with non-operative management (NOM) were included. Of these, 27 patients (56.3%) were female and 21 (43.8%) were male. Most patients were aged <60 years (36/48, 75.0%), while 12 patients (25.0%) were aged ≥60 years. Diabetes mellitus (DM) as a comorbidity was present in 12 patients (25.0%), whereas 36 patients (75.0%) had no DM.

Table 1. Baseline Characteristics of Study Participants (n = 48)

Variable	Category	n (%)
Sex	Male	21 (43.8)
	Female	27 (56.3)
Age group	<60 years	36 (75.0)
	≥60 years	12 (25.0)
DM comorbidity	Yes	12 (25.0)
	No	36 (75.0)

Clinical Characteristics and Outcome

The median body temperature was 36.75°C (range 36.0–38.4°C) with a mean of 36.95 ± 0.66°C. Median CRP was 7.06 mg/L (range 0.05–33.67 mg/L) with a mean of 10.21 ± 9.06 mg/L. Median WBC was 10.56 ×10³/μL (range 4.45–45.22 ×10³/μL) with a mean of 12.01 ± 6.68 ×10³/μL. Normality testing showed that temperature, CRP, and WBC were not normally distributed ($p < 0.05$).

Regarding NOM outcome, 26 patients (54.2%) had successful NOM, while 22 patients (45.8%) experienced NOM failure.

Table 2. Clinical Variables and Normality Testing (n = 48)

Variable	Range (Median)	Mean ± SD	Normality p-value
Temperature (°C)	36.0–38.4 (36.75)	36.95 ± 0.66	0.005
CRP (mg/L)	0.05–33.67 (7.06)	10.21 ± 9.06	0.001
WBC (×10³/μL)	4.45–45.22 (10.56)	12.01 ± 6.68	<0.001

Variable	Range (Median)	Mean ± SD	Normality p-value
Outcome	Successful NOM	26 (54.2%)	–
	Failed NOM	22 (45.8%)	–

Association Between Age and NOM Outcome

No significant association was observed between age group and NOM outcome (p = 0.316). In patients aged <60 years, NOM was successful in 18 (50.0%) and failed in 18 (50.0%). In patients aged ≥60 years, NOM was successful in 8 (66.7%) and failed in 4 (33.3%).

Table 3. Association Between Age Group and NOM Outcome

Age group	Total (n)	Successful (%)	Failed (%)	p-value
<60 years	36	18 (50.0)	18 (50.0)	0.316
≥60 years	12	8 (66.7)	4 (33.3)	

Association Between Diabetes Mellitus and NOM Outcome

DM comorbidity was not significantly associated with NOM outcome (p = 0.094). Among patients with DM, NOM was successful in 9 (75.0%) and failed in 3 (25.0%). Among patients without DM, NOM was successful in 17 (47.2%) and failed in 19 (52.9%).

Table 4. Association Between Diabetes Mellitus and NOM Outcome

DM comorbidity	Total (n)	Successful (%)	Failed (%)	p-value
Yes	12	9 (75.0)	3 (25.0)	0.094
No	36	17 (47.2)	19 (52.9)	

Comparison of Body Temperature Between Outcome Groups

Body temperature differed significantly between patients with successful and failed NOM (Mann–Whitney U test, p = 0.022). Patients with successful NOM had a median temperature of 36.70°C (range 36.0–37.9°C), while those with NOM failure had a higher median temperature of 37.10°C (range 36.0–38.4°C).

Table 5. Comparison of Temperature by NOM Outcome

Variable	Total (n)	Successful (Median)	Failed (Median)	p-value
Temperature (°C)	48	36.0–37.9 (36.70)	36.0–38.4 (37.10)	0.022

ROC Analysis and Temperature Cut-off

ROC analysis showed that body temperature significantly discriminated NOM outcome (p = 0.013), with an AUC of 0.693 (95% CI 0.543–0.818). The optimal cut-off value was >37.3°C.

Table 6. ROC Analysis of Temperature for Predicting NOM Failure

Variable	n	p-value	AUC	95% CI	Cut-off
Temperature (°C)	48	0.013	0.693	0.543–0.818	>37.3

Using this cut-off, temperature >37.3°C was significantly associated with NOM failure (p = 0.003). Patients with temperature >37.3°C had an odds ratio (OR) of 12.00 (95% CI 2.266–63.562) for NOM failure compared with those with temperature ≤37.3°C.

Table 7. Association Between Temperature Cut-off and NOM Outcome

Temperature	Total (n)	Successful (%)	Failed (%)	p-value	OR	95% CI
≤37.3°C	35	24 (68.6)	11 (31.4)	0.003	12.00	2.266 – 63.562
>37.3°C	13	2 (15.4)	11 (84.6)			

Comparison of CRP Between Outcome Groups

CRP levels differed significantly between outcome groups (Mann–Whitney U test, p = 0.001). Patients with successful NOM had a median CRP of 3.25 mg/L (range 0.16–33.67 mg/L), whereas patients with NOM failure had a median CRP of 16.49 mg/L (range 0.05–26.12 mg/L).

Table 8. Comparison of CRP by NOM Outcome

Variable	Total (n)	Successful (Median)	Failed (Median)	p-value
CRP (mg/L)	48	0.16–33.67 (3.25)	0.05–26.12 (16.49)	0.001

ROC Analysis and CRP Cut-off

ROC analysis showed that CRP significantly predicted NOM outcome (p < 0.001), with an AUC of 0.787 (95% CI 0.645–0.892). The optimal cut-off value was >11.73 mg/L.

Table 9. ROC Analysis of CRP for Predicting NOM Failure

Variable	n	p-value	AUC	95% CI	Cut-off
CRP (mg/L)	48	<0.000	0.787	0.645–0.892	>11.73

Using this cut-off, CRP >11.73 mg/L was significantly associated with NOM failure ($p < 0.001$). Patients with CRP >11.73 mg/L had an OR of 20.444 (95% CI 4.446–94.013) for NOM failure compared with those with CRP ≤11.73 mg/L.

Table 10. Association Between CRP Cut-off and NOM Outcome

CRP	Total (n)	Successful (%)	Failed (%)	p-value	OR	95% CI
≤11.73 mg/L	29	23 (79.3)	6 (20.7)	0.000	20.444	4.446–94.013
>11.73 mg/L	19	3 (15.8)	16 (84.2)			

Comparison of WBC Between Outcome Groups

WBC levels were not significantly different between patients with successful and failed NOM (Mann–Whitney U test, $p = 0.336$). Patients with successful NOM had a median WBC of 10.88 $\times 10^3/\mu L$ (range 4.54–24.45 $\times 10^3/\mu L$), while those with NOM failure had a median WBC of 10.28 $\times 10^3/\mu L$ (range 4.54–45.22 $\times 10^3/\mu L$).

Table 11. Comparison of WBC by NOM Outcome

Variable	Total (n)	Successful (Median)	Failed (Median)	p-value
WBC ($\times 10^3/\mu L$)	48	4.54–24.45 (10.88)	4.54–45.22 (10.28)	0.336

DISCUSSION

The management of adhesive small bowel obstruction (ASBO) still contains several critical areas that can be improved, particularly the early detection of intestinal ischemia, determination of the optimal timing for surgery, and the appropriate duration of non-operative management (NOM). Intestinal ischemia is a key condition that should prompt termination of NOM and indicate the need for early surgical intervention. However, preoperative identification of intestinal ischemia remains challenging because no single preoperative examination can be considered a definitive marker of ischemia. Clinical signs such as increased body temperature and infection markers have been proposed as criteria for intestinal ischemia.[7,8]

In this study, the distribution of male and female patients was nearly equal, with a slightly higher proportion of female patients. Most patients were younger than 60 years, representing 75% of the sample, and the mean age was 46.73 years. This finding differs from previous data reported in Canada (2005–2011), where the mean age of ASBO patients was 64.5 years.

The failure rate of NOM in this study was 45.8%, which is higher than that reported in several previous studies. According to the Bologna guidelines, NOM for ASBO is effective in approximately 70–90% of cases. (9) In another study, 72.78% of ASBO patients required surgical intervention, and 16.85% of those who underwent surgery required bowel resection.[9] The higher NOM failure rate observed in the present study may be influenced by differences in clinical assessment and decision-making processes across healthcare centers.

Fever has been considered an early clinical sign of intestinal ischemia.[10] Nevertheless, other studies have reported that a temperature increase above 38°C was not significantly associated with intestinal ischemia.[11] In the present study, body temperature elevation was significantly associated with NOM failure. Patients with a temperature above 37.3°C demonstrated a higher risk of NOM failure. This association may be explained by the pathophysiology of intestinal obstruction. Bacterial overgrowth occurs proximal to the obstruction, and more severe obstruction can reduce bowel wall perfusion and disrupt the mucosal barrier. Loss of mucosal integrity allows bacterial translocation into systemic circulation, potentially leading to sepsis. As body temperature is one of the systemic inflammatory response syndrome (SIRS) criteria, it may increase in this setting.

Laboratory markers that may indicate intestinal ischemia include C-reactive protein (CRP) and white blood cell count (WBC). Patients treated non-operatively have been reported to have lower WBC and CRP levels compared with those requiring surgery. In a previous study, patients with WBC >10,000 g/dL or CRP >7.5 mg/dL were more frequently operated on and more likely to undergo bowel resection. (15) Other studies also identified elevated CRP and WBC as predictors for surgical intervention in ASBO. In this study, elevated CRP showed a significant association with NOM failure. ROC analysis demonstrated that patients with CRP >11.73 mg/dL had a higher likelihood of NOM failure. In contrast, WBC did not show a significant relationship with NOM failure. This may be due to the limited specificity of WBC in detecting intestinal ischemia. Furthermore, WBC elevation can be influenced by immune status, with potentially blunted responses in immunocompromised patients or those receiving corticosteroid therapy.[12]

In older patients with ASBO, NOM is often selected as the initial approach to reduce the risk of surgical complications. Surgical intervention may also negatively affect quality of life due to chronic postoperative pain. However, this approach remains controversial because delayed surgery in elderly patients who ultimately require operative management is associated with increased morbidity and mortality.[13,14] In the present study, age was not significantly associated with NOM failure. This finding differs from previous studies suggesting that age may affect NOM outcomes in ASBO. Another study focusing on elderly ASBO patients reported that NOM produced better

outcomes than early surgery. This may be explained by the higher operative risk in elderly patients, resulting in increased mortality, longer length of stay, and more complications among those undergoing early surgery.[15]

The influence of comorbid diabetes mellitus (DM) on NOM failure in ASBO has not been widely investigated. Some studies have suggested that comorbidities—particularly DM—may contribute to NOM failure, although statistical significance has not always been demonstrated. A national database study from the United States reported a significant association between comorbidities (including diabetes mellitus, chronic heart failure, chronic lung disease, chronic peripheral vascular disease, and chronic kidney disease) and NOM failure, although DM alone did not reach statistical significance.[16] In the present study, no significant association was found between comorbidities and NOM failure. This may be related to the uneven distribution of comorbidities within the study sample and the limited sample size.

This study has limitations. The operative sample was not stratified according to the type and number of previous abdominal surgeries. Variations in surgical history may influence the severity of adhesions and therefore affect NOM outcomes. Previous laparotomies ≥4 times have been reported to significantly increase adhesion severity compared with <4 laparotomies. Additionally, the type of prior surgery also affects adhesion severity, as laparotomy performed for peritonitis or abscess is associated with more severe adhesions.[17]

CONCLUSION

This study found a significant association between elevated body temperature and increased serum CRP levels with the failure of non-operative management (NOM) in patients with adhesive small bowel obstruction (ASBO). Patients with a body temperature >37.3°C and serum CRP >11.73 mg/dL demonstrated a higher rate of NOM failure. In contrast, age, comorbid diabetes mellitus, and white blood cell (WBC) count were not significantly associated with NOM failure in ASBO patients.

Future studies should be conducted with a larger sample size and a broader range of variables to identify additional factors associated with NOM failure in ASBO. In addition, study samples may be further classified according to the number and type of previous abdominal surgeries

REFERENCE

1. Coco D, Leanza S, Fiume I. Small bowel obstruction: a prognostic score index for surgery – a review. Prz Gastroenterol.Termedia Publishing House Ltd. 2022;17(3):177-182. doi:10.5114/pg.2022.118454

2. Bueno-Lledó J, Barber S, Vaqué J, Frasson M, Garcia-Granero E, Juan-Burgueño M. Adhesive Small Bowel Obstruction: Predictive Factors of Lack of Response in Conservative Management with Gastrografin. Dig Surg. 2016;33(1):26-32. doi:10.1159/000441530

3. Ellis H, Moran BJ, Thompson JN, et al. Adhesion-related hospital readmissions after abdominal and pelvic surgery: A retrospective cohort study. Lancet. 1999;353(9163):1476-1480. doi:10.1016/S0140-6736(98)09337-4

4. Ng ZQ, Hsu V, Tee WWH, Tan JH, Wijesuriya R. Predictors for success of non-operative management of adhesive small bowel obstruction. World J Gastrointest Surg. 2023;15(6):1116-1124. doi:10.4240/wjgs.v15.i6.1116

5. Quiroga-Centeno AC, Pinilla-Chávez MC, Chaparro-Zaraza DF, et al. Design and validation of a predicting adverse outcomes toll for patients with adhesive small bowel obstruction: HALVIC score. Rev Colomb Cir. 2023;38(1):84-100. doi:10.30944/20117582.2288

6. Podda M, Khan M, Di Saverio S. Adhesive Small Bowel Obstruction and the six w's: Who, How, Why, When, What, and Where to diagnose and operate? Scand J Surg.SAGE Publications Inc. 2021;110(2):159-169. doi:10.1177/1457496920982763

7. Tyagunov AE, Tyagunov AA, Nechay T V, Vinogradov VN, Kurashinova LS, Sazhin A V. Timing of surgery, intestinal ischemia and other real factors of mortality in acute adhesive small bowel obstruction: a multiple-center study. Khirurgiia (Sofiia). 2021;(3):26-35. doi:10.17116/hirurgia202103126

8. Bazaz1 R, , Sadhana Tiwari2 , Bikramjit Singh Sodhi3 JK, 1Senior. Predictors of Intestinal Ischemia in Small Bowel Obstruction-A Prospective Study. Int J Sci Study. 2017;5(4):119-124. doi:10.17354/ijss/2017/347

9. Bouassida M, Laamiri G, Zribi S, et al. Predicting Intestinal Ischaemia in Patients with Adhesive Small Bowel Obstruction: A Simple Score. World J Surg. 2020;44(5):1444-1449. doi:10.1007/s00268-020-05377-6

10. Tilsed JVT, Casamassima A, Kurihara H, et al. ESTES guidelines: acute mesenteric ischaemia. Eur J trauma Emerg Surg Off Publ Eur Trauma Soc. 2016;42(2):253-270. doi:10.1007/s00068-016-0634-0

11. Li X, Tian M, Liu Y, Zhang Y, Chen J. Predictive Factors of Intestinal Ischaemia in Adhesive Small Bowel Obstruction. J Coll Physicians Surg Pakistan. 2024;34(2):146-150. doi:10.29271/jcpsp.2024.02.146

12. Montagnana M, Danese E, Lippi G. Biochemical markers of acute intestinal ischemia: possibilities and limitations. Ann Transl Med. 2018;6(17):341. doi:10.21037/atm.2018.07.22

13. Rosa F, Covino M, Fransvea P, et al. Management of Small Bowel Obstruction (SBO) in older adults (>80 years): a propensity score-matched analysis on predictive factors for a (un)successful non-operative management (NOM). Eur Rev Med Pharmacol Sci. 2022;26(19):7219-7228. doi:10.26355/eurrev_202210_29914

14. Ozturk E, van Iersel M, Stommel MM, Schoon Y, Ten Broek RR, van Goor H. Small bowel obstruction in the

elderly: a plea for comprehensive acute geriatric care. World J Emerg Surg. 2018;13:48. doi:10.1186/s13017-018-0208-z

15. Quero G, De Sio D, Covino M, et al. Adhesive small bowel obstruction in octogenarians: A 6-year retrospective single-center analysis of clinical management and outcomes. Am J Surg. 2022;224(5):1209-1214. doi:https://doi.org/10.1016/j.amjsurg.2022.04.019

16. Malkiely G, Paran M, Elgabsi M, Kessel B. Chronic Comorbidities and Failure of Non-Operative Management in Adhesive Small Bowel Obstruction: Results of Analysis of National Inpatient Data from the United States. J Clin Med. 2025;14(17). doi:10.3390/jcm14175989

17. Strik C, Stommel MWJ, Ten Broek RPG, van Goor H. Adhesiolysis in Patients Undergoing a Repeat Median Laparotomy. Dis Colon Rectum. 2015;58(8):792-798. doi:10.1097/DCR.0000000000000405