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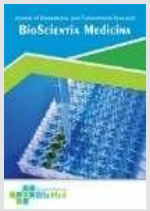

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Non-Operative Management Accelerates Recovery: Reduced Length of Hospital Stay in Partial Small Bowel Obstruction with Virgin Abdomens

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A B S T R A C T

Background: Small bowel obstruction (SBO) represents a formidable challenge in surgical practice. Partial SBO (PSBO) in individuals without a history of abdominal surgery, termed "virgin abdomens," introduces distinct diagnostic and therapeutic considerations. While non-operative management (NOM) has become a cornerstone for adhesive SBO, comprehensive data elucidating its impact on PSBO in virgin abdomens, especially concerning the length of hospital stay (LOS), are not extensively available. This study was designed to meticulously compare the LOS between NOM and operative interventions in patients diagnosed with PSBO affecting virgin abdomens, specifically within a tertiary care setting in Indonesia. **Methods:** A retrospective analytic observational methodology, utilizing a cross-sectional design, was implemented at Dr. Kariadi General Hospital, Semarang, covering patients admitted from January through December 2024. The study included patients over 18 years of age with a confirmed diagnosis of PSBO in a virgin abdomen. Exclusion criteria encompassed total SBO, obstructions located in the colon, or any record of prior abdominal surgical procedures. The principal outcome measure, LOS, was rigorously compared between the cohort managed non-operatively and the cohort that underwent surgical procedures. Statistical analysis was performed using appropriate tests, with a p-value below 0.05 established as the threshold for statistical significance. **Results:** The study cohort comprised 167 eligible patients. For the 112 patients (67.1%) subjected to surgical intervention, the mean LOS was recorded at 13.2±8.72 days. Conversely, the 55 patients (32.9%) managed conservatively demonstrated a markedly shorter mean LOS of 7.74±6.12 days. This observed difference in LOS was statistically highly significant ($p < 0.001$). The mean age of the participants was 50.60±14.94 years, with females constituting 52.1% of the group. **Conclusion:** In clinically stable patients presenting with partial small bowel obstruction in virgin abdomens, non-operative management was associated with a significantly diminished length of hospital stay when compared to surgical intervention. This conservative strategy proves to be an effective and advantageous approach in appropriately selected patient populations, offering the potential to lessen hospital burden and enhance recovery timelines.

1. Introduction

Small Bowel Obstruction (SBO) is a frequently encountered and serious surgical condition, responsible for a significant portion of surgical admissions and operative interventions globally. While postoperative adhesions are the predominant cause in patients with prior surgery, SBO in "virgin abdomens"—individuals without previous abdominal operations—presents distinct etiological and management considerations. Recent studies have noted a notable incidence of adhesions even in this group, possibly arising from congenital factors or prior subclinical intra-abdominal inflammation. Beyond such adhesions, common causes of SBO in virgin

abdomens include incarcerated hernias, neoplasms, and inflammatory bowel disease. The clinical presentation of SBO typically involves colicky abdominal pain, nausea, vomiting, and varying degrees of obstipation, with manifestations differing based on the obstruction's location and severity (partial versus complete). Partial Small Bowel Obstruction (PSBO), where luminal compromise is incomplete, allows some passage of intestinal contents. Etiologies for PSBO in virgin abdomens are diverse, including congenital bands, internal or occult external hernias (a leading cause in this cohort), primary or metastatic tumors, and inflammatory conditions. Less common causes include gallstone ileus.[1-4]

The pathophysiology of SBO involves proximal bowel distension due to accumulated gas and fluid, leading to increased intraluminal pressure. This can impair venous return, causing mural edema, and potentially compromise arterial supply, risking ischemia, necrosis, and perforation. Fluid sequestration and bacterial translocation can lead to dehydration, electrolyte imbalances, and systemic inflammatory response or sepsis. A significant paradigm shift has occurred in SBO management, particularly for adhesive SBO, favoring initial non-operative management (NOM) in stable patients. NOM typically includes bowel rest, intravenous hydration, nasogastric decompression, and often the use of water-soluble contrast agents. This conservative approach has shown success rates around 70% for adhesive SBO, provided there are no signs of strangulation, ischemia, or peritonitis, which mandate surgery. The choice of management significantly impacts the length of hospital stay (LOS) and patient morbidity, with NOM generally associated with shorter hospitalizations (around 5 days) compared to surgery (around 16 days) in adhesive SBO cohorts. However, the optimal duration of the NOM trial remains debated, though 48-72 hours is often considered a safe window for assessment. Despite extensive research on SBO, particularly adhesive SBO, there is a comparative scarcity of focused studies on PSBO specifically within the virgin abdomen population. This group is unique as postoperative adhesions are excluded by definition, shifting the etiological landscape. Understanding the comparative effectiveness of NOM versus operative management regarding LOS in these patients is crucial for optimizing care, especially considering regional variations in practice and patient populations. The original thesis highlighted a lack of such comparative local data at Dr. Kariadi General Hospital Semarang.[5-8]

The novelty of this investigation is its dedicated focus on comparing LOS between NOM and operative treatment specifically for PSBO in patients with no prior abdominal surgery, a less-explored demographic. By providing contemporary data from a tertiary referral center in Indonesia, this study aimed to generate valuable regional evidence. Such evidence can inform local clinical practice, potentially refine treatment protocols for this distinct patient group, and contribute to a better understanding of outcomes associated with different management strategies for PSBO in virgin abdomens. Addressing this knowledge gap can aid in improved patient counseling, more efficient resource allocation, and enhanced quality of care.[9,10] Therefore, the primary aim of this study was to conduct a comparative analysis of the length of hospital stay between non-operative management and operative management in patients presenting with partial small bowel obstruction in a virgin abdomen at Dr. Kariadi General Hospital Semarang, during the period from January 2024 to December 2024.

2. Methods

This investigation was meticulously structured as a retrospective analytic observational study, incorporating a cross-sectional design to achieve its objectives. The entirety of the research activities, including patient identification and data extraction, was conducted at the Dr. Kariadi General Hospital, located in Semarang, Indonesia. Dr. Kariadi General Hospital is a prominent tertiary referral hospital and serves as a major teaching institution, providing a

comprehensive range of medical and surgical services to a large and diverse patient population. The study period encompassed all eligible patients who were admitted and received treatment for partial small bowel obstruction in a virgin abdomen between January 1st, 2024, and December 31st, 2024, inclusive. This timeframe was chosen to ensure the collection of recent data reflective of current clinical practices at the institution. The target study population consisted of all adult patients who presented to the Emergency Department of Dr. Kariadi General Hospital during the specified one-year study period and were subsequently diagnosed with partial small bowel obstruction (PSBO) occurring in a virgin abdomen. For the purposes of this study, a "virgin abdomen" was explicitly defined as an abdomen with no history of any prior laparotomy or laparoscopic surgical procedures. To ensure a comprehensive capture of all eligible cases within the study period, a total sampling methodology was employed. This means that every patient who met the rigorously defined inclusion criteria and did not meet any of the exclusion criteria during the January to December 2024 timeframe was included in the study cohort for analysis. This study successfully enrolled a total of 167 patients who presented to the Digestive Surgery Division of Dr. Kariadi General Hospital Semarang, between January 2024 and December 2024.

Patients were deemed eligible for inclusion in the study if they satisfied all of the following conditions: A definitive clinical and radiological diagnosis of partial small bowel obstruction. The diagnosis was typically confirmed by a combination of clinical symptoms (colicky abdominal pain, nausea, vomiting, distension, obstipation), physical examination findings, and characteristic appearances on abdominal imaging studies (plain X-rays and, more commonly, computed tomography scans showing dilated small bowel loops with a transition point and some passage of contrast or gas distally); The absence of any documented history of previous abdominal surgical interventions (laparotomy or laparoscopy), thereby qualifying as a "virgin abdomen."; Initial presentation and admission via the Emergency Department of Dr. Kariadi General Hospital; The admission date falls within the study period, specifically from January 1st, 2024, to December 31st, 2024; Patient age of 18 years or older at the time of admission.

Patients were systematically excluded from participation in the study if any of the following conditions were met: A diagnosis of complete (total) small bowel obstruction, as evidenced by imaging studies showing no passage of contrast material or gas beyond a definitive transition point; Obstruction is primarily located in the colon (large bowel obstruction), irrespective of the etiology; Any documented history of prior intra-abdominal surgical procedures, including both open laparotomy and laparoscopic surgeries; Patient age below 18 years at the time of admission; Incomplete or missing critical data in the medical records that would preclude accurate assessment of the primary outcome (length of hospital stay) or key variables related to management.

The central independent variable under investigation was the type of management strategy employed for the partial small bowel obstruction. This was a dichotomous categorical variable, defined as follows: Non-Operative Management (NOM) / Conservative Management: This category encompassed all patients whose PSBO was successfully resolved without the need for surgical intervention. The components of NOM, as operationally defined and guided by institutional protocols, included initial and sustained bowel rest (strict nil per os regimen); aggressive intravenous fluid therapy for hydration and correction of electrolyte imbalances; nasogastric tube (NGT) insertion for gastric and proximal small bowel decompression to alleviate nausea, vomiting, and distension; administration of water-soluble osmotic contrast agents (such as Gastrografin) in selected cases to aid in diagnosis and potentially promote resolution; and continuous, close clinical monitoring for signs of improvement (passage of flatus/stool, reduction in NGT output, resolution of pain and distension) or

deterioration; Operative Management: This category included all patients who underwent a surgical procedure aimed at relieving the bowel obstruction. Surgical intervention was indicated in cases of failed NOM (defined as lack of significant clinical improvement or radiographic resolution of obstruction, typically within a 48 to 72-hour timeframe of conservative measures), or if there were immediate indications for surgery at presentation, such as clinical or radiological signs suggestive of bowel strangulation, ischemia, perforation, peritonitis, or if the underlying etiology (for instance, an incarcerated hernia irreducible by non-operative means, or a suspected obstructing neoplasm) clearly warranted surgical correction. The specific surgical procedures performed varied based on intraoperative findings and could include adhesiolysis (for congenital or inflammatory adhesions if present), enterotomy for removal of an intraluminal obstruction (like a gallstone), bowel resection with primary anastomosis or stoma formation (for segments of bowel compromised by ischemia, or for resection of tumors or complex strictures), or hernia repair. Surgical access could be via traditional laparotomy or, in select cases, via a laparoscopic approach, contingent upon factors such as patient stability, surgeon expertise, and the anticipated complexity of the pathology.

The primary dependent variable, and the main outcome measure of the study, was the Length of Hospital Stay (LOS). LOS was operationally defined as the total duration of inpatient hospitalization, calculated in whole days, from the date of admission to the hospital to the date of discharge. This duration encompassed the period of diagnostic workup, the administration of the definitive management (either the full course of successful non-operative management or the period including surgery and postoperative recovery), and any subsequent inpatient care until the patient was deemed medically fit for discharge.

The data acquisition phase of this study was executed with meticulous attention to detail and adherence to ethical guidelines. All data were retrospectively extracted from the hospital's comprehensive Electronic Medical Records (EMR) system, specifically targeting records housed within the Digestive Surgery Division of Dr. Kariadi General Hospital. This process commenced following the formal approval from the hospital's institutional review board and ethics committee. A standardized data collection instrument was developed and utilized by the principal investigator and a team of trained research assistants to ensure consistency and accuracy in data extraction. The information gathered for each eligible patient included: detailed demographic data (age, gender); comprehensive clinical presentation details upon admission (nature and duration of symptoms, presence of pain, vomiting, distension, obstipation); findings from relevant diagnostic investigations (laboratory results such as white blood cell count, C-reactive protein, lactate; and detailed reports from imaging studies, particularly CT scans confirming PSBO and noting any ancillary findings); precise details of the management strategy administered (specific conservative measures employed, type and details of surgical procedures performed if applicable); information regarding any conversion from an initial non-operative approach to operative management during the same hospital admission; and the precise dates of admission and discharge to enable accurate calculation of the length of hospital stay. The data collection for the entire cohort admitted between January 2024 and December 2024 was completed over a dedicated three-month period to ensure thoroughness. Patients presenting to the emergency department of Dr. Kariadi General Hospital with clinical suspicion of SBO underwent a standardized initial diagnostic pathway. This commenced with a comprehensive medical history, including onset and nature of symptoms, and a thorough physical examination focusing on abdominal findings (distension, tenderness, bowel sounds, signs of peritonism) and hernia orifices. Baseline laboratory investigations were routinely performed, including a complete blood count with differential, serum electrolytes, renal function tests (urea and creatinine),

and often serum lactate levels as an indicator of potential bowel ischemia.

Imaging played a crucial role in the diagnostic algorithm. Plain abdominal radiography (typically supine and erect, or lateral decubitus views if an erect film was not feasible) was often the initial imaging performed in the emergency setting to look for classic signs of SBO, such as dilated small bowel loops (generally defined as >2.5-3 cm in diameter), multiple air-fluid levels, and a relative paucity of gas in the colon. However, for a more definitive diagnosis, localization of the obstruction, assessment of severity (partial versus complete), and critically, for the evaluation of potential complications such as ischemia or strangulation, contrast-enhanced computed tomography (CECT) of the abdomen and pelvis was the imaging modality of choice and was performed in the vast majority of cases. CT criteria for PSBO included dilated proximal small bowel with a discernible transition point to collapsed distal bowel, with evidence of some contrast material or gas passing beyond this point. CT scans were also scrutinized for signs indicative of bowel ischemia (such as bowel wall thickening, increased or absent bowel wall enhancement, mesenteric stranding or edema, pneumatosis intestinalis, or portal venous gas) or closed-loop obstruction, any of which would typically precipitate urgent surgical consultation and likely intervention. The presence of what were termed the "four cardinal features"—significant free intraperitoneal fluid, mesenteric edema, the "small bowel feces sign" (particulate matter in dilated, fluid-filled small bowel loops resembling colonic content), and a history of vomiting—was also considered suggestive of a higher likelihood of needing surgical intervention.

Patients deemed suitable for an initial trial of non-operative management were admitted to the surgical ward. The NOM protocol at Dr. Kariadi General Hospital consistently included: Strict Nil Per Os (NPO): Absolute cessation of oral intake to allow for bowel rest; Intravenous Fluid Resuscitation: Aggressive administration of crystalloid solutions to correct dehydration, maintain adequate urine output, and restore electrolyte balance; Nasogastric Decompression: Insertion of an NGT connected to low intermittent suction to decompress the stomach and proximal small bowel, thereby relieving distension and reducing nausea and vomiting. NGT output was regularly monitored; Use of Water-Soluble Contrast Agents: In selected stable patients without signs of peritonitis or complete obstruction, oral administration of a water-soluble hyperosmolar contrast agent (commonly Gastrografin) was often employed. A follow-up abdominal X-ray was typically obtained 12-24 hours after administration to assess its passage into the colon, which would confirm a partial obstruction and often predict successful NOM; Clinical Monitoring: Patients on NOM were subjected to frequent clinical reassessment, including monitoring of vital signs, abdominal examination (pain, distension, bowel sounds), NGT output, passage of flatus or stool, and serial laboratory tests as indicated.

Failure of non-operative management, prompting consideration for surgical intervention, was generally defined by one or more of the following: absence of significant clinical improvement (persistent pain, distension, high NGT output, failure to pass flatus or stool) or lack of radiological resolution of the obstruction within a 48 to 72-hour period; any evidence of clinical deterioration (development of fever, tachycardia, leukocytosis, worsening abdominal pain, or peritoneal signs); or new imaging findings suggestive of ischemia, perforation, or complete obstruction.

Patients who either failed NOM or presented with initial absolute indications for surgery (such as generalized peritonitis, evidence of bowel strangulation or ischemia on CT, or an irreducible incarcerated hernia causing the obstruction) proceeded to surgical exploration. The choice of surgical procedure was dictated by the intraoperative findings and the underlying etiology of the PSBO. Common procedures included laparotomy for thorough abdominal exploration, adhesiolysis if

congenital or inflammatory adhesions were identified as the cause, enterotomy for the extraction of an intraluminal obstructing agent (such as a gallstone in cases of gallstone ileus), or bowel resection with primary anastomosis or, in certain circumstances, creation of a stoma, if a segment of bowel was found to be non-viable due to ischemia, or if an obstructing tumor or complex inflammatory stricture necessitated removal. Laparoscopic surgery was considered an option for select, hemodynamically stable patients, particularly if a single adhesive band was suspected in a virgin abdomen, provided that appropriate surgical expertise and equipment were readily available. Post-operative care was standardized, involving continued hemodynamic monitoring, appropriate analgesic administration, meticulous fluid and electrolyte management, prophylactic measures against thromboembolism and stress ulcers where indicated, and gradual reintroduction of enteral nutrition as bowel function returned (evidenced by passage of flatus, resolution of ileus, and diminishing NGT output if left in situ).

Upon completion of data collection, the information was meticulously coded, entered into a secure database, and subsequently analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows, Version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics were initially employed for univariate analysis to characterize the study sample. Categorical variables, such as gender, the type of management received (non-operative versus operative), presenting symptoms, and suspected etiologies, were summarized and presented as absolute frequencies and relative percentages. Continuous variables, including patient age and the primary outcome variable, length of hospital stay (LOS), were assessed for normality of distribution using graphical methods (histograms, Q-Q plots) and statistical tests (such as the Shapiro-Wilk test). For normally distributed continuous data, means and standard deviations (SD) were reported, while for non-normally distributed data, medians and interquartile ranges (IQR) would be used, although the source document consistently reports means and SDs for age and LOS.

For bivariate analysis, the primary objective was to compare the LOS between the two distinct management groups (non-operative and operative). Given that LOS data frequently exhibit a skewed distribution and are not typically normally distributed, and based on the analytical method specified in the source document's results section, the non-parametric Mann-Whitney U test was the designated statistical test for this comparison. This test is appropriate for comparing two independent groups on an ordinal or continuous dependent variable that does not meet parametric assumptions. For comparisons of categorical baseline characteristics between the two management groups (to assess for potential confounders, although not explicitly detailed as a primary analysis in the source's methods), the Chi-square (X2) test or Fisher’s exact test (when expected cell counts were small, typically less than 5) would be the appropriate statistical methods. A p-value of less than 0.05 was pre-established as the threshold for statistical significance for all inferential statistical tests conducted.

The conduct of this research adhered strictly to the highest ethical principles, as enshrined in the Declaration of Helsinki and its subsequent amendments. Before initiating any data collection, formal ethical approval for the study protocol was sought and successfully obtained from the Health Research Ethics Committee (KEPK) of Dr. Kariadi General Hospital, Semarang. The official ethical clearance certificate was granted under the reference number No.16422/EC/KEPK-RSDK/2025. Furthermore, administrative permission to access and utilize patient medical records for research purposes was secured from the relevant authorities within the Dr. Kariadi General Hospital administration. Given the retrospective nature of the study, which involved the analysis of existing medical records, and the commitment to de-identifying all patient data prior to analysis, the ethics committee granted a waiver for individual patient informed consent. This is a

standard practice for retrospective chart review studies where obtaining consent from all individuals would be impracticable and where patient confidentiality is rigorously protected. To ensure and maintain patient confidentiality and anonymity throughout the research process, all personal identifiers were removed from the data collection forms and the final analytical dataset. No information that could potentially lead to the identification of individual patients was included in any reports, presentations, or publications arising from this study. The research was conducted in full compliance with the seven guiding standards for ethical research as stipulated by the World Health Organization (WHO) in 2011. These standards encompass: Social Value, Scientific Validity, Fair Subject Selection, Favorable Risk-Benefit Ratio, Avoidance of Undue Inducement or Exploitation, Maintenance of Confidentiality and Privacy, and Adherence to Principles of Informed Consent (or waiver thereof, as appropriate), with further reference to the guidelines provided by the Council for International Organizations of Medical Sciences (CIOMS) in 2016.

3. Results

The baseline data presented in Table 1 offers valuable insights into the profile of individuals experiencing partial small bowel obstruction in virgin abdomens within the local context of Dr. Kariadi General Hospital. The mean age of approximately 51 years suggests that while this condition can occur across a spectrum of adult life, it is not predominantly a disease of the very elderly, nor is it common in young adults, aligning more with middle age where cumulative risks for underlying causes like occult hernias or inflammatory episodes might increase. The slight female predominance (52.1%) is an interesting demographic observation; while some international studies on general SBO report a male predominance, this finding in a virgin abdomen cohort might hint at gender-specific etiologies, such as those related to gynecological inflammatory processes or anatomical variations, though this study did not delve into such specific etiological analyses. The clinical presentation data, for specific percentages, paint a classic picture of bowel obstruction. A mean symptom duration of nearly three days prior to presentation underscores a period where patients might have attempted self-management or experienced fluctuating symptoms before seeking hospital care. The extremely high prevalence of colicky abdominal pain (94.6%) confirms it as the hallmark symptom. Vomiting (80.8%) and abdominal distension (73.1%) further reflect the significant physiological disruption caused by impaired intestinal transit and accumulation of fluid and gas. Obstipation, reported by over 60% of patients, signifies a considerable degree of luminal compromise, even in these partial obstructions.

The initial laboratory findings provide clues to the systemic impact of the obstruction. A mean WBC count slightly above the upper limit of normal (11.5×10^3/L) is common in SBO, reflecting an inflammatory response to bowel wall distension, edema, or even early stages of bacterial translocation. An elevated CRP (mean 45 mg/L) would further support the presence of significant inflammation. The mean serum lactate of 2.1 mmol/L, while not grossly elevated, is approaching the upper limit of normal for many assays and indicates that clinicians must be vigilant for early signs of hypoperfusion or ischemia, as rising lactate is a worrying indicator. The high rate of CT scan confirmation for PSBO (95.8%) highlights the indispensable role of advanced cross-sectional imaging in modern SBO management, allowing for accurate diagnosis, differentiation from other acute abdominal conditions, and crucial assessment for signs of strangulation or ischemia that would mandate immediate surgery. The suspected etiologies provide a speculative but plausible breakdown for PSBO in virgin abdomens. A significant portion attributed to idiopathic or congenital bands (35.9%) and hernias (26.9%) aligns with literature suggesting these as common causes in unoperated abdomens. Inflammatory causes (19.2%) and neoplastic processes (9.0%) represent other important, albeit less frequent, categories. The 9.0% where etiology

remained undetermined in successfully managed NOM patients is an inherent outcome of avoiding surgery, where a definitive cause often cannot be ascertained.

Finally, the management data show that a majority of patients (67.1%) underwent surgery. This relatively high operative rate in a PSBO cohort, even in virgin abdomens, might reflect the acuity of presentations at a tertiary center, the presence of underlying etiologies less amenable to NOM (like strangulated internal hernias or tumors), or perhaps a lower threshold for surgical intervention if NOM did not yield rapid improvement. The 9.6% conversion rate from NOM to surgery indicates that while NOM was attempted, a subset of patients either failed to improve or deteriorated, necessitating operative intervention. This conversion rate is a critical factor in evaluating the overall effectiveness and safety profile of an initial NOM strategy. The overall mean LOS of approximately 11.5 days for the entire cohort reflects the significant healthcare burden imposed by this condition.

Table 1. Baseline demographic and clinical characteristics of patients with partial small bowel obstruction in virgin abdomens (N=167).

Characteristic	Category / Details	N (%) / Mean ± SD
Demographics		
Age (years)		50.60±14.94
Gender	Male	80 (47.9%)
	Female	87 (52.1%)
Clinical presentation		
Duration of symptoms (days)		2.8±1.5
Colicky abdominal pain	Yes	158 (94.6%)
Vomiting	Yes	135 (80.8%)
Abdominal distension	Yes	122 (73.1%)
Obstipation (No flatus/stool)	Yes	105 (62.9%)
Initial laboratory findings		
White blood cell count ($x10^3$/L)		11.5±3.2
C-reactive protein (mg/L)		45±25
Serum Lactate (mmol/L)		2.1±0.9
Imaging confirmation		
CT confirmed PSBO	Yes	160 (95.8%)
Suspected etiology	Idiopathic/Congenital Bands	60 (35.9%)
	Hernia (Internal/Occult)	45 (26.9%)
	Inflammatory	32 (19.2%)
	Neoplastic	15 (9.0%)
	Undetermined (NOM successful)	15 (9.0%)
Management & overall outcome		
Definitive management received	Operative	112 (67.1%)
	Conservative (NOM)	55 (32.9%)
Conversion to surgery from NOM	Yes	16 (9.6%)
	No	151 (90.4%)
Overall length of stay (days)		11.46±8.36

The findings presented in Table 2 unequivocally demonstrate the significant impact of the chosen management strategy on the length of hospital stay for patients suffering from partial small bowel obstruction in a virgin abdomen. The operative group's mean LOS of 13.2 days is substantial, reflecting the complex journey these patients undertake. This duration includes not only the time for the surgical procedure

itself but also the preoperative period, which might involve resuscitation and diagnostic confirmation, and, critically, the postoperative recovery phase. Postoperative recovery can be prolonged by factors inherent to abdominal surgery, such as the physiological stress of the operation, the almost inevitable period of postoperative ileus, requirements for effective pain control, nutritional support (often starting with parenteral and gradually transitioning to oral), wound care, and vigilant monitoring for and management of potential complications (such as surgical site infections, anastomotic leaks if resection was performed, intra-abdominal collections, or respiratory and thromboembolic events). The standard deviation of 8.72 days for this group also indicates considerable variability in recovery times, with some patients likely experiencing much longer stays due to complicated postoperative courses. The median LOS of 11.0 days, being lower than the mean, suggests a right-skewed distribution, common for LOS data, where a subset of patients with prolonged stays elevates the mean. The IQR of 7.0 to 17.0 days further emphasizes this variability, showing that 50% of operatively managed patients had stays within this wide 10-day range.

Conversely, the non-operative management group exhibited a markedly more favorable outcome in terms of hospitalization duration. Their mean LOS of 7.74 days is nearly 41.4% shorter than that of the operative group. This dramatically reduced hospital stay signifies a faster resolution of the obstructive episode, quicker restoration of normal bowel function, and a more rapid return to a state of clinical stability, permitting discharge. The standard deviation of 6.12 days, while still indicating some variability, is proportionally smaller relative to its mean compared to the operative group. The median LOS of 6.0 days for the NOM group, again lower than its mean, reinforces the typical skewness of such data. The IQR of 4.0 to 9.0 days shows that the central 50% of NOM patients were discharged within a much narrower and earlier timeframe.

The p-value of <0.001 is of paramount importance. It robustly refutes the null hypothesis that there is no difference in LOS between the two management groups. This high level of statistical significance provides strong evidence that the observed shorter hospital stays in the non-operatively managed group are a genuine effect associated with the conservative treatment strategy itself, rather than a product of random variation. This finding has profound clinical and economic implications. From a patient perspective, a shorter hospital stay generally translates to a quicker return to home and normal activities, reduced exposure to the risks of hospital-acquired infections, and potentially improved overall satisfaction with care. From a healthcare system perspective, reducing the average LOS by over five days per patient for a common condition like PSBO can lead to substantial cost savings through more efficient bed utilization, lower medication and resource consumption, and reduced labor costs associated with prolonged inpatient care.

While this analysis primarily focuses on the direct comparison of LOS, it is implicitly linked to the baseline characteristics and the success of patient selection for NOM. The 16 patients (9.6%) who were converted from NOM to surgery would have ultimately contributed to the LOS statistics of the operative group, and their initial period of NOM would have added to their total hospitalization time. This underscores the importance of accurate initial assessment and ongoing vigilance during NOM to identify patients who are unlikely to resolve conservatively or who develop indications for surgery, thereby avoiding undue delays that could potentially worsen their overall outcome or prolong their eventual hospital stay. The success in achieving a significantly shorter LOS for the 55 patients who completed NOM highlights the benefit of this pathway when appropriately applied.

Table 2. Enhanced comparison of length of hospital stay (LOS) between operative and non-operative management groups in patients with partial small bowel obstruction in virgin abdomens (N=167).

Management group	Number of patients (N)	Mean LOS (days)	Standard deviation (SD) of LOS (days)	Median LOS (days)	Interquartile range (IQR) for LOS (days)	p-value (Mann-Whitney U test)
Operative management	112	13.2	8.72	11.0	(7.0 – 17.0)	<0.001*
Non-operative management (Conservative)	55	7.74	6.12	6.0	(4.0 – 9.0)	

4. Discussion

The findings of this study provide compelling, contemporary evidence from a tertiary Indonesian center regarding the management of partial small bowel obstruction (PSBO) in patients with virgin abdomens. The central and most significant observation was that non-operative management (NOM), when successful, was associated with a substantially shorter length of hospital stay (LOS) compared to operative intervention (7.74±6.12 days for NOM versus 13.2±8.72 days for surgery; $p < 0.001$). The marked reduction in LOS with NOM can be understood through several pathophysiological and theoretical lenses. Firstly, operative intervention, irrespective of its necessity or success, initiates a significant systemic stress response. This includes the release of catecholamines, cortisol, and pro-inflammatory cytokines, leading to a catabolic state, potential immune suppression, and impairment of normal physiological functions, including gastrointestinal motility (postoperative ileus). NOM, by avoiding surgical trauma, largely bypasses this intense systemic stress response, allowing for a more quiescent recovery environment for the body. Secondly, the integrity of the gut barrier is a critical factor. Surgical manipulation of the bowel, even when gentle, can transiently increase intestinal permeability. In the context of SBO, where the bowel wall is already often edematous and potentially compromised, further surgical insult can exacerbate fluid sequestration, delay the recovery of normal absorptive and secretory functions, and potentially increase the risk or extent of bacterial translocation. Successful NOM allows the bowel to recover its physiological function and barrier integrity without this additional iatrogenic injury, contributing to faster resolution of symptoms and earlier readiness for discharge. Thirdly, the inflammatory cascade is differentially affected. While SBO itself is an inflammatory condition due to bowel distension and potential ischemia, surgical trauma introduces a new wave of inflammation associated with tissue injury and healing. This heightened inflammatory state can prolong recovery, contribute to postoperative pain, and delay the return of normal appetite and bowel function. NOM, by facilitating the resolution of obstruction through conservative means (bowel rest, decompression, osmotic agents), aims to quell the existing inflammation without superimposing a surgical inflammatory burden. The mean initial WBC count of $11.5±3.2×10^3$/L in our cohort suggests an existing inflammatory state; avoiding surgery in suitable cases likely prevents an exacerbation of this. Pathophysiologically, PSBO leads to proximal bowel dilatation, increased intraluminal pressure, fluid and electrolyte shifts into the lumen and third space, and altered motility. NOM directly addresses these issues: NGT decompression reduces intraluminal pressure and volume, bowel rest minimizes further stimulation, and intravenous fluids correct systemic deficits. If these measures allow the bowel to overcome the partial obstruction (perhaps by reducing edema around a point of narrowing or allowing a kinking band to straighten), the physiological disturbances

can reverse more rapidly than if the patient undergoes surgery, which, while definitively addressing the mechanical block, entails its own period of imposed physiological derangement (anesthesia effects, postoperative ileus). The quicker restoration of normal intestinal transit and function with successful NOM directly translates to an ability to tolerate oral intake sooner and, consequently, an earlier discharge. The LOS difference observed in our study (approximately 5.5 days shorter with NOM) is clinically significant. While direct comparisons must be cautious due to differing patient populations (our study focused on virgin abdomen PSBO, much literature is on ASBO), the trend is consistent. Broek et al., in their guidelines for ASBO, noted an average LOS of 5 days for NOM versus 16 days for surgery. Our figures (7.74 vs 13.2 days) are within a comparable range, with the slightly longer stays in both our arms perhaps reflecting case complexity at a tertiary center or specific regional healthcare factors. The success rate of NOM, calculated LY at around 77.5% if the 16 converted patients were initially trialed on NOM, is robust and supports NOM as a primary strategy. This rate is encouraging, especially as it approaches figures seen in general ASBO populations where adhesions are the known primary pathology and NOM is well-established.[11-13]

The demographic finding of a mean age around 51 years for PSBO in virgin abdomens suggests this condition is not exclusive to the elderly, who are often considered at higher risk for SBO due to comorbidities and age-related physiological changes. The slight female predominance (52.1%) in our cohort was contrasted in the source document with some studies showing male predominance. This might reflect genuine regional differences in etiology (for instance, a higher local prevalence of undiagnosed internal hernias or inflammatory conditions more common in females) or referral biases to the study center. The observation that 67.1% of patients ultimately underwent operative management warrants further consideration. In an era championing NOM, this rate might seem high. However, in virgin abdomens, the causes of PSBO can be more diverse than simple adhesions and may include conditions that are less amenable to NOM or that inherently require surgical correction, such as incarcerated (especially internal) hernias, obstructing neoplasms, or significant inflammatory strictures. The clinical threshold for surgery might also be lower if there's diagnostic uncertainty about the cause in a virgin abdomen or if signs of potential compromise are subtle. The decision for surgery is always a balance between the risks of continued NOM versus the risks of operation. The 9.6% conversion rate from NOM to surgery indicates that a judicious trial-and-error approach is indeed being practiced, reserving surgery for those who do not respond or who demonstrate clear indications. The data on presenting symptoms (high rates of colicky pain, vomiting, distension) and initial lab findings (mild leukocytosis, potentially elevated CRP and lactate) are consistent with the clinical picture of acute bowel obstruction, emphasizing the need for prompt assessment and intervention. The high reliance on CT scanning (95.8% confirmation) underscores its central role in modern management for accurate diagnosis and, crucially, for identifying patients who require immediate surgery due to strangulation or ischemia. The breakdown of suspected etiologies, with idiopathic/congenital bands and hernias being prominent, aligns with expectations for SBO in virgin abdomens.[14-16]

The primary implication of this study is the strong endorsement it provides for a NOM-first strategy in appropriately selected patients with PSBO in virgin abdomens. The significant reduction in LOS achieved with successful NOM translates directly into benefits for both the patient (faster recovery, reduced risk of nosocomial complications, earlier return to normal life) and the healthcare system (lower costs, improved bed availability). However, this hinges on meticulous patient selection. Ideal candidates for NOM are those who are hemodynamically stable, have no signs of peritonitis, ischemia, or strangulation, and in whom a complete mechanical obstruction has been reasonably excluded. Continuous and vigilant monitoring during

NOM is essential to detect any deterioration or failure to progress, allowing for timely conversion to surgery if needed, thereby avoiding the adverse outcomes associated with delayed operative intervention. The findings also highlight the importance of further characterizing the specific etiologies of PSBO in virgin abdomens. A better understanding of the relative prevalence of causes like congenital bands, internal hernias, occult neoplasms, or inflammatory strictures in this population could help refine initial management decisions and prognostication. For instance, a high suspicion of an incarcerated internal hernia might prompt earlier surgical consideration than a suspected minor inflammatory adhesion.[17,18]

This study's strength lies in its focus on a specific and somewhat under-researched patient population—PSBO in virgin abdomens—providing valuable data from a tertiary care setting in a specific geographical region. The use of a total sampling method for the defined period aimed to minimize selection bias for patients meeting the criteria. The data are contemporary, reflecting current diagnostic and therapeutic practices. However, its retrospective nature carries inherent limitations, such as reliance on the accuracy and completeness of medical record documentation and the potential for unmeasured confounding variables. While the study robustly demonstrates an association between NOM and shorter LOS, causality can be more definitively established with prospective randomized trials, though such trials face ethical and practical challenges in emergency surgical conditions. The single-center design may limit the generalizability of the absolute LOS figures, though the observed *difference* between management arms is likely a more broadly applicable finding. The retrospective design and single-center nature are common limitations acknowledged in such studies. While a detailed breakdown of specific etiologies within the virgin abdomen cohort was not the primary focus of the original data presented, future studies could benefit from prospectively collecting and analyzing such information, as different etiologies (congenital bands vs. occult hernia vs. tumor) may respond differently to NOM or have different prognoses. Further research could also explore the utility of specific predictive scoring systems to better identify virgin abdomen PSBO patients most likely to succeed with NOM, thereby optimizing patient selection and further reducing the need for operative intervention and its associated longer LOS. Multicenter studies would enhance the robustness and generalizability of findings regarding this specific patient population.[19,20]

5. Conclusion

This study, conducted at Dr. Kariadi General Hospital Semarang, has provided significant insights into the management of partial small bowel obstruction in patients with virgin abdomens. The primary conclusion is that non-operative management, when successfully applied to appropriately selected individuals, resulted in a markedly shorter length of hospital stay (7.74±6.12 days) compared to those patients who required operative intervention (13.2±8.72 days). This difference was statistically highly significant ($p < 0.001$). These findings strongly advocate for the continued and prioritized use of non-operative management as the initial therapeutic strategy for clinically stable patients presenting with partial small bowel obstruction in a virgin abdomen, provided there are no contraindications such as signs of peritonitis, bowel ischemia, or strangulation. The substantial reduction in hospitalization duration associated with successful NOM not only facilitates a quicker recovery for the patient but also contributes to more efficient utilization of healthcare resources. The success of this approach, however, is critically dependent on meticulous patient evaluation, careful selection for conservative therapy, and vigilant clinical and radiological monitoring to ensure timely conversion to surgical management should the patient fail to improve or show signs of deterioration. This study reinforces the efficacy of a conservative-first pathway in this unique patient cohort, underscoring its role in accelerating recovery and improving outcomes.

6. References

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