



Optimizing management of sigmoid volvulus: predictors of surgical intervention and early recurrence

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ABSTRACT

Introduction: Sigmoid volvulus is a life-threatening condition requiring urgent intervention. Endoscopic detorsion is the preferred initial treatment; however, delayed surgical management in emergent cases may increase complications and mortality. Additionally, early recurrence following successful detorsion remains a significant challenge. This study aims to identify predictors of emergency surgery and early recurrence in patients with sigmoid volvulus.

Methods: A retrospective analysis was conducted on patients with sigmoid volvulus treated between January 2015 and January 2025. Patients were stratified based on the need for emergency surgery. Demographic data, clinical presentation, laboratory parameters, radiologic findings, and treatment modalities were analyzed. The primary outcomes were the need for emergency surgery and recurrence, while short-term postoperative outcomes were assessed as secondary outcome.

Results: A total of 62 patients were included, with a median age of 77 years. Emergency surgery was required in 34 patients (53.2%). Higher C-reactive protein and lactate levels were associated with emergency surgery. The presence of ischemia on CT or colonoscopy, increased transverse colon diameter, a longer distance from the vascular origin to the obstructed bowel segment, and volvulus rotation $\geq 360^\circ$ were significant predictors of emergency surgical intervention. Multivariate analysis confirmed all predictors except lactate level and transverse colon diameter. Emergency surgery resulted in higher complication and ostomy rates compared to elective surgery following successful detorsion. Recurrence occurred in 13 patients (44.8%), but no significant predictors were identified. However, ostomy rates were higher in the recurrence group without an associated increase in complications.

Conclusion: Predictors of emergency surgery in sigmoid volvulus include a longer distance from the vascular origin to the obstructed segment, ischemia on imaging, elevated CRP levels, and volvulus rotation $\geq 360^\circ$. Early recognition of these factors may facilitate timely surgical decision-making and improve patient outcomes. Further studies are needed to assess recurrence predictors and optimize management strategies.

1. Introduction

Sigmoid volvulus (SV) is a life-threatening condition characterized by the twisting of the sigmoid colon around its mesenteric axis, leading to large bowel obstruction that necessitates urgent intervention [1]. It represents the third most common cause of mechanical large bowel obstruction, following colorectal cancer and diverticular disease [2,3]. SV predominantly affects elderly individuals and is associated with

predisposing factors such as a redundant colon, prior abdominal surgery, diabetes mellitus, and neuropsychiatric disorders [1,4,5]. These patients may pose a higher surgical risk but are also at a higher risk of morbidity and mortality when hospitalized [6,7].

The diagnosis of SV is often diagnosed by clinical history and abdominal radiography, which typically demonstrates a markedly dilated loop of colon—the classic “coffee bean” sign—accompanied by an absence of rectal gas. In recent years, computed tomography (CT) has

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been increasingly utilized to confirm the diagnosis and assess disease severity. Beyond its diagnostic utility, CT may also play a critical role in risk stratification and guiding management decisions. Emergency sigmoid resection is indicated when endoscopic detorsion fails or when evidence of bowel ischemia, necrosis, or perforation is identified on flexible sigmoidoscopy or CT [8]. These patients may experience increased morbidity and mortality and prolonged hospital stay owing to delays during prolonged endoscopic evaluation and management [9].

In cases of uncomplicated SV, endoscopic detorsion alone is often effective. The success rate of endoscopic detorsion has been reported to be between 75–95%, depending on patient selection and clinical factors [10–12]. Nonetheless, recurrence rates remain high, ranging from 30% to 90%, while mortality rates are reported between 7% and 20% [3,5]. Current guidelines recommend early elective sigmoid resection—either open or laparoscopic—following successful endoscopic decompression in patients deemed fit for surgery [13,14]. Ideally, after initial conservative management and medical optimization, such patients should be evaluated for elective surgery during the same hospitalization [8]. However, early recurrence during the initial hospitalization may occur and many patients with early recurrent SV are elderly, frail, and burdened with significant comorbidities, rendering them poor surgical candidates. Despite this, data remain limited regarding factors that predict early recurrence among patients initially treated with endoscopic detorsion during the initial hospitalization.

Given this context, identification of demographic, clinical, biochemical and radiological predictors for both emergency surgery and early recurrence in SV is crucial. Therefore, this study aims to determine factors associated with the need for emergency surgery and the risk of recurrence in patients with sigmoid volvulus. We hypothesize that radiological findings may help predict these outcomes and guide individualized management strategies.

2. Material and methods

2.1. Study design and outcomes

This study was approved by the Institutional Review Board (IRB), and the requirement for informed consent was waived due to its retrospective design. It was a single-center, cross-sectional study conducted at a tertiary-care institution, including patients aged 18 years and older who were admitted and treated under emergency conditions for sigmoid volvulus (SV) between January 2015 and January 2025. The inclusion criteria were: (1) clinically and radiologically confirmed diagnosis of sigmoid volvulus, and (2) computed tomography (CT) of the abdomen and pelvis performed within 24 h of presentation. Patients with a prior history of sigmoid volvulus managed conservatively, as well as those who died before intervention or declined the recommended procedures during emergency department evaluation, were excluded from the study. Patients were categorized into two groups based on the need for emergency surgery: an endoscopic detorsion group and an emergency surgery group. The two groups were compared in terms of demographic, clinical, biochemical, and radiologic characteristics. Patients who underwent endoscopic detorsion were also categorized in early recurrent patients and non-early recurrent patients. Non-early recurrent patients included those who underwent elective surgery during the initial hospitalization or those who were discharged after initial detorsion and did not experience recurrence within 30 days.

The primary outcomes were the need for emergency surgery and recurrence of volvulus. The secondary outcome was the assessment of short-term postoperative results. The study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were followed in reporting the study.

2.2. Treatment Algorithm

Diagnosis and management followed a standardized institutional protocol. Initial evaluation included detailed clinical history, physical examination, and digital rectal examination (DRE) to assess rectal emptying and rule out distal obstruction. Laboratory tests included complete blood count, serum electrolytes, renal function tests, and inflammatory markers to evaluate systemic status and possible complications.

Abdominal radiography was performed as the initial imaging modality, with a markedly dilated sigmoid loop (“coffee bean” sign) and absence of rectal gas considered diagnostic. CT imaging was then used to confirm the diagnosis, evaluate bowel viability, and detect complications such as ischemia, necrosis, or perforation. CT images were retrieved from the institution’s Picture Archiving and Communication System (PACS) (IDS7, Sectra, Linköping, Sweden). All CT images were independently reviewed and subsequently re-evaluated in consensus by two abdominal radiologists with five and ten years of experience, respectively. Abdominal CT scans were performed using either a 160-slice CT system (Aquilion Prime; Toshiba Medical Systems) or a single-source 64-slice dual-energy CT scanner (Discovery CT750 HD; GE Healthcare, WI, USA).

Intravenous contrast enhancement was achieved by administering 80–120 mL of iodinated contrast material (300 mg iodine/mL) at a rate of 3–5 mL/s, followed by a 30–40 mL saline flush through an 18- or 20-gauge antecubital catheter using an automated dual-syringe injector. Image acquisition was performed using a bolus-tracking technique during the portal venous phase.

Patients without evidence of bowel ischemia, necrosis, or perforation on CT underwent endoscopic detorsion using a flexible sigmoidoscope. Successful decompression was confirmed by the passage of stool and gas, along with radiologic evidence of colonic decompression. Following successful detorsion, patients were hospitalized, medically optimized, and evaluated for elective sigmoid resection during the same admission. Non-operative management was reserved for patients deemed poor surgical candidates due to advanced age, severe comorbidities, or poor functional status. These patients were educated about the symptoms of recurrence and instructed to seek immediate medical attention if such symptoms occurred.

Patient selection for surgery after endoscopic detorsion was based, when feasible, on measurable markers of physiological fitness, including hemodynamic stability (systolic blood pressure ≥ 90 mmHg, mean arterial pressure ≥ 65 mmHg), adequate oxygenation ($\text{SpO}_2 \geq 94\%$ on room air or minimal supplemental oxygen), and the absence of uncontrolled infection or severe electrolyte disturbances. Comprehensive cardiopulmonary evaluation and assessment of surgical fitness were performed by anesthesiology, cardiology, and pulmonary specialists. Patients deemed poor surgical candidates were managed conservatively with repeated endoscopic detorsion in the event of early recurrence.

Emergency surgery was indicated in cases of failed endoscopic detorsion or when bowel ischemia, necrosis, or perforation was identified on CT or endoscopy, and in cases of early volvulus recurrence occur. The conventional open approach with midline incision was used for emergency surgical intervention. Surgical technique was selected based on intraoperative findings and patient stability. Hartmann’s procedure or sigmoid resection and Mikulicz colostomy was performed for unstable patients or those with nonviable bowel, whereas sigmoid resection with primary anastomosis was preferred for hemodynamically stable patients with viable bowel.

2.3. Data collection and Definitions

Demographic data included age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) score, presence of diabetes mellitus, neurological comorbidities, and history of previous abdominal surgery. Neurological disorders that affect bowel motility include

Parkinson's disease, multiple sclerosis, stroke, spinal cord injury, amyloidosis, chronic intestinal pseudo-obstruction, Alzheimer's disease, and amyotrophic lateral sclerosis. Overweight patients were defined as a BMI greater than or equal to 25 kg/m². Clinical findings included presenting symptoms and their duration, abdominal distension, and presence of rebound tenderness or rigidity. Bowel obstruction was defined as not passing gas or stool.

Laboratory parameters included white blood cell (WBC) count, neutrophil count, C-reactive protein (CRP), lactate dehydrogenase (LDH), and lactate levels. Radiological findings assessed were the "coffee bean" sign on x-ray, and ischemia suspicion, presence of perforation, degree and direction of volvulus rotation, distance from the obstructed segment to the vascular origin, length of the obstructed sigmoid colon, diameters of the transverse and sigmoid colon, and type of rotation on CT scan.

Radiologic findings were evaluated by an experienced radiologist using coronal and transverse sections of CT scans obtained upon admission to the emergency department. The "coffee bean sign" on abdominal radiography was defined as a markedly dilated, air-filled loop of sigmoid colon with its apex directed toward the right upper quadrant, creating a characteristic bean-shaped configuration with loss of rectal gas. Suspicious ischemia on CT referred to bowel wall thickening, pneumatosis intestinalis, poor or absent mural enhancement, mesenteric stranding, or the presence of pericolic fluid, suggesting compromised vascular perfusion. Perforation on CT was identified by the presence of extraluminal free air, focal discontinuity of the bowel wall, or localized fluid collections adjacent to the sigmoid colon. Volvulus rotation degree was defined as torsion degree of the sigmoid colon around its mesenteric axis, determined by tracing the mesenteric vessels on multiplanar CT images. The direction of rotation was classified as clockwise or counterclockwise according to the orientation of the twisted mesenteric vessels on axial imaging. The distance from the vascular origin to the point of obstruction was measured from the root of the inferior mesenteric artery to the level of maximal luminal narrowing along the sigmoid mesentery (Fig. 1). The length of the obstructed bowel segment was measured from the proximal point of bowel dilation to the distal collapsed segment. Colonic diameters were assessed as follows:

the transverse colon diameter was measured at the widest portion of the transverse colon on axial CT sections, while the sigmoid colon diameter was recorded at the most dilated segment of the volvulized loop (Fig. 2). The axis of torsion was categorized as organoaxial (rotation along the longitudinal axis of the sigmoid colon) or mesenteroaxial (rotation along the short mesenteric axis). Finally, ischemia on colonoscopy was defined by mucosal discoloration, cyanosis, loss of vascular pattern, or ulceration observed during flexible sigmoidoscopy, indicating impaired perfusion or necrosis of the colonic wall.

Early recurrence defined as the return of colonic obstruction during the same hospitalization or within 30 days. Postoperative short-term surgical outcomes were type of surgery, presence of stoma, length of hospital stay (LOS), and 30-day postoperative morbidity (Clavien-Dindo classification ≥ 3) and mortality.

2.4. Statistical analysis

The Shapiro–Wilk test was used to assess the normality of distribution for continuous variables. Continuous data were presented as mean $\pm$ standard deviation (SD) for normally distributed variables and as median with interquartile range (IQR) for non-normally distributed variables. Between-group comparisons were performed using the Student's *t*-test for normally distributed data and the Mann–Whitney *U* test for non-normally distributed data. Categorical variables were summarized as frequencies and percentages, and comparisons between groups were conducted using the Chi-square test or Fisher's exact test, as appropriate.

A two-tailed *p*-value of < 0.05 was considered statistically significant. To identify independent predictors of emergency surgery, a logistic regression model was developed. Variables found to be significant in univariate analyses were entered into the multivariate logistic regression model. Variables with missing data, and definitive operation indications were excluded from the model. All statistical analyses were performed using Jamovi software (version 2.3.28.0; The Jamovi Project, Sydney, Australia).



Fig. 1. Calculation of distance from vascular origin to obstructed segment Figure A shows an axial CT image, and Figure B demonstrates a sagittal MIP reconstruction. The distance from the vascular origin to the point of obstruction was measured from the root of the inferior mesenteric artery to the level of maximal luminal narrowing along the sigmoid mesentery. Yellow interrupted reference lines on both figures indicate the level corresponding to the maximal luminal narrowing.

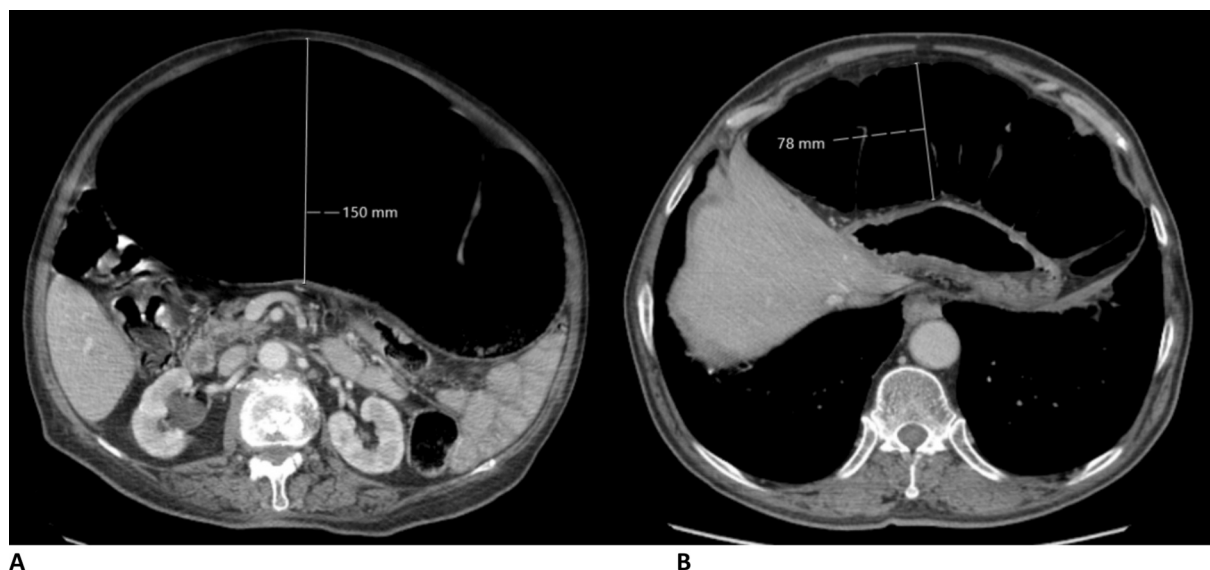


Fig. 2. Maximum diameters of the sigmoid colon (A) and transverse colon (B) were measured from outer wall to outer wall at the points where these bowel loops were widest.

3. Results

After the exclusion (Fig. 3), a total of 62 patients with a median age of 77 years were included in the statistical analysis. Baseline demographic and clinical characteristics are summarized in Table 1.

Due to the presence of acute abdomen findings or perforation at the time of admission, 11 patients (17.74%) underwent emergency surgery without an attempt at detorsion. Endoscopic detorsion was attempted in 51 patients (82.25%) after hospital admission. Emergency surgery was required in 22 of these patients (35.48%) due to endoscopic findings of ischemia or unsuccessful detorsion. In total, 33 patients (53.2%) necessitated emergency surgical intervention upon presentation. Surgical interventions were necessitated by ischemia identified in 10 patients during endoscopic examination, perforation detected in 2 patients via computed tomography (CT) scan, and unsuccessful endoscopic detorsion in 21 patients, which resulted in perforation in one case. Conversely, 29 patients (46.8%) successfully underwent colonoscopic detorsion.

There was no statistically significant difference between the emergency surgery and detorsion groups regarding age, sex, BMI, presence of diabetes mellitus or neurologic disease, ASA score, or abdominal surgery history (Table 1). Similarly, no significant differences were found in clinical presentation between the two groups. The median time from symptom onset to hospital admission was 4 days in both groups.

Among biochemical parameters, higher CRP and lactate levels were significantly associated with the need for emergency surgery (CRP: OR 1.02, 95% CI 1.01–1.03, $p = 0.013$; lactate: OR 2.12, 95% CI 1.01–4.45, $p = 0.024$). The significant predictive factors for emergency surgery were the ischemia suspicion on CT or presence of ischemia on colonoscopy, increased transverse colon diameter, greater distance between the obstructed bowel segment and the vascular origin, and volvulus rotation $\geq 360^\circ$ (Table 1). Patients requiring emergency surgery had a significantly larger transverse colon diameter compared to those undergoing detorsion (6.6 ± 1.9 cm vs. 5.1 ± 1.6 cm; OR 1.66, 95% CI 1.11–2.47, $p = 0.005$). Similarly, the distance between the vascular origin and the obstructed segment was greater in the emergency surgery group (7.6 ± 1.8 cm vs. 5.2 ± 2.1 cm; OR 1.78, 95% CI 1.24–2.54, $p < 0.001$).

In addition, volvulus rotation $\geq 360^\circ$ (OR 3.40, 95% CI 1.02–11.2, $p = 0.042$) and suspicion of ischemia on CT (OR 6.00, 95% CI 1.42–25.1, $p = 0.014$) were significantly associated with the need for emergency

surgery.

The multivariate analysis model incorporated predictive factors, excluding lactate level due to missing data, as well as ischemia observed during flexible sigmoidoscopy, which serves as a definitive indication for surgical intervention. Logistic regression analysis identified that a volvulus rotation of $\geq 360^\circ$, long distance between the vascular origin and the occluded segment, suspicion of ischemia on CT scan, and elevated CRP levels are predictors of the necessity for emergency surgery (Table 2).

There was no significant difference in the length of hospital stay between the endoscopic detorsion and emergency surgery groups ($p = 0.05$). In terms of 30-day mortality, 2 patients (6.9%) in the detorsion group and 7 patients (21.2%) in the emergency surgery group died, with no statistically significant difference ($p = 0.15$). Postoperative complications of Clavien-Dindo grade ≥ 3 occurred in 4 patients (14.8%) in the detorsion group and 13 patients (39.4%) in the emergency surgery group ($p = 0.046$) (Table 1). Stoma was required in 29 patients (87.9%) undergoing emergency surgery.

Among the 29 patients who underwent successful endoscopic detorsion, 4 (13.7%) were managed non-operatively and discharged. All four of these patients subsequently experienced volvulus recurrence, with a median interval of 354 days; three underwent emergency surgery, while one underwent elective resection after volvulus recurrence following second endoscopic detorsion. 15 patients (51.8%) underwent sigmoid resection with primary anastomosis during the initial hospitalization, with a median time to surgery of 7 days. 10 patients (34.4%) experienced early volvulus recurrence during the initial hospitalization, with a median interval of 6 days.

Of the patients with early recurrent volvulus, 6 underwent emergency surgery (4 patients; Hartmann's procedure, and 2 patients; sigmoid resection with Mikulicz colostomy), while 4 were managed with repeat endoscopic detorsion. Of these 4, 2 later underwent surgery during the same hospitalization—one emergently and one electively—while the remaining two underwent surgery at a median of 763.5 days after the initial detorsion.

Univariate analysis demonstrated that both higher ASA scores and a greater incidence of ostomy formation were observed in the early sigmoid volvulus recurrence group (Table 3).

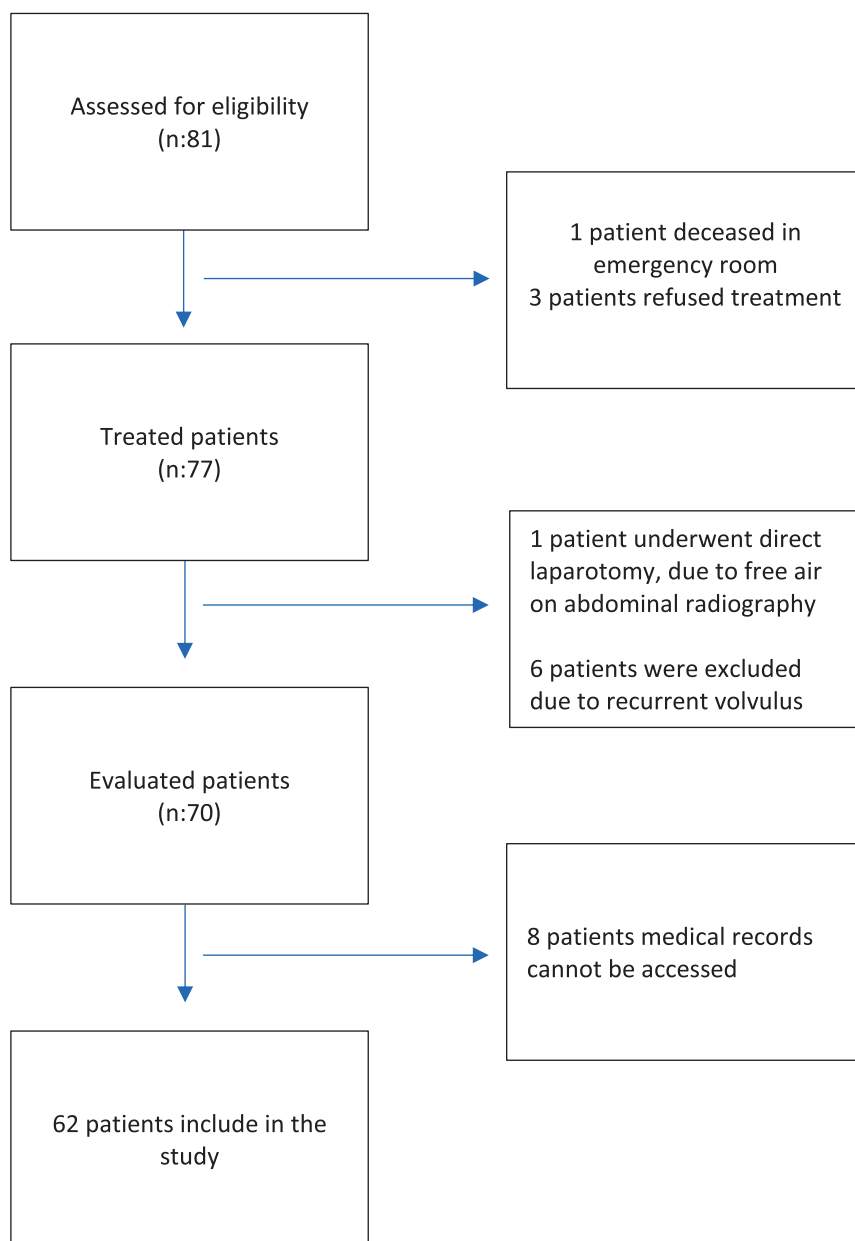


Fig. 3. Flow chart.

4. Discussion

Sigmoid volvulus is a significant cause of gastrointestinal obstruction and requires urgent treatment. Due to the nature of the disease, the presence of comorbid conditions such as old age, immobility, neurological disorders, and diabetes mellitus complicate treatment decisions [15,16]. In our study, we evaluated demographic, clinical, biochemical, and radiological factors to predict the need for urgent surgery. We found that a longer distance between the vascular origin and the occluded segment, radiological suspicion of ischemia, and volvulus rotation $\geq 360^\circ$ were predictive factors for urgent surgery. The presence of these conditions may facilitate early decision-making for urgent surgery and improve patient outcomes.

No significant difference was found in demographic parameters in predicting the need for emergency surgery. However, previous studies have identified female gender and older age as risk factors for emergency surgery [3,17,18]. We probably did not detect a significant difference due to the older male population in our study. Physical

examination findings may support the diagnosis of sigmoid volvulus but are not definitive in determining the need for emergency surgery. Decision-making is often based more on imaging and overall clinical presentation. In our cohort, physical examination findings were not predictive of emergency surgery or recurrence.

Biochemical parameters indicative of sepsis, shock, or ischemia were assessed at baseline. Among these, CRP and lactate levels demonstrated significant associations with the need for emergency surgery in univariate analyses; however, this significance was not retained following logistic regression analysis. The evaluation of lactate levels is contingent upon the discretion of surgeons or emergency room physicians and is not a standardized procedure in our institute. Despite its potential as a predictive marker, lactate levels were excluded from the model due to the presence of missing data in some patients. Nevertheless, Easterday et al. identified preoperative sepsis, leukocytosis, and acute kidney injury as predictors of emergency surgery [3]. In our study, the relatively small cohort may have impacted the identification of biochemicals as predictors.

Table 1

Univariate analysis between endoscopic detorsion and emergency surgery groups.

		Detorsion (n = 29)	Emergency operation (n = 33)	p value
DEMOGRAPHICS and PATIENT HISTORY	Age, years (IQR)	76 (17)	78 (18)	0,20
	Male sex, n (%)	21 (72,4%)	26 (78,8%)	0,55
	Overweight patient, n (%)	6 (20,7%)	1 (3%)	0,11
	Diabetes mellitus, n (%)	6 (20,7%)	8 (24,2%)	0,73
	Neurological comorbidity, n (%)	2 (6,9%)	2 (6,1%)	1
	ASA score $\geq$ III, n (%)	14 (48,3%)	21 (63,6%)	0,22
	Abdominal surgical history, n (%)	8 (27,6%)	9 (27,3%)	0,97
CLINICAL VARIABLES	Duration of symptom presentation, day (IQR)	4 (4,7)	4 (5)	0,60
	Obstruction $>$ 24 h, n (%)	21 (72,4%)	26 (78,8%)	0,55
	Abdominal distention, n (%)	29 (100%)	30 (90,9%)	0,24
	Rebound tenderness, n (%)	3 (10,3%)	8 (24,2%)	0,19
BIOCHEMICAL VARIABLES	WBC, (IQR)	10,5 (6,4)	12,2 (8,7)	0,25
	Neutrophile, (IQR)	8,1 (5,6)	9,4 (7,9)	0,15
	CRP, (IQR)	7 (20,6)	32 (86)	0,013
	LDH, (IQR)	225 (107)	247 (90)	0,22
	Lactate, (IQR)*	1,2 (1,2)	2,4 (1,8)	0,024
IMAGING VARIABLES	Coffee bean sign, n (%)	22 (78,6%)	21 (67,7%)	0,35
	Suspicious ischemia on CT, n (%)	3 (12,5%)	12 (46,2%)	0,014
	Perforation on CT, n (%)	0 (0%)	2 (6,1%)	0,49
	Rotation $\geq$ 360°, n (%)	7 (29,2%)	14 (58,3%)	0,042
	Clockwise rotation, n (%)	13 (54,2%)	10 (41,7%)	0,38
	Distance from vascular origin to obstruction, cm ($\pm$ SD)	5,2 (2,1)	7,6 (1,8)	<0,001
	Length of obstructed bowel segment, cm ($\pm$ SD)	5,2 (2,2)	5,4 (1,8)	0,71
	Transvers colon diameter, cm ($\pm$ SD)	5,1 (1,6)	6,6 (1,9)	0,005
	Sigmoid colon diameter, cm ($\pm$ SD)	9,7 (2,1)	9,7 (2,2)	0,99
	Organoaxial rotation, n (%)	16 (66,7%)	14 (58,3%)	0,55
	Ischemia on colonoscopy, n (%)	0 (0%)	10 (45,5%)	<0,001
	LOS, day (IQR)	14 (11)	8 (5)	0,05
SHORT-TERM POSTOPERATIVE OUTCOMES	Patient process resulted in ostomy, n (%)	1 (7,7%)	10 (76,9%)	<0,001
	Clavien-Dindo score $\geq$ 3, n (%)	4 (14,8%)	13 (39,4%)	0,046
	Mortality (30-day), n (%)	2 (6,9%)	7 (21,2%)	0,15

*missing data in 17 patients.

Table 2

Predictors of emergency operation (Logistic regression analysis).

	reference	Odds Ratio (% 95 CI)	p value
Biochemical variables			
CRP, (IQR)	–	1.02 (0.99 – 1.05)	0.17
CT scan			
Presence of ischemia on CT	no	14.3 (1.52 – 135.3)	0.020
Presence of rotation $\geq$ 360°	$<360^\circ$	19.9 (1.84 – 215.5)	0.014
Distance from vascular origin to obstruction, cm ($\pm$ SD)	–	1.83 (1.08 – 3.08)	0.024
Transvers colon diameter, cm ($\pm$ SD)	–	1.25 (0.72 – 2.16)	0.42

In radiological assessments, the abrupt absence of mucosal enhancement in the volvulus torsion knot, bowel wall thickening, and colonic distension exceeding 9 cm have been documented in the literature as predictive indicators for emergency surgical intervention [14,19,20]. Maloney et al. evaluated clinical outcomes and recurrence based on CT findings and, consistent with our results, demonstrated that imaging features suggestive of ischemia were predictive of the need for surgery. They also reported that marked sigmoid colon distension was associated with recurrence, while the direction of rotation was not related to clinical outcomes [21]. Based on these findings, we focused on the degree of rotation rather than its direction, as well as the distance from the vascular origin. In our study, although colonic distension was evaluated as a potential predictor, the analysis did not demonstrate statistical significance. Our findings initially suggested that a greater distance between the vascular origin and the occluded segment, the presence of ischemia suspicion, and a volvulus rotation of 360° or more were significant predictive factors for emergency surgery. The studies

and variables assessed in this context were limited. Bayeh et al. reported that a long sigmoid colon with an extensive and wide mesentery, yet with a constant base, is highly likely to predispose individuals to sigmoid volvulus; however, they measured the distance intraoperatively rather than through radiological methods [22]. We posit that a longer distance between the vascular origin and the occluded segment may impede the feasibility of endoscopic detorsion, and high rotation rates may increase the risk of ischemia post-rotation. Consequently, radiological predictors should be regarded as critical indicators for emergency surgical intervention.

Early recurrence was another primary outcome in this study. We know that recurrence after endoscopic detorsion is high in the literature ranging between 45% and 71% [19,20,23]. Therefore, elective surgery following endoscopic detorsion is recommended by the WSES consensus guideline, ASCRS Colonic Volvulus and Acute Colonic Pseudo-Obstruction guideline, and ASGE guideline [13,14,24]. However, early recurrence may occur during the initial hospitalization following endoscopic detorsion and has been reported in 5% to 25% of cases [25,26]. In our study, overall recurrence was observed in 44.8% of patients, while early recurrence occurred in 34.4%. Previous studies have reported that older age and male gender are associated with a higher risk of early recurrence [10]. Since the majority of the patients included in the study were older men, we believe this may have contributed to the high early recurrence rate. Various factors predictive of early recurrence have been identified in the literature. Kusunoki et al. reported that a long and redundant sigmoid colon and a sigmoid colon diameter $>$ 9 cm on CT scan were associated with an increased risk of early recurrence [27]. Similarly, Maloney et al. also found that a sigmoid colon distension greater than 9 cm on baseline CT was associated with higher recurrence risk [21]. Tantinam et al. observed that a cecal diameter $\geq$ 6.8 cm and BMI $\geq$ 18.5 kg/m² were significantly associated with recurrence [28]. In contrast, our study did not identify any significant clinical or radiological predictors of recurrence. This discrepancy may be attributable to the limited number of events in our cohort, which may have reduced the

Table 3

Univariate analysis between early recurrent patients and non-recurrent patients.

		Non-early recurrent (n = 19)	Early recurrence (n = 10)	p value
DEMOGRAPHICS and PATIENT HISTORY	Age, years (IQR)	76 (17)	75.5 (11.8)	0.66
	Male sex, n (%)	14 (73.7%)	7 (70%)	1.00
	Overweight patient, n (%)	6 (31.6%)	0 (0%)	0.06
	Diabetes mellitus, n (%)	5 (26.3%)	1 (10%)	0.63
	Neurological comorbidity, n (%)	1 (5.3%)	1 (10%)	1.00
	ASA score $\geq$ III, n (%)	6 (31.6%)	8 (80%)	0.021
	Abdominal surgical history, n (%)	14 (73.7%)	7 (70%)	1.00
	Duration of symptom presentation, day (IQR)	4 (5)	3 (3)	0.44
CLINICAL PRESENTATION	Obstruction > 24 h, n (%)	13 (68.4%)	8 (80%)	0.67
	Abdominal distention, n (%)	19 (100%)	10 (100%)	n/a
	Rebound tenderness, n (%)	2 (10.5%)	1 (10%)	1.00
BIOCHEMICAL VARIABLES	WBC, ($\pm$ SD)	10.8 (4.4)	10.8 (2.9)	0.97
	Neutrophile, ($\pm$ SD)	8.4 (4.1)	8.3 (3.1)	0.92
	CRP, (IQR)	7 (31.4)	7.9 (12.8)	0.81
	LDH, (IQR)	211 (85)	267 (123)	0.40
IMAGING VARIABLES	Lactate, (IQR)	1 (0.7)	2.1 (1.1)	0.06
	Coffee bean sign, n (%)	15 (83.3%)	7 (70%)	0.63
	Suspicious ischemia on CT, n (%)	1 (7.1%)	2 (20%)	0.55
	Rotation $\geq$ 360°, n (%)	4 (28.6%)	3 (30%)	1.00
	Clockwise rotation, n (%)	7 (50%)	6 (60%)	0.69
	Dis from vascular origin to obstruction, cm ($\pm$ SD)	5.5 (2)	5 (1.8)	0.61
	Length of obstructed bowel segment, cm ($\pm$ SD)	4.8 (1.8)	6 (2.8)	0.20
	Transvers colon diameter, cm ($\pm$ SD)	5.3 (2.7)	5.1 (1.8)	0.77
	Sigmoid colon diameter, cm ($\pm$ SD)	9.2 (2.7)	9.4 (1.8)	0.78
	Organoaxial rotation, n (%)	8 (57.1%)	8 (80%)	0.38
	Ischemia on colonoscopy, n (%)	2 (10.5%)	0 (%)	0.53
	LOS, day ($\pm$ SD)	13 (12)	14 (9.5)	0.79
	Patient process resulted in ostomy, n (%)	3 (18.8%)	8 (80%)	0.004
	Clavien-Dindo score $\geq$ 3, n (%)	4 (23.5%)	0 (0%)	0.26
	Mortality (30-day), n (%)			

statistical power to detect meaningful associations.

In our institute, elective surgery was planned during the index hospitalization. Suzanne et al. reported that elective surgery after detorsion resulted in lower stoma formation rates, but longer hospital stays in elderly patients and those with comorbidities [29]. Similarly, our study found lower rates of stoma placement in elective surgery compared with emergency surgery. Although the duration of hospitalization was extended in the elective group, this difference did not reach statistical significance. The prolonged hospital stays may be attributed to the preoperative assessment period required before elective surgery in patients who underwent successful endoscopic detorsion. Additionally, the stoma rate was significantly higher in the early recurrence group, likely due to the increased need for emergency surgery after recurrence. Postoperative complications classified as Clavien-Dindo grade $\geq$ 3 were significantly more common in the emergency surgery group. These findings support the strategy of attempting detorsion whenever possible and performing elective surgery in stable patients. Lastly, the overall 30-day mortality rate was 14.5%, aligning with existing literature, which reports a range from 8% to 44% [30–32]. Our analysis revealed that the 30-day mortality rate was higher in the emergency surgery group, although this difference was not statistically significant. This finding contrasts with previous literature, which reported a significantly higher mortality rate following emergency surgery [33].

As a single-center study conducted at a tertiary-care institution, our findings may not be fully generalizable to other healthcare settings. Moreover, the study population—predominantly elderly males—further limits generalizability to younger patients or those with different gender distributions, in whom predisposing factors and disease progression may differ. Although treatment protocols were designed to ensure standardization, the inherent subjectivity of clinical judgment in critical decision-making—such as whether to proceed with emergency surgery or attempt endoscopic detorsion—could have introduced unquantifiable variability. The relatively small sample size (n = 62), along with the even smaller subgroups analyzed, limited the statistical power to identify predictors of early recurrence. In addition, the limited number of events relative to the number of variables included in the multivariable model may increase the risk of overfitting, potentially affecting the stability and generalizability of the identified predictors. Therefore, the results of the multivariable analysis should be interpreted with caution. This limitation is reflected in our inability to detect statistically significant predictors, despite certain variables (e.g., serum lactate, ASA score) demonstrating trends that might reach significance in a larger cohort. Furthermore, the exclusion of eight patients due to incomplete medical records and the exclusion of those who refused treatment raises the possibility of selection bias. Nevertheless, while ischemia on imaging has been previously recognized as a predictor, our study uniquely identifies and quantifies the prognostic significance of a longer distance between the vascular origin and the occluded segment, as well as a volvulus rotation of $\geq$ 360°, as independent predictors. These findings provide more granular insights into the pathophysiologic mechanics of severe sigmoid volvulus. Although significant predictors of early recurrence could not be identified, larger, multicenter studies with more heterogeneous patient populations are warranted to elucidate these factors. In contrast to prior investigations that focused primarily on either clinical or radiologic parameters, our study offers a comprehensive and integrated evaluation of demographic, clinical, biochemical, and novel radiologic variables, thereby providing a more holistic understanding of predictors for emergency surgery in sigmoid volvulus.

5. Conclusion

Predictors of emergency surgery in sigmoid volvulus include a longer distance between the vascular origin and the obstructed segment, radiologic suspicious of ischemia, elevated CRP levels, and volvulus rotation $\geq$ 360°. Early identification of these factors may facilitate timely surgical decision-making and improve patient outcomes. Further

studies are warranted to evaluate predictors of early recurrence and to optimize treatment strategies.

CRedit authorship contribution statement

Tolga Girgin: Writing – original draft. **Kamil Erozkhan:** Writing – original draft, Validation, Project administration, Methodology, Formal analysis, Conceptualization. **Firat Basci:** Data curation. **Berk Can Karabag:** Data curation. **Aziz Anil Tan:** Visualization, Methodology, Data curation. **Ezgi Guler:** Visualization, Data curation. **Safa Vatans- ever:** Formal analysis. **Osman Bozbiyik:** Writing – review & editing, Supervision, Project administration, Conceptualization. **Cemil Caliskan:** Writing – review & editing. **Mustafa Ali Korkut:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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