

Sigmoid volvulus: diagnosis in 938 patients over 45.5 years

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Abstract

Background Sigmoid volvulus (SV) is the wrapping of the sigmoid colon around itself and its mesentery. The goal of this study was to investigate the diagnosis approach to 938 patients with SV treated at our institution and their clinical outcomes.

Methods The clinical records of 938 patients with SV treated at our institution between June 1966 and January 2012 were retrospectively reviewed.

Results The mean age was 58.6 years (range 10 weeks to 98 years), and 774 patients (82.5 %) were male. A total of 210 (25.1 %) of 837 patients, who provided information on anamnesis and clinical features, had recurrent episodes of volvulus; 215 patients (25.7 %) had comorbidities, and 108 patients (12.9 %) presented with toxic or hypovolemic shock. The mean duration of symptoms was 38.7 h (range 6 h to 7 days), and the most common clinical features were abdominal pain and tenderness (827 of 837 patients, 98.8 %), distention (805 patients, 96.2 %), and obstipation (771 patients, 92.1 %). The final diagnosis was made with endoscopy in 519 patients (55.3 %), endoscopy followed by surgery in 154 patients (16.4 %) and at surgery in 265 patients (28.3 %). The correct diagnosis rate was 71.6 % based on clinical findings compared with 66.7 % based on plain X-ray films, 81.4 % based on both clinical and plain X-ray findings, and 100.0 % based on CT or MRI findings.

Conclusions Sigmoid volvulus is common in adult men. The disease is generally associated with recurrent episodes, comorbidity, and shock. SV generally presents as a

large-bowel obstruction. Although plain X-rays may help with diagnosis, CT and MRI are more reliable diagnostic tools, and flexible endoscopy is always diagnostic. However, surgery is used to diagnose SV in limited situations.

Keywords Sigmoid colon · Volvulus · Radiology · Endoscopy

Introduction

Sigmoid volvulus (SV) describes the wrapping of the sigmoid colon around itself and its mesentery. Although SV is an uncommon disease, it has an interesting geographical distribution, and its incidence is high in Turkey, particularly in Eastern Anatolia, where we are located. Although SV generally presents as a mechanical large-bowel obstruction, the diagnosis of this condition may be difficult and is sometimes made during laparotomy or autopsy [1–3]. The aim of this study was to assess diagnostic methods used in SV patients.

Materials and methods

A total of 938 patients with SV were treated as emergency cases in the Department of General Surgery, Faculty of Medicine, Atatürk University over a 45.5-year period between June 1966 and January 2012. The patients' clinical records were reviewed retrospectively, and the age, gender, number of previous SV episodes, associated diseases, duration of symptoms, clinical signs and symptoms, and radiological and endoscopic findings were noted.

Clinical examinations of all patients were performed after resuscitation. The presence of symptoms and signs

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including hypotension, tachycardia, tachypnea, fever, oliguria, and confusion was accepted as shock. In addition to abdominal X-rays, which were obtained for all patients, CTs or MRIs were obtained in some stable patients. Non-operative procedures, including barium enema, rigid sigmoidoscopy, or flexible sigmoidoscopy were performed for both the diagnosis and the treatment of stable patients. Emergent surgical procedures, including various nondefinitive or definitive procedures, such as detorsion, sigmoidopexy, mesosigmoidoplasty, sigmoid resection with primary anastomosis, or stoma were used as the initial treatment in the patients with acute abdominal findings, including muscular defense, rebound tenderness during clinical examination, melanotic stools during rectal examination, and other difficulties with diagnosis. Emergent surgery was also used after nonoperative procedures in the patients with bowel gangrene, which was determined during endoscopy, and in those with unsuccessful nonoperative detorsion procedures or early recurrences occurred in the same hospitalization period. A successful nonoperative detorsion was defined as passing to the proximal of the twisted segment site in endoscopic examination, providing an adequate gas and/or stool discharging in addition to removing abdominal pain, distention, and other complaints in clinical examination, and disappearing the SV signs in radiological examination in the current hospitalization period. The final diagnosis of SV was confirmed by endoscopy or, in some patients, by surgery.

Results

The ages of the 938 patients with SV ranged from 10 weeks to 98 years (mean 58.6 years) (Table 1), and 774 patients (82.5 %) were male.

Table 1 Age of the patients with sigmoid volvulus

Age	Patient	%
0–9	4	0.4
10–19	14	1.5
20–29	36	3.8
30–39	39	4.2
40–49	173	18.4
50–59	195	20.8
60–69 ^a	253	27.0
70–79	136	14.5
80–89	79	8.4
90 and over	9	1.0
Total	938	100.0

^a The peak incidence

Of the 837 patients who provided information on anamnesis and clinical features, 210 (25.1 %) had a history of volvulus (164 patients after nonoperative detorsion, 46 patients after surgical detorsion), and 215 (25.7 %) had comorbidities, including chronic obstructive pulmonary disease in 143 patients, hypertension in 95 patients, cardiac, or coronary disease in 83 patients, diabetes mellitus in 26 patients, neurological diseases in 15 patients, and renal insufficiency in 10 patients. Of the total 837 patients, 12.9 % (108 patients) suffered from toxic and/or hypovolemic shock. The duration of symptoms ranged from 6 h to 7 days (mean 38.7 h). The most common symptoms were abdominal pain, distention, and obstipation, and the most common signs were abdominal tenderness and distention (Table 2; Fig. 1).

Of the 787 patients for whom abdominal X-ray films (plain erect or lateral decubitus) were evaluated, 525 (66.7 %) presented X-ray findings of SV, such as a dilated sigmoid colon with intestinal air-fluid levels (Fig. 2). CT was used in 50 patients (5.3 %), while MRI was used in 34 patients (3.6 %), and in all patients, these advanced imaging procedures showed evidence of SV, including a whirl pattern in the mesentery and dilated segments of sigmoid colon (Figs. 3, 4).

Nonoperative procedures were performed in 673 patients (71.7 %), including barium enema in 13 patients (1.9 %) from 1966 to 1968; rigid sigmoidoscopy in 351 (52.2 %) from 1966 to 1988, and flexible sigmoidoscopy in 309 (45.9 %) from 1988 to the present. Rigid sigmoidoscopy was the most preferred procedure before 2003, while flexible sigmoidoscopy was the most utilized method from 2003 to the present. Endoscopic examination enables the diagnosis by visualization of the twisted segment site and is also valuable at assessing mucosal viability (Fig. 5). Barium enema was successful in 9 of 13 patients (69.2 %). Of

Table 2 Signs and symptoms associated with the patients with sigmoid volvulus

Symptom/sign	Patients ^a	%
Abdominal pain and/or tenderness	827	98.8
Distention	805	96.2
Obstipation	771	92.1
Vomiting	591	70.6
Empty rectal vault	549	65.6
Diminished bowel sound	380	45.4
Increased bowel sound	257	30.7
Melanotic stool	93	11.1
Guarding/rebound tenderness	69	8.2
Toxic and/or hypovolemic shock	108	12.9

^a In 837 patients who provided information on anamnesis and clinical features



Fig. 1 Clinical appearance of sigmoid volvulus (asymmetrical distention in abdomen)

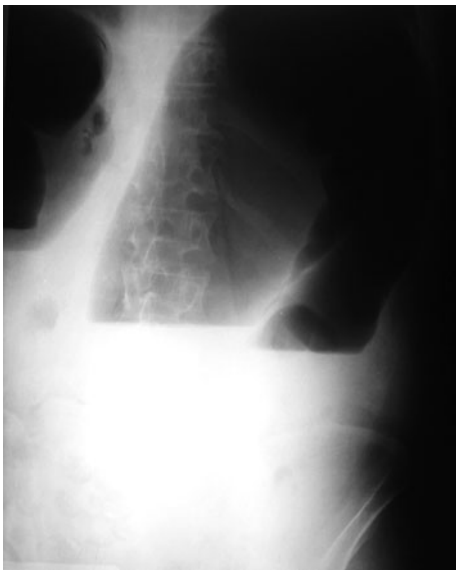


Fig. 2 Plain erect abdominal X-ray film of sigmoid volvulus (dilated omega-like sigmoid colon)

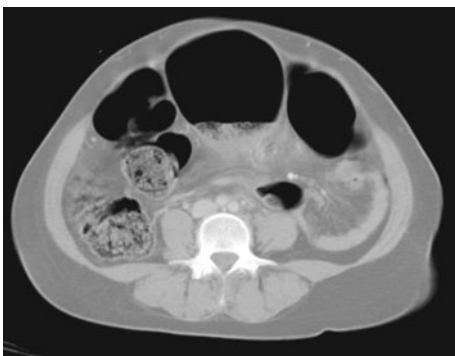


Fig. 3 Axial abdominal CT image of sigmoid volvulus (dilated sigmoid colon with whirl pattern in mesentery)

the 660 patients who underwent endoscopic detorsion, the procedure was successful in 510 patients (77.3 %). Of the nonsurgically treated 673 patients, 37 (5.5 %) had endoscopic signs of bowel gangrene and underwent immediate

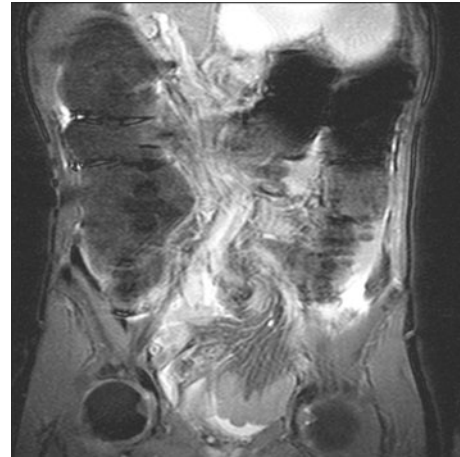


Fig. 4 Coronal T2-weighted abdominal MRI image in sigmoid volvulus (dilated sigmoid colon with whirl pattern in mesentery)

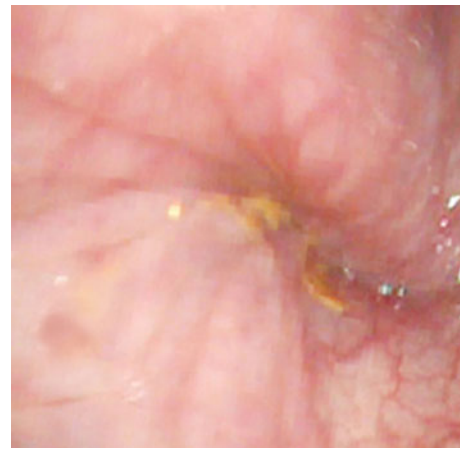


Fig. 5 Endoscopic appearance of sigmoid volvulus (spiral spincter-like twist of the mucosa)

surgery, 117 (17.4 %) had unsuccessful detorsion requiring emergency surgery, 23 (3.4 %) had early SV recurrence and underwent immediate surgery, 5 (0.7 %) died, while 491 (73.0 %) did not undergo any further emergency treatment after successful endoscopic detorsion.

Surgical treatment was necessary in 442 patients (47.1 %). Surgery was used as the initial treatment in 69 patients with acute abdominal findings, in 93 patients (9.9 %) with melanotic stools during at rectal examination, in 91 patients (9.7 %) with uncertain diagnosis, and in 12 pediatric patients. Surgery was also used after nonoperative procedures in 37 patients with bowel gangrene, which was diagnosed during endoscopy, in 117 patients with unsuccessful nonoperative detorsion procedures, and in 23 patients with early recurrence. In surgically treated group, in 292 (84.1 %) of 347 evaluated patients, we found evidence of a redundant sigmoid colon with an elongated mesentery with a narrow base, which is an anatomic factor

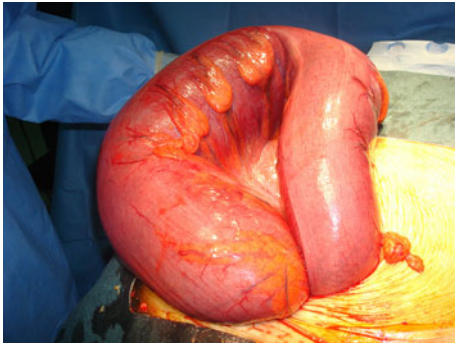


Fig. 6 Operative appearance in sigmoid volvulus (dilated sigmoid colon with an elongated mesentery and a narrow base)

that predisposes patients to SV (Fig. 6). Of the 442 patients, 271 (61.3 %) had sigmoid gangrene including 37 patients diagnosed after endoscopic detorsion.

The final diagnosis was made with endoscopy in 519 patients (55.3 %), endoscopy followed by surgery in 154 patients (16.4 %) and at surgery in 265 patients (28.3 %). The correct diagnosis rate was 71.6 % based on the clinical findings (672/938), 66.7 % based on X-rays (525/787), 81.4 % based on both clinical and X-ray findings (764/938), and 100.0 % based on CT or MRI findings (50/50 and 34/34, respectively). In contrast, 100 % of cases were correctly diagnosed based on endoscopic findings (140/140 when 117 patients with unsuccessful therapeutic endoscopy and 23 patients with early recurrence were included and 37 patients with endoscopically diagnosed bowel gangrene were excluded). However, the retrospective interpretation of the clinical features demonstrated that 734 of 837 evaluated patients (87.7 %) suffered from the classical SV triad, including abdominal pain, distention, and obstipation. Based on the clinical and radiological evaluation, SV was misdiagnosed as an obstructive abdominal emergency (adhesive ileus, malignancy, and intussusception) in 159 patients (17.0 %) and nonobstructive abdominal emergency (perforated appendicitis and intestinal ischemia) in 14 patients (1.5 %).

Discussion

Sigmoid volvulus (SV) is a condition in which the sigmoid colon wraps around itself and its mesentery, thereby causing a closed-loop large-bowel obstruction [1–3]. The incidence of SV is high in Africa, Asia, the Middle East, Eastern and Northern Europe, and South America [1–4], as well as in Turkey, particularly in Eastern Anatolia. The highest rate of incidence of SV is between the fourth and eighth decades of life (mean age range 52–68 years), and the male-to-female ratio ranges from 1.4:1 to 4:1 [1, 2], which is in agreement with our sample.

A clear characteristic of SV is its tendency to recur. The recurrence rate of SV ranges from 13 to 85 % [3–5], and we observed that 25.1 % of our patients had prior episodes of SV. Similarly, comorbidities often accompany the diagnosis of SV, reportedly ranging from 25 to 63 % of SV patients [1, 3–5], and 25.7 % of our patients with SV had serious comorbidities. Finally, SV is also commonly associated with toxic and/or hypovolemic shock, reportedly seen in 7–13.5 % of SV patients [1, 3–6], and shock was diagnosed in 12.9 % of the patients in this series. Shock associated with SV is due to comorbidities, and delays in seeking medical attention [1, 3, 7–9], the last of which is, in our opinion, associated with low socioeconomic levels.

The clinical presentation of SV depends on the duration and degree of colonic torsion [1]. Abdominal pain, abdominal distention, and obstipation, which are seen in an average of 93.0, 89.9, and 83.0 % of endemic SV cases, while an average of 64.8, 88.9, and 52.4 % of the sporadic SV cases, respectively, are the most common clinical signs. Together, these are known as the classical SV triad [1–3, 5–17]. The classical SV triad was seen in a high percentage of the patients in this series. We contend that the presence of this triad in a male patient over 40 years of age, particularly in one who lives in an endemic region, is highly suggestive of SV. Other common complaints include vomiting (40.6–47.6 %), nausea (29.5–36.1 %), diarrhea (9.5–21.6 %), and anorexia. In addition, asymmetrical abdominal distention and abdominal tenderness, which are seen in an average of 73.9 % of SV patients, are the major clinical findings. Additional findings include empty rectum (42.8–63.6 %), decreased bowel sounds (31.2–58.9 %), increased bowel sounds (41.1–68.8 %), visible peristalsis (7.3–31.9 %), dehydration (28.8–50.5 %), fever (25.9–28.1 %), muscular defense/rebound sign (8.9–14.9 %), melanotic rectal stool (7.3–11.8 %), hematemesis (11.5 %), dyspnea (6.8–88 %), abdominal mass, and fecal breath odor. The presence of melanotic rectal stools or muscular defense and/or rebound sign may be indicators of bowel gangrene and/or perforation with peritonitis [1–3, 5–17]. In this series, the clinical features were compatible with those that have been reported in the literature (Table 3).

Although SV is known as a cause of hypokalemia [18] and hypokalemia is believed to be a risk factor for intermittent SV [19], routine laboratory findings are not clear indicators of SV, and these findings are often related to intestinal obstructions and/or bowel ischemia or gangrene [20].

In SV, although the main diagnostic plain abdominal X-ray signs are the presence of a dilated sigmoid colon and/or multiple intestinal air-fluid levels, several signs are described including omega or horseshoe sign (an omega-like or horseshoe-like formation of the dilated sigmoid colon), bird-beak sign (sharp bird-beak aspects of the ends

Table 3 Clinical features of patients with sigmoid volvulus in various series

Author	Years	Patient number	Clinical features (%)								
			Pain/tenderness	Distension	Obstipation	Vomiting	Empty rectal vault	Decreased bowel sounds	Increased bowel sounds	Melanotic stools	Guarding/rebound tenderness
Raveenthiran et al. [1]	2010	4–50 series	89.9	93.0	83.0	47.6	63.6	41.1	58.9	11.5	14.9
Atamanalp et al. [3]	2011	Elderly, 453	98.8	95.9	91.2	73.5	64.0	44.4	33.4	11.5	9.5
Ballantyne et al. [5]	1985	59	85	88	73	27					
Grossmann et al. [6]	2000	228	21.9	67.1	21.9	21.9					
Bak et al. [8]	1986	Elderly, 51	63	94	51	35	39			3.9	
Heis et al. [10]	2008	32	91	84	63	72	53		31	19	47
Raveenthiran [14]	2000	86									33.7
Arnold et al. [15]	1973	99	52.4	87.4	76.2		30.1			4.2	28.7
Atamanalp et al. [16]	2004	Children, 19	89.5	78.9	57.9	73.7	57.9	57.9	31.6	21.1	52.6
Oncu et al. [17]	1991	18	100.0	100.0	100.0	100.0		22.3	77.8		

of the sigmoid segments), inverted U or V sign (U or V-type formations of the ends of sigmoid segments), Y sign (a Y-type formation of the swollen sigmoid mesentery and haustras), northern exposure sign (a dilated sigmoid colon formation that ascends cephalad to the transverse colon), coffee bean sign (a coffee bean-like shape formed by dilated sigmoid colon), bent inner tube or ace of spade sign (a dilated, ahaustral loop of sigmoid colon), left pelvic overlap or left flank overlap sign (two distended sigmoid colon segments touching each other in the left pelvis or flank), liver overlap sign (a distended bowel touching the lower border of the liver shadow at the right upper quadrant), and empty left iliac fossa sign (absence of gas shadow at the left iliac fossa) [1, 2, 5, 9, 14, 21–25]. Additionally, barium or water-soluble contrast enemas may show the obstructive lumen as a beak-like termination, but this approach is not used if there is evidence or suspicion of bowel gangrene, perforation, or peritonitis [1, 2, 5, 21, 22, 26]. In this series, the use of contrast enemas was limited, particularly in children. Alternatively, Doppler ultrasonography and laser Doppler flowmetry may be useful for predicting bowel ischemia or gangrene rather than diagnosing SV [1, 27, 28].

Abdominal CT generally shows a whirled sigmoid mesentery in addition to dilated sigmoid loops and intestinal air-fluid levels [1, 2, 10, 21, 29–31]. Similar findings are generally found in abdominal MRI analysis [1, 2]. Both CT and MRI are valuable tools for diagnosing SV. Furthermore, these studies may help to exclude other causes of intestinal obstruction, such as intestinal malignancy, and to diagnose such complications as perforation [1, 2, 29–31].

In our series, CT and MRI were highly accurate in diagnosing SV in a limited patient population in recent years.

Rigid or, preferably, flexible endoscopy usually shows a spiral sphincter-like twist of the mucosa in the obstructed distal sigmoid segment, which is usually 20–30 cm from the anal verge. In addition to its high diagnostic value, flexible endoscopy directly shows the viability of the sigmoid mucosa and may also identify the other causes of intestinal obstruction; in addition, it may contribute to the treatment of noncomplicated patients [1–3, 11, 32–34]. In the present study, rigid or flexible endoscopy was used for both the diagnosis and the initial treatment of a large number of SV patients. We believe that flexible endoscopy is the most suitable and successful method in SV patients in whom bowel gangrene, perforation, or peritonitis is not present. Additionally, in accordance with reports in the literature, emergency surgical treatment was used in this study for SV patients with bowel gangrene, perforation, or peritonitis and for those in whom nonoperative treatment was unsuccessful.

Although various clinical and radiological findings have been thoroughly described, the diagnosis of SV may be difficult, particularly when CT, MRI, or flexible endoscopy is not used [1–3, 15, 16]. In previous reports, clinical and X-ray findings have been found to lead to correct diagnoses in 63–87.5 % of cases [10, 15], and they did so in 81.4 % of the cases in this series. Similarly, the correct diagnosis rate based on X-ray radiography alone has been reported to be 57–90 % [8, 10, 15, 17, 26], and this rate was 66.7 % in our series. In contrast, although some reports agree that barium enema is diagnostic in only 20–30 % of SV cases

[5, 14], in some others, this technique has been found to be more beneficial than plain radiography in the diagnosis of SV, and it is more useful in children than in adults [1, 26]. The major cause of misdiagnosis is the presence of accompanying findings indicative of small bowel obstructions, which result in improper diagnoses of small bowel obstructions. Other forms of large-bowel obstruction, especially those due to colorectal malignancy, pseudo-obstruction, paralytic ileus, toxic megacolon, Hirschsprung's disease, cecal volvulus, and giant colonic diverticulum, may clinically or radiologically mimic or be confused with SV [1, 2, 14]. The diagnostic accuracy rates of CT and MRI analysis approaches 100 % for SV [1, 2, 10, 21, 23, 31], and it is clear that using these techniques whenever possible improves the rate of correct diagnosis of the disease. Similarly, flexible endoscopy has a high diagnostic value for SV [1, 2, 32, 33], and it has been promoted as the primary treatment option for noncomplicated cases [4, 34].

Despite modern technology, the diagnosis of SV is currently made only at laparotomy or autopsy in 10–15 % of patients [1, 10]. These findings suggest that SV may be difficult to diagnose in some cases. Although the diagnosis of SV is often made by clinical, radiological, and occasionally operative findings, CT, MRI, or flexible endoscopy may be valuable tools for facilitating proper diagnoses.

Conflict of interest The author declares that he has no conflict of interest to the publication of this article.

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