

Acute Small Bowel Volvulus in Adults

A Sporadic Form of Strangulating Intestinal Obstruction

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Small bowel volvulus is an uncommon but important cause of small intestinal obstruction. It often results in ischemia or even infarction. Delay in diagnosis and surgical intervention increases morbidity and mortality rates. Based on cause, small bowel volvulus can be divided into primary and secondary type. Goals for treatment of small bowel volvulus should include physician awareness of this uncommon diagnosis, accurate workup, and advanced surgical intervention. The presentation and subsequent management of 35 patients with small bowel volvulus confirmed by laparotomy are reviewed and discussed. The incidence of small bowel volvulus in the adult European and North American is low. The resultant mortality rate, however, makes diagnosis critically important. The cardinal presenting symptom is abdominal pain. There is no single specific diagnostic clinical sign or abnormality in laboratory or radiologic finding. In practice, the diagnosis can only be made by laparotomy. The failure to perform an exploratory laparotomy cannot be justified. Early diagnosis and early surgery are the keys for successful management of strangulation obstruction of the small bowel.

VOLVULUS IS A special form of mechanical intestinal obstruction. It results from abnormal twisting of a loop of bowel around the axis of its own mesentery. The clinical presentation is that of an acute abdomen. The cause of symptoms may be due to narrowing of the bowel itself, or strangulation of the blood supply, or both.¹ With failure to recognize volvulus, the result of impaired circulation to the obstructed intestine can be catastrophic. The types and incidence of intestinal volvulus are age related and demonstrate wide geographic differences.² In adults, volvulus of the colon, sigmoid colon in 70% to 80%, and the cecum in 10% to 20% of cases, is common.³ Volvulus of the small intestine, however, is relatively rare in contrast.²

Reflecting cause, small bowel volvulus can be differentiated into primary and secondary type.⁴ Primary small

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bowel volvulus occurs in a normal abdominal cavity with no underlying anatomic abnormalities or predisposing factors. This type of bowel disorder is relatively common among the adult population of certain states in Africa, the Middle East, and Indian subcontinent. It seems to be associated with special dietary habits.⁵⁻¹² It is also surprisingly frequent in Finland,¹³ but rarely seen within the rest of Europe and the North American continent. Secondary small bowel volvulus occurs in the presence of predisposing lesions, either congenital or acquired. Included are anatomic malformations and malrotations or midgut nonrotations,¹⁴⁻¹⁸ tension bands, and postoperative adhesions.

Both types of small bowel volvulus are an unusual surgical condition of obstruction in the adult population of Western Europeans and North Americans.² Little attention has been focused on this problem, and so there are only a few specific and detailed reports on this topic out of these regions.^{4,19-21} The purpose of this report was to review our own experience with small bowel volvulus treated at the Massachusetts General Hospital over a 10-year period with respect to clinical, laboratory, and roentgenographic findings and outcome.

Methods

The clinical records of patients with a discharge diagnosis of volvulus or small bowel obstruction were reviewed to find those with small bowel volvulus proven by laparotomy. The patients were seen during a 10-year period from July 1980 to June 1990. Patients with small bowel obstruction due to incarcerated external hernias, or strangulation caused by mesenteric defects (internal hernias), malignant tumors, inflammatory bowel disease with obstruction, neonates, and young children with volvulus due

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TABLE 1. Review of the Pertinent Literature

Authors	Roggo (current study)	Frazer ¹²	Welch ⁴¹	Juler ¹⁸	Moretz ²³	Duke ⁸	Gulati ¹⁴	Wapnick ²⁹	Agrawal ¹	Sajid ²⁸	Vaez-Zadeh ²⁷	De Souza ⁶
Location	Boston	Rochester, MN	Glasgow, UK	Long Beach, CA	Salt Lake City, UT; Rochester, NY	Afghanistan	India	Israel	India	Iran	Iran	Uganda
Period	1980-1990	1975-1984	1965-1980	1950-1970	1925-1947	1970-1971	1966-1971	1967-1970	1967-1968	1962-1968	1962-1967	1962-1964
No. of patients	35	57	53	40	36	26	54	51	29	65	41	12
Annual occurrence	3.5	5.7	3.5	2	1.7	24	9	12.8	24.9	10.8	8.2	6
Male	16 (46%)	28 (50%)	25 (47%)	37 (93%)	—	26 (100%)	50 (93%)	—	26 (89%)	61 (94%)	37 (90%)	9 (75%)
Female	19 (54%)	29 (50%)	28 (53%)	3 (7%)	—	—	4 (7%)	—	3 (11%)	4 (6%)	4 (10%)	3 (25%)
Average age (yr)	67	59	54	58	45	—	37	—	—	31	42	34
Operative findings (%)												
Primary SBV	14	11	30	10	22	100	70	—	31	74	80	100
Secondary SBV	86	89	70	90	78	—	30	—	69	26	20	—
Gangrenous small bowel	46	49	43	43	50	—	15	—	—	—	—	17
Necessary resection	51	49	64	—	—	—	—	20	41	—	—	17
Mortality (%)												
Overall	9	12	28*	10†	33*	15†	26	14*	38	28	15	33
Viable bowel	0	3	11	—	6	5	26	8	25	—	—	20
Gangrenous bowel	17	21	47	—	61	40	25	29	67	—	—	100

† One patient died before surgery.

SBV, small bowel volvulus.

* Four patients died before surgery.

to anomalies of intestinal malrotation were excluded. Patients with small bowel obstruction and suspected volvulus who were treated successfully without surgery and for that reason lacking intraoperative diagnostic verification were also eliminated. The remaining records of 35 cases were carefully examined and analyzed retrospectively for history, physical examination, laboratory values, x-ray studies, time from admission to operation, surgical findings, hospital course, and complications. Small bowel volvulus was classified as primary or secondary. The results of these 35 consecutive patients are compiled and compared with detailed previous reports in Table 1.

Results

Patient Population

Thirty-five patients with small bowel volvulus as a cause of small bowel obstruction made or proven at laparotomy were treated. All 35 patients were admitted through the emergency room. They represent 1.7% of all cases admitted with acute intestinal obstruction, and 4% of all cases with small bowel obstruction. The patients ranged in age from 31 to 90 years, with a mean of 67 years (Fig. 1). Sixteen patients were male (46%) and 19 were female (54%). None were pregnant. Before surgical intervention, adequate resuscitative measures were instituted, electrolyte and fluid balance disturbances were corrected, and a nasogastric tube for decompression was placed.

History and Symptoms

Thirty-three of 35 patients had the typical history and symptoms of an acute abdomen. In 29 cases (83%), they were highly suggestive of bowel obstruction. Three patients gave a history of earlier intestinal volvulus or bowel obstruction. Twenty-seven patients had undergone previous abdominal surgery. Eight patients had severe concomitant medical disorders, including pancreatitis, chronic obstructive pulmonary disease, congestive heart failure and Crohn's disease. The duration from first symptoms to hospital admission ranged from a few hours to 5 days. The onset of symptoms was acute in 30 patients (86%). Abdominal pain was the most frequent symptom, present in 94%. Nausea and vomiting was present in 83% (in 94% of those cases with bowel necrosis). Two patients, one with multiple sclerosis and another who was institutionalized, had painless abdominal distention.

Physical Examination

Twenty-seven patients (77%) had abdominal distention. Abdominal tenderness on palpation was present in 31 (89%). Nine patients (26%) showed signs of peritoneal irritation (rebound tenderness, involuntary guarding, or rigidity) There was a positive correlation for gangrenous small bowel in six cases. A palpable abdominal mass was

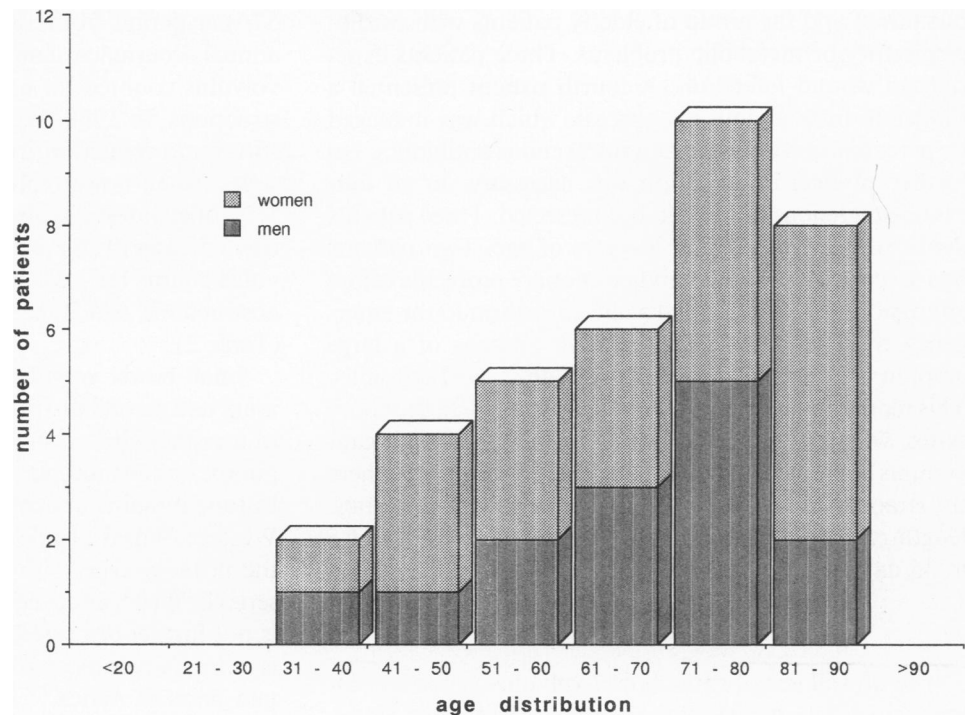


FIG. 1. Age and sex distribution.

found in seven patients (20%). At laparotomy, three of these seven patients had gangrenous small bowel. Bowel sounds were reported as absent 14 times (40%), high-pitched 16 times (46%), normal two times, and three times were not recorded. Seven patients (20%) had an oral temperature higher than 37.8 C (100 F). Five of them were found to have a gangrenous small bowel. In 13 cases (37%), a tachycardia with a heart rate greater than 100 beats/minute was recorded, eight patients without and five with bowel necrosis.

Laboratory Tests

A white blood cell (WBC) count of greater than 10,000/cm³ was recorded in 23 patients (66%), 37% (7 cases) of the 19 patients with viable bowel and in 100% of the 16 patients with gangrenous bowel. The WBC count was greater than 18,000/cm³ in 13 of 16 patients (81%) who had gangrenous bowel. Other routine laboratory tests such as hematocrit, electrolytes, and transaminases, as well as hyperamylasemia recorded in four cases, were of no diagnostic value. Testing of the stool for occult blood was positive in nine patients (26%). Lactate level was rarely determined.

Radiologic Examinations

Supine and upright abdominal radiograph films were obtained for all patients. Findings of distended bowel, air fluid levels, or both, consistent with small bowel obstruction, were noted in 31 of 35 cases (89%). In one case, the appearance of closed loop obstruction suggested small

bowel volvulus. In four patients, films failed to demonstrate convincingly the presence of obstruction.

Surgical Findings

After admission through the emergency room, patients underwent surgical exploration in the group with gangrenous bowel at a median time of 16 hours (range, 8 to 32 hours) and in the group with viable bowel at a median time of 19 hours (range, 9 to 44 hours). Small bowel volvulus as the cause of obstruction was confirmed in all. The twisted segment was found to be gangrenous in 16 patients (46%). Resection of a small bowel segment for vascular compromise was carried out in 18 patients (51%). Primary anastomosis was performed in all cases. Seventeen patients with viable twisted small bowel segment underwent simple derotation.

In five patients (14%), all men, small bowel volvulus was considered primary. In 30 patients (86%), 11 men and 19 women, it was secondary. In 29 patients, secondary type was due to adhesions or fibrous bands, and in one patient it was related to a Meckel's diverticulum. Twenty-three of 30 patients with secondary type had undergone previous laparotomy. There was no patient with small bowel volvulus as a result of midgut nonrotation, or other anatomic abnormalities predisposing to a small bowel volvulus.

Morbidity and Mortality Rates

Postoperative complications occurred in 37% (13 patients) and were found mainly in the group with gangrenous

ous bowel and the group of elderly patients with cardiorespiratory or metabolic problems. Three patients experienced wound infections. A fourth patient presented a moderate intra-abdominal abscess, which was managed by percutaneous drainage and intravenous antibiotics. No further surgical intervention was necessary. In all four cases, gangrenous bowel had been resected. Three patients died. All were older than 70 years of age. Two patients had severe cardiovascular and pulmonary problems before admission. One patient had a late admission to the emergency room and the intraoperative findings of a large amount of gangrenous small bowel with severe peritonitis. This represents an overall mortality rate of 9% in the entire series, with a 17% mortality rate in the group with gangrenous small bowel. No patient died in the group where the strangulated small bowel was still viable. The average length of hospitalization was 15 days, with a range of 5 to 35 days.

Discussion

The prevalence of small bowel volvulus varies considerably in different parts of the world. In the United States, Canada, and Western Europe, small bowel volvulus does not represent a health problem of the same magnitude as it is in some African and Asian States, where the disease seems to be more common (Table 1). This may be the reason that little attention is directed toward this relatively rare and uncommon surgical problem in the North American literature.

Our data, together with the literature review of extensive reports,^{4-9,11,12,19,21} are compiled in Tables 1 and 2. The annual occurrence in North America^{4,19,20} and Western Europe²¹ is 1.7 to 5.7, which is quite low when compared with that in African,⁶ Asian,^{5,7,8} and Middle Eastern countries.^{9,11,12} In these areas, the annual occurrence varies from 6 in Lira, Uganda⁶ to 24 in Jalalabad, Afghanistan⁷ or 24.9 in Varanasi, India.⁵ In a former analysis performed by Sweet²² at the Massachusetts General Hospital, the author found only 36 cases of small bowel volvulus in the

57-year period from 1873 to 1930. This represented an annual occurrence of only 0.6 cases each year. Small bowel volvulus counted for 6.9% of all observed intestinal obstructions. In 1958, Welch²³ reported from the same institution a reduction from 6.9% to 3.3%. In the current series, small bowel volvulus was responsible for merely 1.7% of all intestinal obstructions. The annual occurrence was 3.5 cases (Table 2). In the literature, small bowel volvulus counts for 3.5% to 6.2% of all cases of small bowel obstructions, and 5% to 22.7% of all intestinal obstructions (Table 2).

Small bowel volvulus is classified into two types, primary and secondary. Primary small bowel volvulus occurs in an otherwise normal abdominal cavity. The cause is poorly understood, and its rarity in North America and Europe remains unexplained.²⁴ The reported data in the Western World (Table 1) show 10% to 22% of cases of the primary type.^{4,19,20} The elevated rate of 30% in the series of Welch and Anderson²¹ from the United Kingdom is not further discussed by the author. The primary type is more frequently observed among the population of certain parts of Africa,^{2,6} in Middle Eastern countries,¹² in Afghanistan,⁷ and in Iran,^{9,11} as well as in the Indian subcontinent,^{5,8} where it may make up to 31% to 100% of cases. Several authors^{5,7-9,11,25} conclude that in their series the high incidence of primary small bowel volvulus was caused by a combination of factors. There is speculation that in some populations a longer mesenteric length and a shortness of the mesenteric root would allow abnormal mobility of the entire small bowel or of a segment of it. But also an important cause could be abrupt changes in dietary habits with ingestion of a single large amount of bulky food after long intervals of fasting or on an empty bowel. This happens during special events such as religious periods like Ramadan or during summer months, when great numbers of marriages and feasts in underdeveloped rural areas are celebrated. It is thought that sudden filling and overloading of an empty bowel by ingestion of only one large and poorly digestible single voluminous meal may induce forceful bowel peristalsis, resulting in small bowel volvulus. In our five male patients (14%) with the primary type, no apparent cause was found at operation. Data about special dietary habits are unknown. The high prevalence of primary small bowel volvulus for male patients in the current series corresponds with findings reported by other authors.^{6-9,11}

Secondary small bowel volvulus occurs in the presence of an acquired lesion. It is ordinarily seen in adults with tension bands, or tethering of a loop of bowel at its apex, often as a result of postoperative adhesions.^{2,4} It also can be the result of malrotation or midgut nonrotation usually observed in newborns and young children.¹⁵⁻¹⁸ Gastrointestinal infestation, as for instance with *Ascaris*,²⁶ is a rare cause of small bowel volvulus. The secondary type is more

TABLE 2. Percentage of Small Bowel Volvulus of Observed Patients

	Small Bowel Obstruction	Total Bowel Obstruction
Agrawal ¹	—	18.8
Argov ²	4.0	—
De Souza ⁶	—	18.5
Frazee ¹²	5.7	—
Gulati ¹⁴	3.5	—
Juler ¹⁸	—	5.0
Mucha ²⁴	6.2	—
Roggo (current study)	4.0	1.7
Saidi ²⁸	—	22.7
Tiwari ³⁶	—	14.2
Vaez-Zadeh ³⁷	—	19.6

common in the Western World,^{4,19-21} constituting 70% to 90% of cases. In our series, 86% had a secondary type of small bowel volvulus.

Small bowel volvulus may occur at any age. The primary type is mainly observed in children and young adults. Male patients predominant in older persons.^{6-9,11} The secondary type is usually encountered between the ages of 40 and 90 (Fig. 1), with the peak age of incidence in the sixth, seventh, and eighth decades.²¹ The chances of recovery in a patient with acute intestinal obstruction, especially strangulating obstruction, depend largely on early and accurate diagnosis and management. The main problem remains to differentiate between those causes of obstruction that require early surgery and those that can be treated conservatively. The signs and symptoms of small bowel volvulus are the same as any condition that produces intestinal obstruction. When unrecognized, this may result in an intra-abdominal catastrophe. The correct diagnosis of small bowel volvulus, however, is made less often than it is, for example, for large bowel volvulus. It is generally agreed that the diagnosis of a small bowel volvulus is very difficult to make because there is nothing pathognomic in the clinical picture to distinguish between simple and strangulating obstruction. The common complaints according to the literature^{4-8,19-21} and our own experiences are in frequency: abdominal pain (94% to 100%), nausea or vomiting (83% to 100%), acute onset (75% to 100%), distention (55% to 100%), and peritoneal irritation (14% to 26%). They all may exist in a particular patient or may occur in any combination. The pathologic alterations in the twisted bowel loop depend largely on the degree of vascular compromise to that loop. Both retrospective analyses²⁷⁻³⁰ as well as a prospective study³¹ for preoperative detection or exclusion of strangulated bowel consistently demonstrated, that neither one of the individual clinical parameters (fever, tachycardia, peritoneal signs, bowel sounds) or clinical judgment by experienced senior attending surgeons,³¹ nor blood chemical studies (hemoglobin concentration, hematocrit level, WBC count, or electrolytes) would appear to be sensitive or specific enough to discriminate between strangulated and simple bowel obstruction. They also do not help to clarify the need for operative intervention.^{7,32} In our series, we have been similarly unsuccessful in clarifying the preoperative diagnosis of strangulation obstruction on the basis of the presence or absence of peritoneal signs, the admission temperature, and tachycardia, or most of the laboratory values. In agreement with Bizer et al.,²⁷ Frazee et al.,⁴ and Sarr et al.,³¹ we did find a positive association between a leukocytosis greater than 18,000/cm³ and gangrenous small bowel. In contrast to data reported by Cheadle et al.,³³ however, we found no correlation between a preoperative finding of peritoneal irritation and the necessity for a small bowel resection. In the series of Stewardson et

al.,³⁴ which included 238 patients, the authors report an incidence of nearly 90% of gangrenous small bowel in patients who exhibited two or more of the so-called classical features (fever, tachycardia, peritoneal irritation, leukocytosis). In the series of Sarr et al.,³¹ however, one of 21 patients with strangulation, and in the series of Cheadle et al.,³³ six of 48 patients who required a small bowel resection did not manifest before operation an increase in temperature, heart rate, or leukocytosis, nor were signs of peritoneal irritation present. In our series, we had a similar case of a patient with multiple sclerosis who showed no typical clinical signs despite the presence of gangrenous bowel. Mucha³² describes elevated serum amylase levels in 55% and abnormal serum lactate levels in 86% of patients with strangulated bowel, in contrast to only 5% and 4% in cases with simple bowel obstruction. Sarr et al.,³¹ in their prospective study of 51 patients, disagree with these findings. The presence of metabolic acidosis was predictive of strangulation in only 75% of their patients in whom it was found, and it was present in only 75% of those with strangulation. Additionally, Sarr et al. found that hyperamylasemia was of no diagnostic value. Because we did not routinely perform these two laboratory tests, we can provide no further data about the usefulness of these tests. Argov et al.,³⁵ in their series of 229 patients, found there was no single statistically significant laboratory study to differentiate between simple and strangulated obstruction. Use of the Bayes statistical model based on 21 different clinical criteria, however, would allow improved differentiation. The authors report accuracy of 97% in predicting strangulated and of 76% in predicting simple small intestinal obstruction. Unfortunately, this article does not give sufficient supporting data to substantiate its claims. Another team, Pain et al.,³⁶ used a multivariate computer-assisted retrospective analysis on 197 patients with small bowel obstruction. The computer identified correctly 85% of patients with simple obstruction, 61% with viable strangulation, and 74% with gangrenous small bowel. It was believed that this could be useful in clinical practice.

In addition to the clinical examinations and laboratory tests, the diagnostic study most commonly used is plain abdominal x-ray. The radiographs may show small bowel obstruction or even a gasless abdomen. Final diagnosis, however, usually cannot be made with plain abdominal roentgenograms alone, there being no characteristic findings, in contrast to cases of colon volvulus. Even an unremarkable abdominal film does not eliminate the possibility of a small bowel volvulus. In our series, preoperative diagnosis of probable small bowel volvulus based on radiologic criteria could be made in only one patient of 35. In four patients (11%), the films failed to demonstrate the presence of obstruction or were read as normal. This failure of conventional abdominal x-rays is also re-

ported in other series.^{20,27,35,37} Mucha³² reports that in as many as 17% of patients with the obstruction confirmed at laparotomy, plain abdominal films are read as normal. Supplementary upper gastrointestinal contrast studies³⁸ could give further information. Newer techniques such as computer tomography^{39,40} and magnetic resonance imaging scores could prove useful as additional methods of preoperatively diagnosing small bowel obstruction.

Early diagnosis and operative intervention offer the best hope to reduce morbidity and mortality rates in patients with strangulation obstruction, especially in patients with gangrene of the small bowel.⁴¹ The chief problem remains to differentiate between those causes of obstruction that demand early surgery and those that can be treated conservatively. It is important, however, to stress early surgical intervention in patients with volvulus of the small bowel, especially when signs of peritoneal irritation are present, because development of gangrenous bowel is time dependent. The appropriate surgical treatment depends on the conditions found during operation. Sometimes simple derotation is all that is required, and an initially markedly ischemic small bowel loop will give evidence of viability after release. Gangrenous small bowel must be resected. In most patients, primary anastomosis can be performed. This was the case in all of our patients. There was no attempt made at fixation of the bowel. The follow-up so far has not demonstrated any recurrence in our patient group.

Physician awareness and advances in the diagnosis and management of simple mechanical obstruction requiring operation have reduced the mortality rates over the last years to 1%,³ 5.8%,²⁷ and 8%.⁴² The mortality rate in cases with infarcted small bowel, however, depending on the age of the patient and associated illness, may vary from 14.6%²⁷ to 30% or even higher.^{31,43} The policy in our institution of early operative intervention after rapid resuscitation in preference to a more conservative nonoperative approach may have contributed to the low mortality rate in the current series with strangulation obstruction. The overall mortality rate was 9%. There was no death in the group with viable small bowel. But a 17% mortality rate (three patients) was found in the group with gangrenous small bowel. The three fatal cases in our series were due mainly to their age (>70 years), aspiration pneumonia, and underlying severe cardiovascular problems. In the literature (Table 1), the overall mortality rate for small bowel volvulus varies from 10% to 38%. In cases with viable bowel, it may range from 3% to 13%,^{4,7,12,20,21,37} and in African and Indian countries up to 20%,⁶ 25%,³⁵ or 26%.⁸ When gangrenous bowel was present, the mortality rate ranged from 20%³³ and 21%⁴ to 40%⁷ and 47%.²¹ In patients with gangrenous bowel, however, mortality rates of 61%,²⁰ 67%,³⁵ and 100%⁶ have also been reported.

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