

Sigmoid volvulus: Long-term clinical outcome and review of the literature

Ozdemir Suleyman, M.D.

Department of Surgery, University of Ufuk, Ankara, Turkey

Aslar A. Kessaf, M.D.

Ankara Numune Training and Research Hospital, Ankara

Kuzu M. Ayhan, M.D., F.A.C.S.

Department of Surgery, University of Ankara

Summary

Objective. Little has been published regarding long-term surgical outcome after the initial management of acute sigmoid colon volvulus.

Methods. Patients undergoing primary resection and anastomosis (PRA) or Hartmann's procedure (HP) for sigmoid volvulus between September 1992 and August 2000 were reviewed. Eligible patients who had had the initial procedure at least 5 years previously were contacted and completed a questionnaire regarding recurrence, current symptoms and bowel habits.

Results. Data on 42 PRA patients and 36 HP patients were analysed. Follow-up (mean 7.2 years, range 5 - 11 years) was completed for 63 patients (37 PRA, 26 HP). Restoration of bowel continuity was successfully performed in 25 of 26 HP patients. No patient had megacolon. Constipation was reported by 83% of PRA and 65% of HP patients. Of these patients, 51% regularly used laxatives. No patient complained of incontinence, and no recurrences of sigmoid volvulus were recorded during the follow-up period.

Conclusion. Sigmoidectomy with primary anastomosis is a good option for the definitive management of sigmoid volvulus. Despite the high constipation rate, no recurrence occurred during long-term follow-up.

Sigmoid colon volvulus is still one of the most frequent reasons for emergency large-bowel surgery in certain parts of the world.¹⁻³ This condition may result in acute large-bowel obstruction and has the potential for high morbidity and mortality, especially in the elderly.⁴⁻⁹

Numerous surgical and non-surgical treatments have been described to relieve this condition.¹⁰⁻¹⁹ Surgical procedures may be non-resective or resective, but lack of randomised trials has led to controversy regarding the optimal treatment for sigmoid volvulus. Non-operative management of acute sigmoid volvulus offers a potentially better treatment option in frail patients.⁶ However, since the recurrence rate is high and this conservative approach is not curative, many surgeons resort to subsequent operative treatment.^{5,20-24} Simple operative detorsion, various methods of sigmoid fixation, extraperitonealisation of non-gangrenous sigmoid volvulus, mesosigmoidoplasty (-pexy), percutaneous sigmoidostomy, and primary resection with or without anastomosis have all been advocated as surgical treatments for sigmoid volvulus.^{16,18,19,21,25,26}

Although morbidity and mortality figures play an important role in determining the safety of a surgical procedure, information regarding long-term clinical outcome strongly influences wide acceptance of a surgical technique. The ideal treatment in large-bowel obstruction due to sigmoid volvulus should result not only in low mortality and morbidity in the short term, but also in low recurrence rates in the long term. The purpose of this prospective study was to assess the clinical outcomes of patients who had undergone emergency primary resection of the acute sigmoid volvulus with or without anastomosis and were followed up for more than 5 years. In addition, a comprehensive literature review was performed to assess rates of recurrence and constipation reported in other publications on the emergency management of acute sigmoid volvulus.

Patients and methods

Patients who had undergone emergency resection for acute sigmoid volvulus between September 1992 and August 2000 at a large government teaching hospital (Ankara Numune Training and Research Hospital, Ankara, Turkey) or between June 1998 and August 2000 at a large university hospital (University of Ankara) were approached and asked to participate in the study. The early surgical outcome of these patients following emergency primary resection with or without anastomosis has been reported previously.²⁷ The participants answered a questionnaire to assess their clinical outcome at least 5 years after surgery, with special attention to recurrence and functional outcomes. The study was approved by the ethics committees of the two hospitals, and written informed consent was obtained from participants.

Eligible patients were contacted either by letter or telephone to determine their willingness to participate in the study. When a patient agreed to participate, a clinic appointment was arranged, at which the patient completed a questionnaire as described below.

The following were recorded for each patient: age, gender, symptoms, concurrent diseases (hypertension, atherosclerotic heart disease, diabetes mellitus, chronic obstructive respiratory disease, chronic renal failure or chronic liver disease), the patient's previous operation notes (primary resection and anastomosis (PRA) or Hartmann's procedure (HP)), Hartmann's reversal operation notes, major morbidity (anastomotic leakage, wound infection, intra-abdominal abscess, re-operation, stoma revision) and mortality following Hartmann's reversal, recurrence rate and

functional outcome. Functional outcome was evaluated using a non-validated survey created for this study. This survey assessed the number of bowel movements per 24 hours, constipation, faecal incontinence and medications for the control of bowel movements, i.e. laxatives and enemas. Constipation and faecal incontinence were defined according to the Rome II criteria.²⁸

In order to assess the morbidity and mortality of Hartmann's reversal, wound infection was defined as pus in the wound or a positive culture from a serous or serosanguinous discharge that needed drainage and packing. Anastomotic dehiscence was diagnosed clinically on the basis of evidence of a faecal fistula, leakage of faeces from the drain, local or generalised peritonitis or evidence of anastomotic dehiscence at re-operation, or by water-soluble radiological studies. Length of stay in hospital was calculated as the period from the day of surgery until discharge. Hospital death was defined as death from any cause within 30 days of hospitalisation for Hartmann's reversal.

In order to compare the long-term postoperative rates of recurrence and constipation in our patients with those of previous studies, a comprehensive literature search was carried out. All randomised trials, controlled clinical trials or case series regarding the treatment of acute sigmoid volvulus were included in our PubMed literature search of the English literature from 1960 to 2009. Searches were carried out using medical subject headings (MeSH) and free textwords including sigmoid colon volvulus. The reference lists of all relevant articles were searched for other relevant studies. Selected articles and reviews were scanned for citations and categorised according to type of treatment. Studies in our review were included if they included at least five participants, specified the follow-up period, and recorded the specific operative procedure. Treatment modalities were classified as non-operative, non-resectional and resectional. Non-operative procedures included decompression by rigid or flexible sigmoidoscopy or colonoscopy and barium enema; non-resectional procedures included operative detorsion, mesosigmoidoplasty, colopexy and extraperitonealisation; and resectional procedures included PRA, HP, Mikulicz resection, exteriorisation and subtotal colectomy.

Results

Patients who underwent emergency resection for acute sigmoid volvulus between 1992 and 2000 at the two hospitals ($N=106$) were eligible for inclusion in this study, and their charts were abstracted to obtain data on the initial procedure and short-term complications, if any. Of the 106 eligible patients, none had megacolon, 7 died during the first admission, and 21 could not be contacted, leaving 78 who were approached after the first admission for participation in this longer-term study; all gave their consent. PRA was performed in 42 patients and HP in 36 patients. Five patients in the PRA and 10 in the HP group died during the follow-up period; none of these deaths was related to the primary procedure or to the Hartmann's reversal surgery. Results were therefore analysed from 63 patients (37 PRA, 26 HP), with a median follow-up of 7.2 years (Fig. 1).

Patient demographics and postoperative outcomes for patients in the PRA and HP groups are shown in Table 1. All 26 patients in the HP group underwent Hartmann's reversal. One patient with anastomotic dehiscence required re-operation and was treated by HP. Four patients had major wound infection, and 3 of these had

respiratory complications. All were treated conservatively and discharged without further complications or death. The mean length of hospital stay for HP patients on their second admission was 8.8 days (range 5 - 15 days).

Constipation was reported by 31 of 37 PRA patients (83%) and 17 of 26 HP patients (65%). Half (51%) of the patients overall used a laxative regularly. None of the patients complained of incontinence. No recurrences of sigmoid volvulus were recorded during the follow-up period (median 7.2 years, range 5 - 11 years).

Our PubMed literature search identified 733 studies, of which 91 met inclusion criteria for review. Studies were excluded because of non-English language ($N=174$), article type (review article, $N=55$), or fewer than 5 participants. The 91 studies we reviewed included 6 120 patients (number of patients per study ranged from 5 to 827), but because of the great heterogeneity in patient populations and data, we were unable to perform a meta-analysis. Twelve of these studies were prospective, 35 were retrospective, and the remaining 44 studies did not report whether the data were obtained prospectively or retrospectively. The majority of the studies described the technique used for treatment of acute sigmoid volvulus. Peri-operative treatment of patients was not described in detail in most of the trials. In nearly all the studies, early outcome parameters such as mortality, morbidity, anastomotic leakage and hospital stay were reported. Long-term recurrence rates were published in only 28 studies, and mean follow-up duration was given in only 23 of these. Long-term results with regard to bowel habits were mentioned in only 7 studies.

Nearly all studies reported using interventional techniques in addition to endoscopic decompression. Decompression only was performed in 509 acute sigmoid volvulus patients reported in 31 studies. Their average mortality rate was 7.5%, and in the 310 patients available for follow-up, the average recurrence rate was 45% (range 11 - 85%).

Forty-four non-resectional and 78 resectional studies were found, which included 1 171 and 3 672 patients, respectively. Their average mortality rates were 8% and 12%, respectively. In the 768 non-resectional surgical patients who were followed up, the recurrence rate was 20% (range 0 - 64%). In the 857 resectional surgical patients who were followed up, the recurrence rate was 3% (range 0 - 37%). Recurrence after sigmoid resection occurred in 27 of 857 patients, and megacolon or megarectum was noted in 21 of these 27 patients (77%). The outcomes of non-operative, non-resectional and resectional treatment modalities are summarised in Tables 2, 3 and 4, respectively.

Discussion

Owing to the paucity of prospective randomised trials, controversy still exists regarding the optimal treatment of acute sigmoid volvulus. To date, no prospective study has reported the long-term results (recurrence and bowel habits) of sigmoid colon resection with PRA or HP. Because sigmoid resection eliminates any anatomical factors that predispose to volvulus, our surgical department has been performing primary resection for years as our first choice for this life-threatening emergency condition. The present study revealed that primary resection with or without anastomosis was associated with no recurrence over a mean follow-up of more than 5 years. However, over 80% of PRA patients complained of constipation, whereas only 65% of HP patients reported this prob-

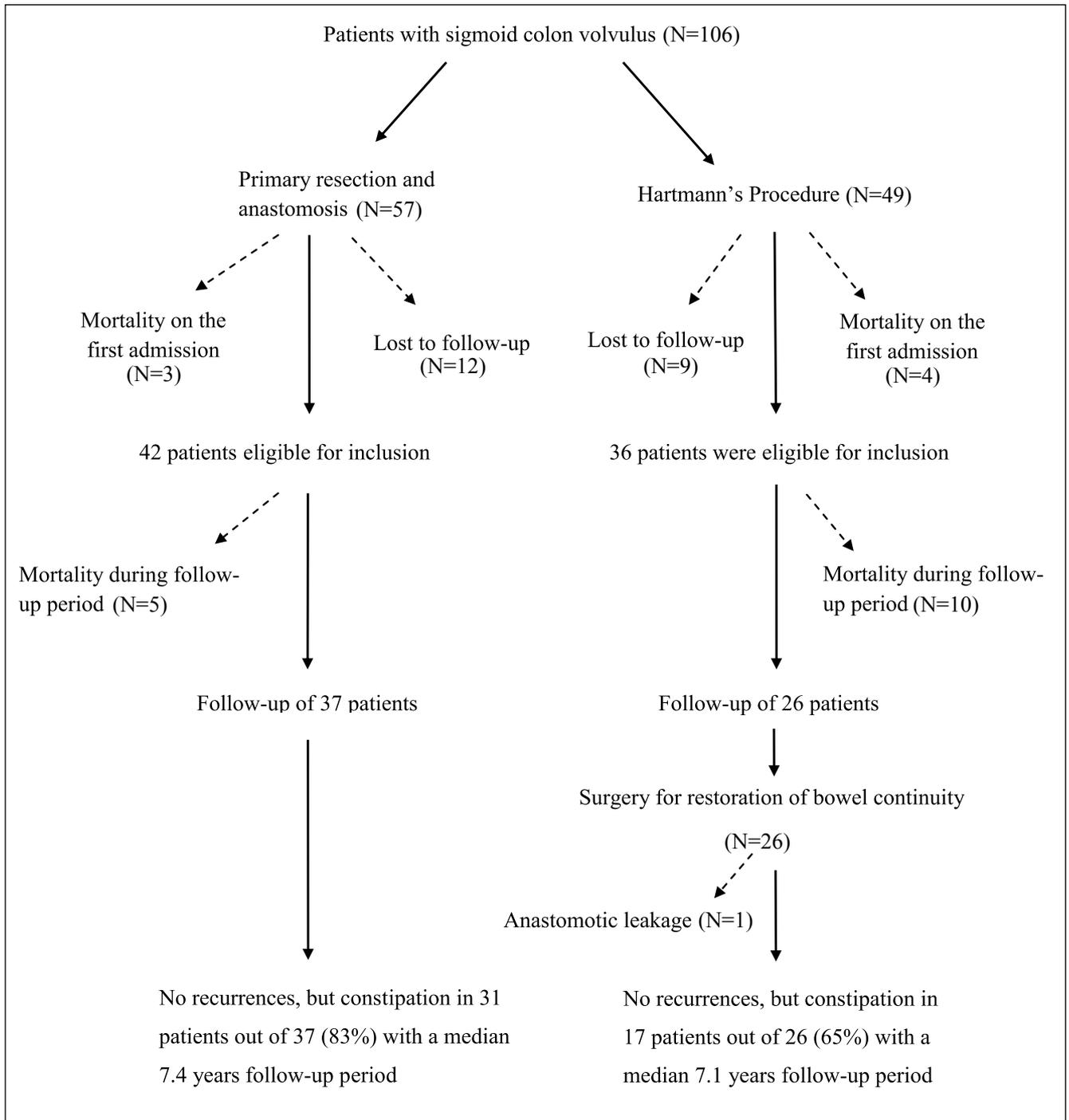


Fig. 1. Schematic depiction of the course of 106 patients with sigmoid volvulus.

lem. As a remedy, more than half of the patients used laxatives.

Non-operative management of acute sigmoid volvulus is usually a better treatment option for frail patients. Furthermore, this approach has the advantage that emergency surgery can be changed to a semi-elective procedure if the colon is still non-gangrenous. However, high recurrence rates are the major drawback of this technique,^{5,8,23,29} the average recurrence rate during the first 3 months after the operation being as high as 45%.^{23,30} Some patients refuse definitive surgery after their obstructive symptoms are relieved with decompression, which is another disadvantage of this procedure. The temporary resolution of symptoms may also result in a delay in the diagnosis of recurrence, thus increasing morbidity

and mortality. Several studies have reported that approximately 50% of patients refused surgery after endoscopic decompression.^{2,23,31} The mortality rate in such patients is between 20% and 40%,^{8,32-34} but increases to 80% if the colon is gangrenous.^{7,35}

A non-resective procedure in a patient with a non-gangrenous colon has the advantage of avoiding an anastomosis under emergency conditions. However, the surgical mortality and long-term recurrence rates of non-resective procedures are not better than those obtained after primary resection. Simple operative detorsion and various methods of sigmoid fixation have been advocated in the past, but have largely been abandoned because of recurrence rates of up to 64%.³⁶ Although the other alternative,

TABLE 1. DEMOGRAPHICS AND OUTCOME OF OUR 63 PATIENTS WHO UNDERWENT A RESECTIONAL PROCEDURE FOR SIGMOID COLON VOLVULUS AND WERE AVAILABLE FOR FOLLOW-UP OVER 5 YEARS LATER

	PRA	HP
N	37	26
Mean age (yrs) at the end of follow-up period (median (range))	67.2 (46 - 81)	68.2 (50 - 83)
Gender (male/female)	25/12	22/4
Concomitant disease*	26	16
Restoration of bowel	NA	25
Complications in the second admission	NA	
Wound infection		4
Pulmonary complication		3
Anastomotic leakage		1
Transient ischaemic attack		1
Mortality in the second admission	NA	0
Length of stay (d) in the second admission (median (range))	NA	8.8 (5 - 15)
Constipation (N (%))	31 (83%)	17 (65%)
Recurrence	0	0
Median follow-up period (yrs)	7.4	7.1

*Concomitant disease included hypertension, atherosclerotic disease, diabetes mellitus, chronic obstructive pulmonary disease and chronic renal failure.
PRA = primary resection and anastomosis; HP = Hartmann's procedure; NA = not applicable.

TABLE 2. MORTALITY AND RECURRENCE RATES OF PATIENTS UNDERGOING A NON-SURGICAL PROCEDURE FOR SIGMOID COLON VOLVULUS IN STUDIES WITH 5 OR MORE PATIENTS

Author, year of publication	Study design	Treatment modality	N	Mortality rate (%)	Recurrence rate (%)	Follow-up period
Drapanas <i>et al.</i> , 1961 ²⁴	Retrospective	Decompression	10	0	50	NR
Taha <i>et al.</i> , 1980 ⁴⁹	Retrospective	Decompression	10	0	21	NR
Knight <i>et al.</i> , 1980 ⁵⁰	Retrospective	Decompression	14	21	42	NR
Anderson and Lee, 1981 ⁵¹	Retrospective	Decompression	20	10	50	1 - 13 yrs
Schagen van Leeuwen, 1985 ⁵²	Retrospective	Decompression	26	0	19	NR
Ballantyne <i>et al.</i> , 1985 ⁹	Retrospective	Decompression	8	0	14	49 mo.
Bak and Boley, 1986 ⁸	Retrospective	Decompression	33	21	69	NR
Friedman <i>et al.</i> , 1989 ²⁹	Retrospective	Decompression	7	0	75	NR
Hiltunen <i>et al.</i> , 1992 ⁴	Retrospective	Decompression	17	11	29	49 mo.
Chung <i>et al.</i> , 1999 ²³	Prospective	Decompression	14	16	85	2.8 mo.
Grossmann <i>et al.</i> , 2000 ³²	Retrospective	Decompression	50	12	23	NR
Lau <i>et al.</i> , 2006 ³⁰	Retrospective	Decompression	14	0	43	84 d
Larkin <i>et al.</i> , 2009 ⁵	Retrospective	Decompression	11	36.4	71.4	NR
Safioleas <i>et al.</i> , 2007 ³⁵	Retrospective	Decompression	26	3	41	NR
Oren <i>et al.</i> , 2007 ²¹	Retrospective	Barium enema	13	7.7	11.1	Early
Tanga, 1974 ¹¹	Retrospective	Catheterisation of colon	10	0	0	2 yrs
Jagetia <i>et al.</i> , 1998 ²⁶	Retrospective	Tube sigmoidostomy	17	0	0	18 mo.
Daniels <i>et al.</i> , 2000 ¹³	Prospective	PEC with temporary tubes	8	0	37	
		PEC with permanent tubes	5	0	0	12.6 mo.
Baraza <i>et al.</i> , 2007 ¹²	Prospective	PEC	19	5	10	35 mo.

NR = not reported; PEC = percutaneous endoscopic colostomy.

TABLE 3. MORTALITY AND RECURRENCE RATES OF PATIENTS UNDERGOING A NON-RESECTIONAL SURGICAL PROCEDURE FOR SIGMOID COLON VOLVULUS IN STUDIES WITH 5 OR MORE PATIENTS

Author, year of publication	Study design	Treatment modality	N	Mortality rate (%)	Recurrence rate (%)	Follow-up period
Sutcliffe, 1968 ³⁶	Retrospective	Operative detorsion	19	10	64	NR
Taha and Suleiman, 1980 ⁴⁹	Retrospective	Operative detorsion	10	0	40	NR
Ballantyne <i>et al.</i> , 1985 ⁹	Retrospective	Operative detorsion	9	11	22	NR
Pahlman <i>et al.</i> , 1989 ⁵³	Retrospective	Operative detorsion	9	0	44	NR
Shepherd, 1971 ²⁵	Retrospective	Operative detorsion	49	16	42	NR
		Fixation	213	8	41	
Oren <i>et al.</i> , 2007 ²¹	Retrospective	Operative detorsion	46	10.9	36	26.4 yrs
		Mesosigmoidoplasty	56	5.4	16	24.7 yrs
Hiltunen <i>et al.</i> , 1992 ⁴	Retrospective	Detorsion with or without sigmoidopexy	21	14	23	NR
Agaoglu <i>et al.</i> , 2005 ⁵⁴	Retrospective	Detorsion and sigmoidopexy	7	14	29	27 mo.
Anderson and Lee, 1981 ⁵¹	Retrospective	Sigmoid colopexy	6	16	33	NR
Salim, 1991 ⁴⁷	Prospective	Colopexy with banding	20	0	0	1 yr.
Khanna <i>et al.</i> , 1999 ⁵⁵	Retrospective	Colocolopexy	13	7	38	NR
		Extraperitonealisation	44	0	0	
Subrahmanyam <i>et al.</i> , 1992 ²⁰	Prospective	Mesosigmoidoplasty	126	0.7	1	8.2 yrs
Bagarani <i>et al.</i> , 1993 ³⁹	Prospective	Mesosigmoidoplasty	7	0	28.5	NR
Akgun <i>et al.</i> , 1996 ⁴⁸	Prospective	Mesosigmoidoplasty	15	6	0	28 mo.
Bach <i>et al.</i> , 2003 ¹⁹	Retrospective	Modified mesosigmoidoplasty	12	0	8	4 mo.
Khanna <i>et al.</i> , 1995 ³⁷	Prospective	Extraperitonealisation	88	0	0	3.2 yrs
Avisar <i>et al.</i> , 1997 ³⁸	Retrospective	Extraperitonealisation	11	0	0	4.5 yrs
Bhatnagar and Sharma, 1998 ¹⁸	Prospective	Extraperitonealisation	84	9	0	6.6 yrs

NR = not reported.

extraperitonealisation, has been reported to have satisfactory surgical outcomes, this operation is not universally accepted as a standard approach because of its complicated technique.^{18,37,38} Another widely used alternative is mesosigmoidoplasty, but its results are also conflicting.¹⁹⁻²¹ The only prospective, randomised study in the literature found that, in the presence of a viable colon, a sigmoid resection, performed either as an HP or as a one-stage definitive operation, had a lower rate of recurrence than mesosigmoidoplasty.³⁹ Our literature review revealed an overall recurrence rate of 20% and generally poor outcomes in patients who underwent non-resective procedures.

Some surgeons are reluctant to perform a definitive operation in the unprepared bowel of an elderly frail patient because of the relatively high incidence of anastomotic complications. HP is still one of the best operative alternatives, especially in the presence of peritonitis and/or a necrotic bowel. However, multistage procedures can be poorly tolerated and also carry a higher risk of mortality and morbidity. Nevertheless, in our series bowel continuity was successfully restored in 25 out of 26 patients with a morbidity of 36% without any deaths. Wound infection occurred in 15% of our patients, the mean length of stay for the second admission was 9 days, and anastomotic dehiscence occurred in one patient who required repeat colostomy. These

results are well within the range of those reported in the literature.⁴⁰⁻⁴²

Even though the traditional method for preventing recurrence of sigmoid volvulus is primary resection of the diseased colon, our literature review found a recurrence rate of 3% after resection. The mean interval between surgery and recurrence was reported in two studies to be 76 (standard deviation (SD) 17) months (range 1 - 156 months) and 27 months, respectively.^{22,23} While the exact pathological mechanism of recurrence is still unclear, the main factor for recurrence was reported to be the presence of concomitant megacolon or megarectum.^{22,23,43} Morrissey *et al.*²² reported that the recurrence rate was 6% if the disease was limited to the sigmoid, but rose to 82% if megacolon was present. Other factors associated with recurrence include insufficient resection,⁴ bulky diets and motility disorders.^{33,44} Absence of ganglionic cells in the colon segment manifests as chronic constipation, and is another cause of recurrence.^{22,45} However, a recent study revealed no relationship between functional bowel movement disorders (elongation of the bowel in sigmoid volvulus and re-volvulus) and the number of ganglion cells in Auerbach's or Meissner's plexus.⁴⁶ Although constipation was not reported in some series,^{19,47} it is still an important issue for the majority of our patients. Routine constipation occurs

TABLE 4. MORTALITY AND RECURRENCE RATES OF PATIENTS UNDERGOING A RESECTIONAL SURGICAL PROCEDURE FOR SIGMOID COLON VOLVULUS IN STUDIES WITH 5 OR MORE PATIENTS

Author, year of publication	Study design	Treatment modality	N	Mortality rate (%)	Recurrence rate (%)	Follow-up period
Anderson and Lee, 1981 ⁵¹	Retrospective	PRA	68	14	0	NR
		HP	3	0	0	NR
		Mikulicz resection	30	30	0	NR
Ballantyne <i>et al.</i> , 1985 ⁹	Retrospective	PRA	25	0	0	NR
		HP	10	0	0	NR
Friedman <i>et al.</i> , 1989 ²⁹	Retrospective	PRA	12	0	8	37.9 mo.
		HP	5	0	0	
		Subtotal colectomy	4	50	0	
Pahlman <i>et al.</i> , 1989 ⁵³	Retrospective	PRA	23	0	0	NR
Hiltunen <i>et al.</i> , 1992 ^{4*}	Retrospective	PRA	19	21	5	NR
Bagarani <i>et al.</i> , 1993 ³⁹	Prospective	PRA	16	25	0	NR
		HP	8	12.5	0	NR
Morrissey <i>et al.</i> , 1994 ^{22†}	Retrospective	PRA	19	0	37	76 mo.
		HP	5	0	20	76 mo.
		Subtotal colectomy	4	25	0	7.3 yrs
Chung <i>et al.</i> , 1999 ^{23‡}	Prospective	PRA	25	4	24	27 mo.
		HP	2	0	0	
		Subtotal colectomy	2	0	0	
Khanna <i>et al.</i> , 1999 ⁵⁵	Retrospective	PRA	29	13	0	NR
		HP	17	11	0	
De <i>et al.</i> , 2003 ⁴¹	Prospective	PRA	197	1	0	2 yrs
Agaoglu <i>et al.</i> , 2005 ⁵⁴	Retrospective	PRA	9	0	0	26.7 mo.
		HP	16	6	0	
Oren <i>et al.</i> , 2007 ²¹	Retrospective	PRA	126	14	0	15.8 yrs
		HP	146	19.2	0	22.1 yrs
		Mikulicz resection	14	21	0	22.8 yrs
Heis <i>et al.</i> , 2008 ⁵⁶	Retrospective	PRA	28	7	0	16 mo.
		HP	4	0	0	
Kuzu <i>et al.</i> , 2002 ^{27‡}	Prospective	PRA	57	5	0	7.2 yrs
		HP	49	8	0	

*Limited resection.

†Presence of megacolon or megarectum.

‡Patients in the present study.

PRA = primary resection and anastomosis; HP = Hartmann's procedure; NR = not reported.

following primary resection in 45 - 64% of patients, but authors state that this was not the cause or result of the recurrence.^{23,29} Moreover, constipation is not a problem peculiar to resection; it occurs in 9 - 77% of patients after extraperitonealisation, and in 13% after mesosigmoidoplasty.^{37,38,48}

The long-term clinical outcome of a procedure strongly influences its wide acceptance as a treatment for a particular condition. In our patient population, with a mean follow-up period of over 7 years, primary resection of the sigmoid colon or resection by HP resulted in no recurrence of sigmoid colon volvulus. Our extensive literature review also revealed that resection procedures have a better outcome than the alternatives, especially in the absence of megacolon.

Conflict of interest. The authors declare that there is no conflict of interest.

REFERENCES

- Jones IT, Fazio VW. Colonic volvulus. Etiology and management. *Dig Dis* 1987;7:203-209.
- Asbun HJ, Castellanos H, Balderrama B, et al. Sigmoid volvulus in the high altitude of the Andes. Review of 230 cases. *Dis Colon Rectum* 1992;35:350-353.
- Jumbi G, Kuremu RT. Emergency resection of sigmoid volvulus. *East Afr Med J* 2008;85:398-405.
- Hiltunen KM, Syrja H, Matikainen M. Colonic volvulus. Diagnosis and results of treatment in 82 patients. *Eur J Surg* 1992;158:607-611.
- Larkin JO, Thekiso TB, Waldron R, Barry K, Eustace PW. Recurrent sigmoid volvulus - early resection may obviate later emergency surgery and reduce morbidity and mortality. *Ann R Coll Surg Engl* 2009;91:205-209.
- Peoples JB, McCafferty JC, Scher KS. Operative therapy for sigmoid volvulus. Identification of risk factors affecting outcome. *Dis Colon Rectum* 1990;33:643-646.
- Bhatnagar BN, Sharma CL, Gautam A, Kakar A, Reddy DC. Gangrenous sigmoid volvulus: a clinical study of 76 patients. *Int J Colorectal Dis* 2004;19:134-142.

8. Bak MP, Boley SJ. Sigmoid volvulus in elderly patients. *Am J Surg* 1986;151:71-75.
9. Ballantyne GH, Brandner MD, Beart RW Jr, Ilstrup DM. Volvulus of the colon. Incidence and mortality. *Ann Surg* 1985;202:83-92.
10. Bruusgaard C. Volvulus of the sigmoid colon and its treatment. *Surgery* 1947;22:466-478.
11. Tanga MR. Sigmoid volvulus: a new concept in treatment. *Am J Surg* 1974;128:119-121.
12. Baraza W, Brown S, McAlindon M, Hurlstone P. Prospective analysis of percutaneous endoscopic colostomy at a tertiary referral centre. *Br J Surg* 2007;94:1415-1420.
13. Daniels IR, Lamparelli MJ, Chave H, Simson JN. Recurrent sigmoid volvulus treated by percutaneous endoscopic colostomy. *Br J Surg* 2000;87:1419.
14. Miller R, Roe AM, Eltringham WK, Espiner HJ. Laparoscopic fixation of sigmoid volvulus. *Br J Surg* 1992;79:435.
15. Chiulli RA, Swankowski TM. Sigmoid volvulus treated with endoscopic sigmoidopexy. *Gastrointest Endosc* 1993;39:194-196.
16. Salim AS. Percutaneous deflation and colopexy for volvulus of the sigmoid colon: a new approach. *J R Coll Surg Edinb* 1990;35:356-359.
17. Liang JT, Lai HS, Lee PH. Elective laparoscopically assisted sigmoidectomy for the sigmoid volvulus. *Surg Endosc* 2006;20:1772-1773.
18. Bhatnagar BN, Sharma CL. Nonresective alternative for the cure of nongangrenous sigmoid volvulus. *Dis Colon Rectum* 1998;41:381-388.
19. Bach O, Rudloff U, Post S. Modification of mesosigmoidoplasty for nongangrenous sigmoid volvulus. *World J Surg* 2003;27:1329-1332.
20. Subrahmanyam M. Mesosigmoidoplasty as a definitive operation for sigmoid volvulus. *Br J Surg* 1992;79:683-684.
21. Oren D, Atamanalp SS, Aydinli B, et al. An algorithm for the management of sigmoid colon volvulus and the safety of primary resection: experience with 827 cases. *Dis Colon Rectum* 2007;50:489-497.
22. Morrissey TB, Deitch EA. Recurrence of sigmoid volvulus after surgical intervention. *Am Surg* 1994;60:329-331.
23. Chung YF, Eu KW, Nyam DC, Leong AF, Ho YH, Seow-Choen F. Minimizing recurrence after sigmoid volvulus. *Br J Surg* 1999;86:231-233.
24. Drapanas T, Stewart JD. Acute sigmoid volvulus. Concepts in surgical treatment. *Am J Surg* 1961;101:70-77.
25. Shepherd JJ. Management of sigmoid volvulus. *Trop Doct* 1971;1(4):174-176.
26. Jagetia A, Verma S, Mittal D, Das Agarwal P, Jains S, Prasad P. Sigmoidopexy (tube sigmoidostomy) as definitive surgical procedure for sigmoid volvulus. *Indian J Gastroenterol* 1998;17:129-130.
27. Kuzu MA, Aslar AK, Soran A, Polat A, Topcu O, Hengirmen S. Emergent resection for acute sigmoid volvulus: results of 106 consecutive cases. *Dis Colon Rectum* 2002;45:1085-1090.
28. Thompson WG, Longstreth GF, Drossman DA, Heaton KW, Irvine EJ, Müller-Lissner SA. Functional bowel disorders and functional abdominal pain. *Gut* 1999;45:1143-47.
29. Friedman JD, Odland MD, Bubrick MP. Experience with colonic volvulus. *Dis Colon Rectum* 1989;32:409-416.
30. Lau KC, Miller BJ, Schache DJ, Cohen Jr. Cohen JR. A study of large-bowel volvulus in urban Australia. *Can J Surg* 2006;49:203-207.
31. Coban S, Yilmaz M, Terzi A, et al. Resection and primary anastomosis with or without modified blow-hole colostomy for sigmoid volvulus. *World J Gastroenterol* 2008;14:5590-5594; discussion 5593.
32. Grossmann EM, Longo WE, Stratton MD, Virgo KS, Johnson FE. Sigmoid volvulus in Department of Veterans Affairs Medical Centers. *Dis Colon Rectum* 2000;43:414-418.
33. Hines JR, Geurkink RE, Bass RT. Recurrence and mortality rates in sigmoid volvulus. *Surg Gynecol Obstet* 1967;124:567-570.
34. String ST, DeCosse JJ. Sigmoid volvulus. An examination of the mortality. *Am J Surg* 1971;121:293-297.
35. Safioleas M, Chatzicostantinou C, Felekouras E, et al. Clinical considerations and therapeutic strategy for sigmoid volvulus in the elderly: a study of 33 cases. *World J Gastroenterol* 2007;13:921-924.
36. Sutcliffe MM. Volvulus of the sigmoid colon. *Br J Surg* 1968;55:903-910.
37. Khanna AK, Misra MK, Kumar K. Extraperitonealization for sigmoid volvulus: a reappraisal. *Aust N Z J Surg* 1995;65:496-498.
38. Avisar E, Abramowitz HB, Lernau OZ. Elective extraperitonealization for sigmoid volvulus: an effective and safe alternative. *J Am Coll Surg* 1997;185:580-583.
39. Bagarani M, Conde AS, Longo R, Italiano A, Terenzi A, Venuto G. Sigmoid volvulus in west Africa: a prospective study on surgical treatments. *Dis Colon Rectum* 1993;36:186-190.
40. Akcan A, Akyildiz H, Artis T, Yilmaz N, Sozuer E. Feasibility of single-stage resection and primary anastomosis in patients with acute noncomplicated sigmoid volvulus. *Am J Surg* 2007;193:421-426.
41. De U, Ghosh S. Single stage primary anastomosis without colonic lavage for left-sided colonic obstruction due to acute sigmoid volvulus: a prospective study of one hundred and ninety-seven cases. *Aust N Z J Surg* 2003;73:390-392.
42. Desai DC, Brennan EJ Jr, Reilly JF, Smink RD Jr. The utility of the Hartmann procedure. *Am J Surg* 1998;175:152-154.
43. Ryan P. Sigmoid volvulus with and without megacolon. *Dis Colon Rectum* 1982;25:673-679.
44. Gibney EJ. Colonic volvulus. *Dis Colon Rectum* 1989;32:1080.
45. Strom PR, Stone HH, Fabian TC. Colonic atony in association with sigmoid volvulus: its role in recurrence of obstructive symptoms. *South Med J* 1982;75:933-936.
46. Furuya Y, Yasuhara H, Yanagie H, et al. Role of ganglion cells in sigmoid volvulus. *World J Surg* 2005;29:88-91.
47. Salim AS. Management of acute volvulus of the sigmoid colon: a new approach by percutaneous deflation and colopexy. *World J Surg* 1991;15:68-72; discussion 73.
48. Akgun Y. Mesosigmoidoplasty as a definitive operation in treatment of acute sigmoid volvulus. *Dis Colon Rectum* 1996;39:579-581.
49. Taha SE, Suleiman SI. Volvulus of the sigmoid colon in the Gezira. *Br J Surg* 1980;67:433-435.
50. Knight J, Bokey EL, Chapius PH, Pheils MT. Sigmoidoscopic reduction of sigmoid volvulus. *Med J Aust* 1980;2:627-628.
51. Anderson JR, Lee D. The management of acute sigmoid volvulus. *Br J Surg* 1981;68:117-120.
52. Schagen van Leeuwen JH. Sigmoid volvulus in a West African population. *Dis Colon Rectum* 1985;28:712-716.
53. Pahlman L, Enblad P, Rudberg C, Krog M. Volvulus of the colon. A review of 93 cases and current aspects of treatment. *Acta Chir Scand* 1989;155:53-56.
54. Agaoglu N, Yucel Y, Turkyilmaz S. Surgical treatment of the sigmoid volvulus. *Acta Chir Belg* 2005;105:365-368.
55. Khanna AK, Kumar P, Khanna R. Sigmoid volvulus: study from a north Indian hospital. *Dis Colon Rectum* 1999;42:1081-1084.
56. Heis HA, Bani-Hani KE, Rabadi DK, et al. Sigmoid volvulus in the Middle East. *World J Surg* 2008;32:459-464.

**DEPARTMENT OF SURGERY, UNIVERSITY OF THE WITWATERSRAND
23rd Biennial Symposium**

**‘Mastery of Surgery – 2012’
A Surgeon’s Roots**

FNB Auditorium, West Campus, University of the Witwatersrand, Monday 25 - Wednesday 27 June 2012

The 23rd Biennial Symposium will cover many sessions of interest including hepato-biliary-pancreatic, transplantation, gastro-intestinal, colorectal, paediatric, vascular, breast, endocrine, upper GIT and general surgery, plus an ethics session.

Our international guest is Professor John Windsor, currently Head of the Department of Surgery at the University of Auckland and an internationally recognised HPB and upper GIT surgeon.

Full details will be available on www.witsbiennial.co.za