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ORIGINAL ARTICLE

Emergency Management of Sigmoid Colon Volvulus in a Volvulus Belt Population and a Review of Literature

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Abstract Algorithm for management of acute sigmoid volvulus is still controversial. This study was undertaken in a volvulus belt population emphasizing on emergency resection and primary anastomosis without on-table colonic irrigation or diversion. Four hundred forty-five acute sigmoid volvulus patients were reviewed retrospectively. Records of 366 operated patients were studied thoroughly. After operative detorsion and simple decompression, resection and primary anastomosis without a diverting stoma with postoperative anal dilatation were done in those who obeyed certain criteria; the rests were subjected for alternative operations. Ileal resection anastomosis was added in compound volvulus cases. Literature was reviewed. *Epidemiology*: constitutes 40.4% of small and large intestinal and 87.8% of large intestinal obstruction cases; maximum of 40–60 years with slight male preponderance. *Operated*: 148 gangrenous, 10 compound, 3 perforated, and 205 uncomplicated patients—mesocoloplasty in 2; resection with primary anastomosis in 270 including 60 gangrenous, 6 compound, and 1 perforated; 92 Hartmann's procedure and 2 Paul Mickulicz in other gangrenous cases. *Mortality*: with primary anastomosis 7.4% with no significant difference between gangrenous and non-gangrenous groups; with no restoration of continuity 19.2% and overall 7.5% without gangrene, 14.3% with gangrene and 10.4% in an average; in reducing trend with ICU facility. There was no death with compound volvulus. *Morbidity with primary anastomosis*: 5.9% anastomotic leak, 9.6% wound infection, and 1% wound dehiscence. Emergency resection and primary anastomosis after decompression without on-table lavage are safe procedures in developing nations in patients who are stable at presentation or after resuscitation having favorable intraoperative criteria.

Keywords Volvulus · Sigmoid colon · Compound volvulus · Resection primary anastomosis · On-table lavage · Surgical stomas

Introduction

Colonic volvulus is relatively rare in USA and is responsible for approximately 4% cases of large bowel obstruction ranking behind cancer and diverticulosis. However, in the region known as "volvulus belt" including South America, Africa, Middle East, India, and Russia, it is more common and accounts for approximately 50% of all cases of colonic obstruction [1]. In Ethiopia, sigmoid volvulus (SV) is the commonest cause of intestinal obstruction (56%) requiring emergency hospitalization [2].

Strategy for emergency management of SV is still controversial. Non-operative reduction to avoid emergency surgery in poorly prepared patient is gaining popularity. It is however not the definitive treatment and recurrences with a significant risk of death have been reported [3–5]; mortality more than 40% in early trial period has been recorded [6, 7]. Further, the costly scopy apparatus is not available in many centers including ours. It is not also easy to convince about the necessity of subsequent elective resection to the poor and illiterate people who are the usual victims of this disease [5].

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Operative detorsion with or without sigmoidopexy or mesocoloplasty has also been associated with high recurrence and mortality [5].

Initial Hartmann's procedure or Paul Mickulicz technique followed by establishment of intestinal continuity after 3 months has long been considered the safest treatment. However, some authors recommend a primary anastomosis with or without protective colostomy and on-table lavage as the preferred treatment in emergency patients [5, 8–11].

We report our experience in emergency management of a comparatively large series of SV patients in a tertiary care teaching hospital catering a volvulus belt population with special emphasis on resection and primary anastomosis (RPA) of SV loop without on-table lavage and without a protective stoma.

Patients and Method

All patients with acute SV admitted to VSS Medical College Hospital, Burla, Odisha, India, from October 2010 to March 2015 were considered for retrospective study. Those with missed or incomplete records were excluded. The case records were analyzed for clinical findings, investigation results, informed consent, operative details, and postoperative management and complications. The diagnosis was made on the basis of clinical features and X-ray findings. Patients were actively resuscitated with nasogastric suction, corrective measures for fluid and electrolyte imbalance, blood transfusion and hemodynamic supports if needed, broad spectrum antibiotics commonly a combination of ceftriaxone and metronidazole, and monitored by hourly urine output. Another subset of patients who were not operated due to pre-operative death, leave against medical advice, or conservative treatment they opted for after spontaneous derotation was excluded from final work up.

Emergency laparotomy was planned in the rest of the cases. Almost all underwent resection of sigmoid colon loop except for few, old, and frail patients or patients with severe comorbidity who were subjected to lateral mesocoloplasty. After clockwise detorsion, the distended colon was usually decompressed by doing colotomy and evacuating the impacted fecal matter proximal to obstruction to reduce the tension on anastomosis without a formal on-table lavage. Care was taken to avoid peritoneal contamination. After the act in every case, gloves were changed. Resection of gangrenous ileum was added in compound volvulus cases followed by ileo-ileal or ileotransverse anastomosis with continuous inner catgut and interrupted outer silk or polyglactin 910 (2–0/3–0) sutures.

Hemodynamic stability (intraoperative mean arterial pressure > 70 mm of Hg), good vascularity of edges, and absence of tension over suture line were taken as the criteria essential for primary anastomosis after resection of the colonic loop whether gangrenous or non-gangrenous. Anastomosis was performed using single-layer interrupted silk (3–0/ 2–0) stitches. In the rest of the cases, Hartmann's or Paul Mickulicz procedure was undertaken.

Whenever necessary, the descending colon was mobilized to avoid tension. In no case, a diverting colostomy or ileostomy was added to RPA. Peritoneal toileting and placement of pelvic drain before abdominal closure and dilation of the anal sphincter at the end of operation were performed routinely. Existing literature was reviewed and compared with the results of the present study.

Results

Epidemiology

A total of 1102 acute dynamic small and large intestinal and 507 large intestinal obstruction cases were admitted during the study period; out of which, 445 cases (40.4% of total and 87.8% of large gut only) were SV. Forty-nine patients were excluded due to missed or incomplete records. Out of 396 records studied, 356 (89.9%) patients were from low socioeconomic status consuming large amounts of rice and roughage including sprouting bamboo roots and stems.

Age ranged from 16 to 80 years with the maximum incidence in the fifth decade (128 cases, 32.3%) followed by the sixth decade (92 cases, 23.2%). The male: female ratio was 1.3:1.

Diagnosis

The patients reached the hospital between 8 h to 8 days after initial symptom; 148 (37.4%) presented after 72 h. All cases complained of some degree of constipation and varying degree of asymmetrical or peripheral distension of the abdomen. Pain was present in 336 patients (84.8%) and vomiting in only 74 patients (18.7%). Common clinical signs were dry tongue (87.9%), shock (15.1%), peripheral abdominal tenderness (15.1%), generalized tenderness (39.9%), rebound tenderness (7.5%), hyper-tympanic note (88.4%), reduced or absent bowel sound (45.3%), exaggerated bowel sound (30.2%), empty rectum (80.3%), and empty left iliac fossa (32.3%). In plain X-ray, 322 (81.3%) patients had "coffee bean" sign or "Frimann–Dahl" sign or "omega" loop along with two air fluid levels inside the loop at two different heights with dilated other parts of the colon typically suggestive of sigmoid volvulus (Fig. 1). In 40 patients (10.1%), the X-ray showed only massive colonic dilatation, and in 37 (9.3%) patients, the X-ray was inconclusive. In no patient, CT examination was done. The MRI and colonoscopy facility was not available.

Treatment (Table 1)

Out of 396 patients, 30 cases were not operated either due to pre-operative death (22), leave against medical advice (6), or

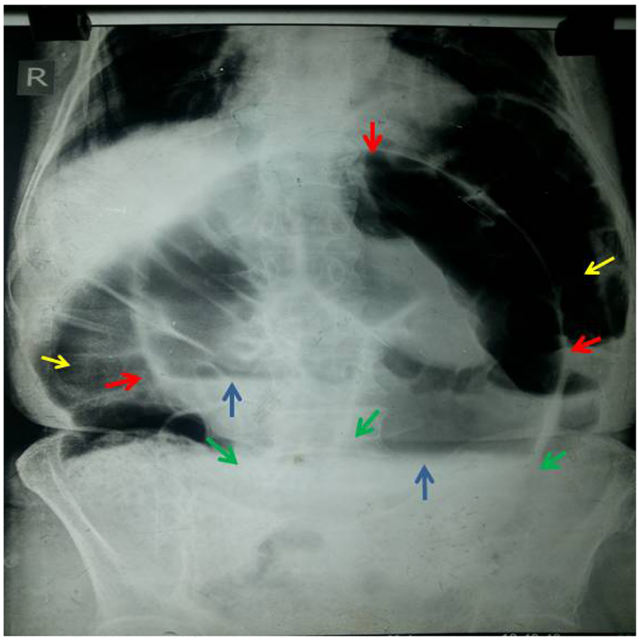

Fig. 1 Typical X-ray picture of SV. Omega loop of dilated colon (*red arrows*); two air fluid levels inside the loop (*blue arrows*); dilated other parts of colon (*yellow arrows*); Frimann–Dahl sign = three dense lines converging to pelvis (*green arrows*); *coffee bean sign* = lateral walls of omega loop form outer walls of the bean; apposed medial walls form cleft of the bean

conservative treatment they opted for after spontaneous derotation (2). The rest 366 patients underwent emergency laparotomy.

Lateral mesocoloplasty was done in 2 patients, one with recurrent volvulus associated with analgesic-induced duodenal ulcer perforation and another due to 80 years of age and poor general condition.

Ten cases of compound volvulus were treated by resection of both sigmoid and ileal segments and then colorectal along with ileo-ileal (1) or ileotransverse anastomosis (5) was done in 6 patients with viable sigmoid colon, and Hartmann's procedure with ileo-ileal (2) or ileotransverse anastomosis (2) was done in 4 patients with gangrenous sigmoid colon.

RPA only was done in 264 patients; Hartmann's procedure only was done in 88 and Paul Mickulicz procedure in 2 patients. In no case, on-table lavage or a diverting colostomy or ileostomy was done.

Out of 76 survivors in no continuity group, only 44 patients underwent re-operation for restoring colorectal continuity within 3 months to 1 year and the rest 32 patients (42% of survivors) did not turn up for re-operation.

Mortality (Table 2)

With RPA, there was no significant difference in mortality in patients with gangrenous (6.7%) and non-gangrenous (7.6%) SV with an overall RPA-related mortality of 7.4%. Without colorectal continuity, 19.2% of patients died postoperatively. Surprisingly, there was no death in patients with compound volvulus.

The overall postoperative mortality was 7.5% in non-gangrenous volvulus and 14.3% in gangrenous volvulus with an average of 10.4%. Interestingly, it was also observed that among the last 200 cases, the overall mortality was only 8% (16 patients), whereas among the first 166 cases, the mortality was 13.3% (22 cases).

Morbidity

In RPA group, 16 patients (5.9%) developed anastomotic leak. Mean day of occurrence of leak was 8.5. Fistula developed in 5.7% of viable colonic resection (12 out of 210) and 6.7% in gangrenous bowel resection (4 out of 60). One patient with a viable colon developed peritonitis due to anastomotic leak on the third day for which re-exploration was done, leak was sutured, proximal loop colostomy was done, and the patient was cured and discharged after 1 month. The rest 15 patients behaved like a colostomy and were treated conservatively and sealed spontaneously between 2 days and 2 months of the development of fistula.

Wound infection after RPA occurred in 26 cases (9.6%) that were controlled by drainage and dressing along with antibiotic coverage as per sensitivity. Wound dehiscence in 2 (1%) patients was corrected by secondary suturing.

Discussion

Epidemiology

The exact cause of high incidence of SV in certain regions of the world known as volvulus belt is largely unknown; dietary habit and habitual constipation are being blamed often. Our patients are mostly from tribal districts of Odisha, India, and there is frequent history of consumption of heavy amount of rice and roughage including sprouting bamboo roots and stems (locally called as kardi and hendua). In this series, 40.4% of total intestinal obstruction and 87.8% of large gut obstruction cases are of SV showing its higher incidence in this locality than described for volvulus belt [1].

Age and sex incidence is comparable to that of other authors from developing countries [12].

Diagnosis

Late presentation is a common problem in this zone probably due to irregular defecation habits, tolerance to pain and distension, and socio-economic problems similar to observation by Atamanalp et al. [13]. We strongly support their belief that in an endemic region, the presence of a triad of abdominal

Table 1 Number of patients treated by different methods

Operative procedure	UCSV (n = 205)	GSV (n = 148)	CV (n = 10)	PSV (n = 3)	Total	Percentage
RPA	203	60	–	1 (NG)	264	72.1
RPA + IIA/ITA	–	–	6 (NG)	–	6	1.6
HP	–	86	–	2 (G)	88	24.0
HP + IIA/ITA	–	–	4 (G)	–	4	1.1
PMO	–	2	–	–	2	0.6
LMC	2	–	–	–	2	0.6
Grand total	205 (56%)	148 (40.5%)	10 (2.7%)	3 (0.8%)	366	100

Ileum was gangrenous in all cases of compound volvulus

RPA resection and primary anastomosis, *IIA* ileo-ileal anastomosis, *ITA* ileotransverse anastomosis, *HP* Hartmann's procedure, *PMO* Paul Mickulicz operation, *LMC* lateral mesocoloplasty, *UCSV* uncomplicated sigmoid volvulus, *GSV* gangrenous sigmoid volvulus, *CV* compound volvulus, *PSV* perforated sigmoid volvulus, *NG* non-gangrenous sigmoid, *G* gangrenous sigmoid

pain, asymmetrical or peripheral distension, and constipation in a patient over 40 years of age is highly significant for the diagnosis of SV. We found no difficulty in diagnosis of acute sigmoid volvulus by taking into account the combination of clinical features and plain X-ray findings.

Treatment

Non-operative deflation by barium or water contrast enema, rectal tube, sigmoidoscopy, or colonoscopy was being tried in selected uncomplicated cases. The blind method is abandoned in fear of life-threatening perforation. Some authors [5, 14] could achieve deflation only in 42% (Turan) or 58% (Keller) by sigmoidoscopy and 60% by colonoscopy. Better results are obtained with flexible scope success rate varying from 70 to 92.9% [3, 4, 15, 16]. But it is costly and not available in all centers including ours; and the non-viable colon and associated ileosigmoid knot, the clinical diagnosis of which is often difficult, are the candidates unfit for non-operative deflation. Failure to decompress or presence of colonic gangrene as evidenced by visualization of devitalized mucosa or blood-stained fluid necessitates emergency RPA [12]. As observed by Keller, incomplete reduction and persistent bowel atony prolong the hospitalization time more than twice after resection, thereby creating an extra burden on limited resources in developing countries [5]. As per Lou [3], following derotation, ischemia-reperfusion injury aggravates intestinal dysfunction and can cause intestinal ulcer and perforation. Again, it has got a high recurrence rate of 25.8 to 75% [3, 7, 13, 17, 18]; recurrence as high as 90% with attendant mortality of 40% has been reported [6]. There is also an inherent complication rate of 2.4 to 2.6% with mortality rate of 0.5 to 0.9% due to iatrogenic perforation [14, 16].

Recent interest on percutaneous endoscopic colostomy [19] in elderly and frail patients is limited by availability of machine and expertise and also under criticism for high chance of tube migration, peritonitis, mortality, and recurrence.

Therefore, emergency RPA is preferred to others particularly in developing nations [20]. Summary of drawbacks of non-operative detorsion in these nations is as follows:

1. Success rate is less and risk is more with a rectal tube or rigid sigmoidoscope. The colonoscope is not available in all centers.
2. Man, machine, and money are lacking to manage the complications including organ failure and prolonged hospitalization.

Table 2 Postoperative mortality

	Resection with restoration of continuity (n = 270)	Resection without restoration of continuity (n = 94)	Lateral mesocoloplasty (n = 2)	Total
Non-gangrenous	16/210 (7.6%)*	–	0/2 (0%)	16/212 (7.5%)
Gangrenous	4/60 (6.7%)*	18/94 (19.2%)	–	22/154 (14.3%)
Overall	20/270 (7.4%)	18/94 (19.2%)	0/2 (0%)	38/366 (10.4%)

*P value for resection with restoration of continuity in non-gangrenous vs. gangrenous SV determined by chi-square test was 0.803 (> 0.05)—not significant

3. It is very difficult to convince the poor and illiterate people, the usual victims of the disease, of the necessity for a later elective resection.
4. Mortality and morbidity increase with recurrence due to delay in diagnosis and referral [4, 21, 22].
5. Even with elective RPA, mortality rate of 0.9 to 7.6% [14–16, 23, 24] has been documented. In our emergency RPA for both viable and non-viable colons, mortality rate of 7.4% is acceptable in comparison.

The safety of RPA in emergency surgery particularly in the presence of gangrene still remains controversial. Resection without restoration of continuity by Paul Mikulicz or Hartmann's type is considered to be the safest.

However, the limitations of the later procedures and a protective colostomy after RPA in third world countries are the following:

1. Any stoma has got its own complications needing regular follow-up which is hardly achieved.
2. Non-availability of and unaffordability for ideal stoma care apparatus add to the burden.
3. A colostomy is also a social taboo in rural areas.
4. Only a fraction of patients can turn up and afford for multiple operations needed for restoration of continuity. In fact, 42% of our patients did not turn up for re-operation.
5. Again, mortality rate is least (25%) in RPA as observed by Ballantyne [25] in a review of world literature. No difference in mortality in gangrenous cases was observed by Bhatnagar if colostomy is added to RPA [22].

Mortality

RPA-related mortality of 7.4% with no significant difference in patients with gangrenous (6.7%) against non-gangrenous (7.6%) SV in developing infrastructure may be acceptable, in our opinion. Raveenthiran found a mortality of 3.5% (1 of 27 gangrenous, 1 of 30 viable colons) in a small sample size of emergency RPA done by senior faculty [26]. RPA was done in our gangrenous patients who were hemodynamically stable on presentation or after resuscitation with good vascularity of edges after resection and absence of tension over anastomotic suture line, similar to other authors from the same institution [11, 26]. For these criteria, 94 high-risk gangrenous patients underwent surgery without continuity with attendant mortality of 19.2%. High mortality even without restoration of continuity may be attributable to reperfusion injury due to delayed presentation. Overall mortality in our series was 10.4%, with gangrene 14.3% and without gangrene 7.5%. Western literature shows higher overall mortality rate of 32% [7], 24% [15] probably due to more incidence in older people.

We do not perform on-table lavage to avoid prolongation of anesthesia time, risk of spillage and contamination, electrolyte imbalance, and its detrimental effect on anastomosis as also suggested by Slim [27]. Rather, we recommend proximal decompression after resection and dilatation of the anus after surgery. Without on-table lavage, encouraging results were obtained by many [5, 10, 21, 26, 28].

Elective RPA after initial non-operative detorsion in two of the recent studies showed mortality of 15.6 and 0% in 32 and 104 cases, respectively [29, 30]. A comparative mortality data by different authors during the last 15 years period for emergency restorative vs. non-restorative resections of SV is shown in Table 3.

Table 3 Mortality following restorative vs. non-restorative resection by different authors

Year	Author	No. of patients	Emergency operations	Emergency RPA	RPA-related mortality	Emergency HP/PMO	HP/PMO-related mortality	Overall operative mortality
2002	Kuzu et al. [21]	106	106	57	3 (5.3%)	49	4 (8.2%)	7/106 (6.6%)
2003	De and Ghosh [28]	197	197	197	2 (1%)	–	–	2/197 (1%)
2004	Turan et al. [14]	81	42	6	1 (16.7%)	19	4 (21.1%)	9/42 (21%)
2004	Bhatnagar et al. [22]	76 (G)	76	40	19 (47.5%)	36	13 (36.1%)	32/76 (42.1%)
2004	Raveenthiran [26]	57	57	57	2 (3.5%)	–	–	2/57 (3.5%)
2007	Oren et al. [16]	827	393	51	11 (21.6%)	160	31 (19.4%)	62/393 (15.8%)
2008	Coban et al. [10]	77	58	47	4 (8.5%)	11	No study	4/47 (8.5%)
2012	Kapan et al. [29]	63	31	31	6 (19.4%)	No study	No study	11/63 (17.5%)
2013	Atamanalp [30]	952	447	151	21 (13.9%)	187	38 (20.3%)	72/447 (16.1%)
2015	Chalya and Mabula [20]	146	136 + 10 elective	92 + 10 elective	17 (16.7%)	44	8 (18.2%)	25/146 (17.1%)
2017	*This study*	445	366	270	20 (7.4%)	94	18 (19.2%)	38/366 (10.4%)

RPA resection and primary anastomosis, *HP* Hartmann's procedure, *PMO* Paul Mikulicz operation, *G* gangrenous only

Relatively low mortality rate (8%) with RPA in the later half of our study period is probably due to availability of ICU facility. In our view, if a patient will be kept in an intensive care with proper monitoring, the mortality may reduce further which requires further study.

Morbidity

Anastomotic leak followed in 5.9% RPA patients without any death among them. We recommend re-exploration only if clinical leak develops within 48 h after surgery which is usually due to technical failure. Commonly, fistula develops in the second week without peritonitis and behaves like a colostomy through the drain site which resolves with conservative management. There is no significant difference in leak rate among gangrenous (6.7%) and viable colons (5.7%) in contrast to 27 and 15%, respectively, as reported by Raveenthiran from this institute [26] which is probably because of better selection of our patients with gangrenous colon for RPA and also improved anastomotic technique. We did not practice any recent technique like colonoscopic closure or gluing. Rather, we used only a colostomy bag as stoma care measure till it closed automatically.

Conclusion

Acute volvulus of the sigmoid colon is fairly a common condition in this part of our country; high-residual and irregular dietary habit with chronic constipation may be contributory. With the availability of blood transfusion and ICU facility, modern anesthetic technique, and newer antibiotics, we strongly recommend emergency laparotomy with primary resection and anastomosis after intraoperative decompression of the proximal colon without on-table lavage and postoperative anal dilatation, a safe procedure in patients who are stable at presentation or after resuscitation and having favorable intraoperative criteria as it has got an acceptable mortality, low morbidity, and manageable complication rate achieved by optimal utilization of human and financial resources of developing nations, thereby avoiding multiple operations and social taboos associated with stomas.

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Compliance with Ethical Standards

Conflict of Interest The author declares that there is no conflict of interest.

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