RESEARCH PAPER

Primary Resection and Anastomosis versus Hartmann's Procedure in Acute Sigmoid Volvulus: A Prospective Comparative Study

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ABSTRACT

The best emergency operation for acute sigmoid volvulus with viable bowel is still debated: primary resection and anastomosis avoids a stoma, and Hartmann's procedure avoids an anastomosis. We compared the two prospectively at Kakatiya Medical College and MGM Hospital, Warangal, India, in 2023–2025. Fifty patients with sigmoid volvulus and intestinal obstruction were included; gangrenous bowel and previous major abdominal surgery were exclusion criteria. Twenty-five patients had primary resection and anastomosis (group A) and 25 had Hartmann's procedure (group B). Operating time, hospital stay, surgical site infection, pelvic abscess, wound dehiscence, re-surgery and death were compared over two weeks of follow-up.

Mean age was 52.8 ± 15.4 years and 52% were men. Group A had a shorter operation (84.7 ± 9.7 vs 114.5 ± 10.8 minutes) and a shorter hospital stay (8.8 ± 1.3 vs 15.5 ± 4.5 days; both $p < 0.001$). Pelvic abscess (12% vs 44%, $p = 0.025$) and re-surgery (4% vs 28%, $p = 0.049$) were less frequent in group A, whereas surgical site infection (12% vs 32%), wound dehiscence (8% vs 16%) and death (8% vs 4%) did not differ significantly. Anastomotic leak occurred in 3 of 25 patients (12%) in group A and stoma-related complications in 14 of 25 (56%) in group B. In this series, primary resection and anastomosis was associated with a shorter operation, a shorter stay, fewer pelvic abscesses and fewer re-operations, with no significant difference in mortality. Larger studies with defined selection criteria are needed.

Keywords: sigmoid volvulus; Hartmann's procedure; primary anastomosis; colectomy; anastomotic leak; colostomy

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Introduction

Sigmoid volvulus is the third most common cause of large-bowel obstruction in adults (Osiro et al., 2012). A redundant sigmoid loop twists around its narrow mesentery, and if the twist is not relieved the bowel can become ischaemic, gangrenous and perforated; mortality of 14% to 45% has been reported (Osiro et al., 2012). The condition has been reviewed in detail elsewhere (Raveenthiran et al., 2010).

Patients without peritonitis or gangrene are usually treated first by endoscopic or sigmoidoscopic detorsion, which avoids emergency surgery (Oren et al., 2007). Recurrence is common after detorsion alone, and the American Society of Colon and Rectal Surgeons advises considering sigmoid colectomy during the same admission after successful detorsion (Alavi et al., 2021). Emergency laparotomy is needed

when detorsion fails or when gangrene or peritonitis is suspected (Oren et al., 2007; Tian et al., 2023).

When the surgeon operates on viable bowel, the choice lies between primary resection and anastomosis and Hartmann's procedure. Primary anastomosis spares the patient a stoma and a second operation, but it is made in a dilated, faeces-loaded and unprepared colon, so anastomotic leak is the main concern. Hartmann's procedure avoids an anastomosis, but it needs an end colostomy, stomas have complication rates of 21% to 70% (Shabbir and Britton, 2010), and the operation to restore continuity carries its own morbidity and is not always performed. The evidence in sigmoid volvulus comes mostly from retrospective series (Oren et al., 2007; Dolejs et al., 2018), and which operation is better when the bowel is viable remains unsettled.

We compared the two operations prospectively in patients with acute sigmoid volvulus and viable bowel at a teaching hospital in Telangana, India. Does primary resection and anastomosis give better early outcomes than Hartmann's procedure?

Materials and methods

Design and setting. This prospective comparative study was done in the Department of General Surgery, Kakatiya Medical College and MGM Hospital, Warangal, Telangana, India, between 2023 and 2025. It is reported in line with the STROBE statement (von Elm et al., 2007). The ethics committee of Kakatiya Medical College and MGM Hospital approved the study before it began (approval number [to be added], date [to be added]; code of ethics followed [to be confirmed by the authors]). All patients gave consent for inclusion in the study [form of consent, written or verbal, to be confirmed by the authors].

Participants. Patients with sigmoid volvulus who presented with features of intestinal obstruction were eligible. The diagnosis rested on clinical features, plain abdominal radiograph, and computed tomography for confirmation. Patients with gangrenous bowel and patients with previous major abdominal surgery were excluded. Fifty patients were included (**Figure 1**).

Operations. All patients were operated through a lower midline laparotomy (**Figure 2**). In primary resection and anastomosis, the peritoneum of the sigmoid mesocolon was incised, the mesosigmoid vessels were isolated, clamped, divided and ligated, and the twisted, dilated sigmoid loop was resected between clamps. An inverting single-layer continuous anastomosis was made, a drain was left in place, and the wound was closed in layers. In Hartmann's procedure, the sigmoid segment was isolated and clamped, the mesosigmoid was divided between ligated vessels, and the segment was resected. The rectal stump was closed by hand sewn in two layers, and long suture ends were left to mark it for the later reversal. An end colostomy was brought out at the marked site below the umbilicus and fixed to the muscle and skin, and the abdomen was closed. Patients were grouped by the operation they had: 25 had primary resection and anastomosis (group A) and 25 had Hartmann's procedure (group B).

Data collection and outcomes. Data were recorded on a structured proforma covering demographics, history, comorbidities, personal habits, examination, investigations, operative details and the postoperative course. Patients were followed for two weeks after surgery. The outcomes were operating time in minutes, length of hospital stay in days, surgical site infection, pelvic abscess, wound dehiscence, re-surgery and postoperative death. Anastomotic leak was recorded in group A, and stoma-related complications and second-stage surgery in group B. Complications were recorded as present or absent. Substance use was recorded as tobacco and/or alcohol use, and body mass index was classified as underweight, normal, or overweight or obese.

Statistical analysis. Continuous variables are summarised as mean ± standard deviation; operating time and hospital stay are also given as median and interquartile range. Normality was assessed with the Shapiro–Wilk test. Means were compared with Welch's t-test, and because hospital stay in group B was not clearly normally distributed (Shapiro–Wilk $p = 0.046$), the Mann–Whitney U test was used as a check. Categorical variables are summarised as numbers and percentages and were compared with Fisher's exact test, or with the chi-square test when a variable had more than two categories. Differences are reported with 95% confidence intervals (Welch's method for means and Newcombe's method for risk differences), and single proportions with Wilson intervals. Because hypertension was unevenly distributed between the groups, operating time and hospital stay were also analysed by linear regression adjusted for age, sex, hypertension and diabetes mellitus, with robust (HC3) standard errors; adjusted models for the binary outcomes were not fitted because there were too few events. Tests were two-sided with a significance level of 0.05. No correction was made for multiple comparisons, and the complication outcomes should be viewed as exploratory.

Results and discussion

Fifty patients with sigmoid volvulus were analysed: 25 had primary resection and anastomosis (group A) and 25 had Hartmann's procedure (group B). No patient was lost to follow-up (**Figure 1**).

Baseline characteristics

Mean age was 52.8 ± 15.4 years (range 23–79), 32 patients (64.0%) were older than 50 years, and 26 (52.0%) were men. Age, sex, occupation and body

mass index category were similar in the two groups. Hypertension was more common in group A than in group B (48.0% vs 12.0%, p = 0.012). Diabetes mellitus, any comorbidity, smoking and alcohol use did not differ significantly (Table 1).

Table 1. Baseline characteristics of the 50 patients, by operation

Characteristic	All patients (N = 50)	Group A: resection and anastomosis (n = 25)	Group B: Hartmann's procedure (n = 25)	p value
Age, years, mean ± SD	52.8 ± 15.4	53.8 ± 14.5	51.8 ± 16.4	0.64
Age 21–50 years, n (%)	18 (36.0)	8 (32.0)	10 (40.0)	0.79
Age 51–60 years, n (%)	16 (32.0)	9 (36.0)	7 (28.0)	
Age over 60 years, n (%)	16 (32.0)	8 (32.0)	8 (32.0)	
Male sex, n (%)	26 (52.0)	12 (48.0)	14 (56.0)	0.78
BMI underweight, n (%)	7 (14.0)	4 (16.0)	3 (12.0)	0.53
BMI normal, n (%)	24 (48.0)	10 (40.0)	14 (56.0)	
BMI overweight or obese, n (%)	19 (38.0)	11 (44.0)	8 (32.0)	
Any comorbidity, n (%)	27 (54.0)	16 (64.0)	11 (44.0)	0.26
Diabetes mellitus, n (%)	14 (28.0)	8 (32.0)	6 (24.0)	0.75
Hypertension, n (%)	15 (30.0)	12 (48.0)	3 (12.0)	0.012
Substance use (tobacco and/or alcohol), n (%)	18 (36.0)	9 (36.0)	9 (36.0)	1.00
Smoking, n (%)	13 (26.0)	5 (20.0)	8 (32.0)	0.52
Alcohol use, n (%)	13 (26.0)	6 (24.0)	7 (28.0)	1.00

p values: Welch's t-test for age; chi-square test for age group and for BMI category (one p value per variable); Fisher's exact test for all other variables.

Operating time and hospital stay

Group A had a shorter operation (84.7 ± 9.7 vs 114.5 ± 10.8 minutes; mean difference −29.8 minutes, 95% CI −35.6 to −23.9; p < 0.001) and a shorter hospital stay (8.8 ± 1.3 vs 15.5 ± 4.5 days; mean difference −6.6 days, 95% CI −8.6 to −4.7; p < 0.001). The Mann–Whitney U test gave the same result for both outcomes (p < 0.001). After adjustment for age, sex, hypertension and diabetes mellitus, the differences were −30.6 minutes (95% CI −37.5 to −23.8) for operating time and −7.1 days (95% CI −9.0 to −5.1) for hospital stay (Table 2). Operating times overlapped only slightly between the groups, and hospital stay was more widely spread in group B (6 to 22 days) than in group A (6 to 12 days) (**Figure 3**).

Table 2. Operating time and hospital stay

Outcome	Group A (n = 25)	Group B (n = 25)	Difference, A − B (95% CI)	p value
Operating time, minutes, mean ± SD	84.7 ± 9.7	114.5 ± 10.8	−29.8 (−35.6 to −23.9)	<0.001

Outcome	Group A (n = 25)	Group B (n = 25)	Difference, A − B (95% CI)	p value
Operating time, minutes, median (IQR)	84 (82–90)	112 (106–124)		
Operating time, adjusted difference *			−30.6 (−37.5 to −23.8)	<0.001
Hospital stay, days, mean ± SD	8.8 ± 1.3	15.5 ± 4.5	−6.6 (−8.6 to −4.7)	<0.001
Hospital stay, days, median (IQR)	9 (8–10)	16 (14–19)		
Hospital stay, adjusted difference *			−7.1 (−9.0 to −5.1)	<0.001

*Welch's t-test; the Mann–Whitney U test also gave p < 0.001 for both outcomes. *Linear regression adjusted for age, sex, hypertension and diabetes mellitus, with robust standard errors.*

Omitting an anastomosis would be expected to shorten an operation. In a series of the same size, with allocation by surgeon preference, a planned two-stage approach was indeed quicker than single-stage resection (71.6 ± 11.8 vs 92.4 ± 19.2 minutes; Romi et al., 2026). We found the opposite. Because of hand sewn distal stump closure and stoma formation made longer duration of surgery in group B . The 30-minute difference should not be read as a property of the operation itself.

Hospital stay also differs between series. The Iranian series found a shorter stay after Hartmann's procedure (p = 0.04; Shahmoradi et al., 2021), and the other retrospective series found a slightly longer stay after resection and anastomosis (Pattanayak et al., 2016). Romi et al. (2026) found no difference, with stays of about 12 days in both groups. Our group B stayed 15.5 days on average, and 11 of its 25 patients had a pelvic abscess and 7 were re-operated, which would lengthen a stay. The index admission also understates the hospital time that Hartmann's procedure needs in total, because restoring continuity requires a second admission.

Postoperative complications

Pelvic abscess was less frequent in group A than in group B (12.0% vs 44.0%; p = 0.025), as was re-surgery (4.0% vs 28.0%; p = 0.049). Surgical site infection (12.0% vs 32.0%; p = 0.171) and wound dehiscence (8.0% vs 16.0%; p = 0.667) were also more frequent in group B, but these differences were not statistically significant and the confidence intervals for the risk differences were wide (Table 3, **Figure 4**).

Anastomotic leak occurred in 3 of 25 patients in group A (12.0%; 95% CI 4.2–30.0%), and none of these three patients needed re-operation. Stoma-related complications occurred in 14 of 25 patients in group B (56.0%; 95% CI 37.1–73.3%), and second-stage surgery was recorded in 8 of 25 (32.0%; 95% CI 17.2–51.6%). Each of these outcomes applies to one operation only (**Figure 2**).

Table 3. Postoperative complications and mortality

Outcome	Group A (n = 25)	Group B (n = 25)	Risk difference, A − B, percentage points (95% CI)	p value
Surgical site infection, n (%)	3 (12.0)	8 (32.0)	−20.0 (−41.1 to 3.3)	0.171
Pelvic abscess, n (%)	3 (12.0)	11 (44.0)	−32.0 (−52.5 to −7.0)	0.025
Wound dehiscence, n (%)	2 (8.0)	4 (16.0)	−8.0 (−27.5 to 11.5)	0.667
Re-surgery, n (%)	1 (4.0)	7 (28.0)	−24.0 (−43.9 to −3.3)	0.049
Death, n (%)	2 (8.0)	1 (4.0)	4.0 (−12.6 to 21.3)	1.000

Outcome	Group A (n = 25)	Group B (n = 25)	Risk difference, A − B, percentage points (95% CI)	p value
Anastomotic leak, n (%)	3 (12.0)	Not applicable		
Stoma-related complications, n (%)	Not applicable	14 (56.0)		
Second-stage surgery, n (%)	Not applicable	8 (32.0)		

Fisher's exact test (two-sided); risk differences with Newcombe 95% confidence intervals. Anastomotic leak, stoma-related complications and second-stage surgery apply to one operation only and were not compared.

Pelvic abscess was the clearest difference (risk difference −32.0 percentage points, 95% CI −52.5 to −7.0), and the rate of 44% after Hartmann's procedure is high. A collection after Hartmann's procedure may arise from the rectal stump, which has no counterpart in group A.

Surgical site infection was less frequent after anastomosis (12% vs 32%), but the interval for the difference (−20.0 percentage points, 95% CI −41.1 to 3.3) includes both a large benefit and a small harm, so the data neither show nor exclude an advantage. The same holds for wound dehiscence (risk difference −8.0 percentage points, 95% CI −27.5 to 11.5). Wound infection is common after emergency colonic surgery. In a series of 63 patients it was more frequent when resection with primary anastomosis was done urgently than electively (Kapan et al., 2012).

Published rates of anastomotic leak after emergency resection with primary anastomosis include 4.3% (2 of 46 patients; Shahmoradi et al., 2021), 15% and 27% in the two groups of Raveenthiran's series (Raveenthiran, 2004), and 24% in the single-stage group of Romi et al. (2026). Our rate of 12% (95% CI 4.2 to 30.0) lies within that range, but with 25 patients the interval is wide.

Stoma-related complications (56%; 95% CI 37.1 to 73.3) lie within the 21% to 70% range summarised by Shabbir and Britton (2010). The term second-stage surgery was not defined, and the time of recording was not stated. Follow-up for the other outcomes lasted two weeks, which is shorter than the usual interval before stoma reversal, so the figure of 32% cannot show how many patients will have continuity restored or with what morbidity. Our data therefore say little about the main long-term cost of the operation. In perforated diverticulitis, trials found that continuity was restored less often after Hartmann's procedure than after primary anastomosis (Lambrichts et al., 2020). Whether that holds in volvulus is unknown.

Mortality

Three patients died (6.0%): two in group A and one in group B (p = 1.000; Table 3). All three were women aged 65 to 73 years with comorbidities. Neither death in group A was associated with a recorded anastomotic leak.

The mortality of 6% is lower than the 15.8% among the 393 patients who were operated on in the series of Oren et al. (2007) and the 17.6% after emergency surgery in the series of Tan et al. (2010). It is close to the 5% 30-day mortality in a US surgical quality database of 2,538 patients, about half of whom had emergency operations (Dolejs et al., 2018). None of these series was restricted to viable bowel, and mortality rises sharply when the bowel is gangrenous (Osiro et al., 2012; Raveenthiran et al., 2010). Our patients were also younger (mean age 52.8 years, against a median of 68 years in the database; Dolejs et al., 2018). Follow-up lasted two weeks, so later deaths were not counted, and these comparisons are approximate. Studies that compared the two operations directly found no significant difference in mortality: a propensity-matched analysis of the database that compared primary anastomosis with end colostomy (Dolejs et al., 2018), a retrospective series of 102 patients from Iran (Shahmoradi et al., 2021), a retrospective series of 122 patients (Pattanayak et al., 2016) and a pooled analysis in gangrenous volvulus (Awedew et al., 2023). Our result agrees with them, but three deaths cannot add much.

Clinical implications

The 2016 ASCRS guideline judged the evidence insufficient to favour primary anastomosis, anastomosis with proximal diversion or end colostomy in emergency volvulus. It advised an individual choice, with end colostomy often best for unstable patients or when an anastomosis is judged too risky (Vogel et al., 2016). Our data do not change that position. In patients with viable bowel who were not randomised, primary anastomosis did not differ significantly from Hartmann's procedure in mortality, infection or wound dehiscence, and it was associated

with less pelvic abscess and fewer re-operations, with an anastomotic leak rate of 12%. That supports primary anastomosis as a reasonable option for carefully selected patients with viable bowel. It does not show that Hartmann's procedure should be avoided, because the patients in group B may have differed from those in group A in ways we did not measure. A multicentre randomised or well-matched study with agreed selection criteria, standard outcome definitions and follow-up long enough to include stoma reversal would settle these questions.

Strengths and limitations

The study has several strengths: prospective data collection on a structured proforma, restriction to viable bowel, no loss to follow-up, and reporting of effect sizes with confidence intervals alongside an adjusted analysis.

It also has important limitations. It was done in one centre with 25 patients per group and no sample size calculation, so it could detect only large differences, as the wide intervals for infection, dehiscence and death show. Patients were not randomised, Confounding by indication is therefore likely.

Follow-up for complications lasted two weeks, so late complications, the course after stoma reversal and long-term survival are not captured. Finally, because gangrenous bowel was excluded, the results do not apply to the patients most likely to need Hartmann's procedure.

Conclusions

In patients with acute sigmoid volvulus and viable bowel, primary resection and anastomosis was associated with a shorter operation, a shorter hospital stay, less pelvic abscess and fewer re-operations than Hartmann's procedure, without a significant difference in surgical site infection, wound dehiscence or mortality. The findings support primary anastomosis as a reasonable option for carefully selected patients with viable bowel, and we need multicentre study with agreed selection criteria and longer follow-up.

Declarations

Funding. No funds were received for this study.

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Conflict of interest. The authors declare no conflict of interest.

Ethics statement. The study was approved by the ethics committee of Kakatiya Medical College and MGM Hospital, Warangal (approval number KIEC/PG DISSERT/2023-24/86 date 29-Feb-2024). The code of ethics followed and the consent procedure are described in Materials and methods.

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Figure legends

Figure 1. Flow of patients through the study. Fifty patients were included and operated on, 25 in each group. None was lost to follow-up in the two weeks after surgery, and all 50 were analysed. Group A had primary resection and anastomosis and group B had Hartmann's procedure. [The number of patients assessed and excluded (gangrenous bowel, previous major abdominal surgery) is to be added by the authors, with the same change in the figure.]

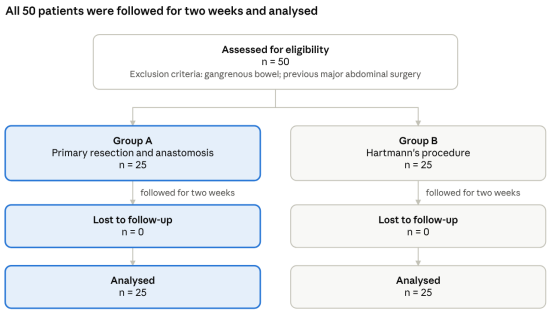
Figure 2. The two operations. Both were done through a lower midline laparotomy, with division of the mesosigmoid vessels and resection of the twisted sigmoid loop between clamps. In group A an inverting single-layer continuous anastomosis was made and a drain was left in place. In group B the rectal stump was closed in two layers and marked with long suture ends, and an end colostomy was brought out below the umbilicus. Shaded boxes show the outcomes recorded for one operation only, as numbers of the 25 patients in each group.

Figure 3. Operating time and hospital stay of each patient. Each dot is one patient, offset sideways to avoid overlap, and the horizontal bar is the group median. The mean difference, group A minus group B, was −29.8 minutes (95% CI −35.6 to −23.9) for operating time and −6.6 days (95% CI −8.6 to −4.7) for hospital stay (Welch's t-test; Table 2).

Figure 4. Risk differences between the groups for five outcomes. Each point is the risk difference (group A minus group B, in percentage points) with its Newcombe 95% confidence interval; n = 25 per group. A point to the left of zero means fewer events in group A. Filled markers show the two intervals that exclude zero. No correction was made for multiple comparisons (Table 3).

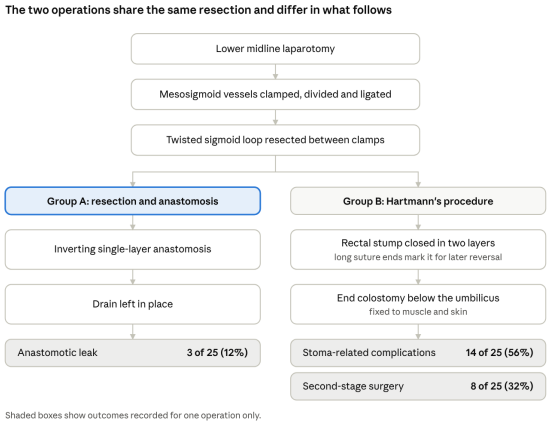
Figures

Figure 1



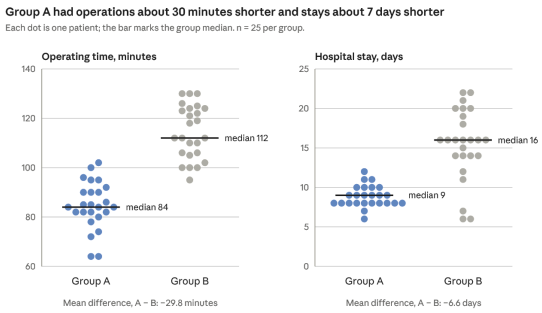
Counts from the thesis CONSORT diagram · 50 patients, 2023–2025

Figure 2



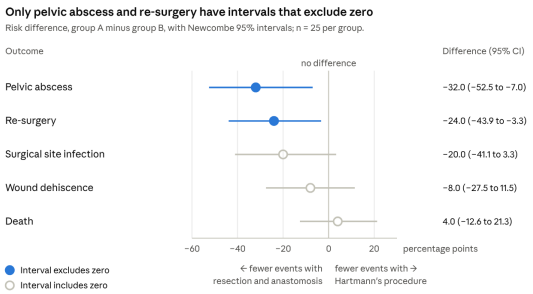
Steps from the Methods section · outcome counts from the master chart, n = 25 per group

Figure 3



Patient-level data from the master chart · 50 patients, serials 1–50

Figure 4



Risk differences with Newcombe intervals from the master chart · 50 patients; values as in Table 3