



# Evaluating outcomes of primary anastomosis versus Hartmann's procedure in sigmoid volvulus: A retrospective-cohort study

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## ARTICLE INFO

### Keywords:

Colectomy  
Colorectal anastomosis  
Hartmann's procedure  
Primary anastomosis  
Sigmoid volvulus

## ABSTRACT

**Background:** The aim of this study is to compare the short outcomes of two methods of sigmoid resection and primary anastomosis with sigmoid resection and end colostomy (Hartmann's procedure) for sigmoid volvulus.

**Methods:** This retrospective study included 102, of which 56 patients underwent end colostomy (Hartmann's procedure) and 46 patients underwent resection and primary anastomosis for sigmoid volvulus. The medical records of the patients were reviewed to evaluate the patients' characteristics, operative data, short-term post-operative outcomes and mortality.

**Results:** The mean age of patients in the groups of Hartmann's procedure and primary anastomosis were  $68.23 \pm 13.42$  and  $70.10 \pm 12.71$ , respectively. From the 46 patients who had primary colorectal anastomosis, 2 patients (4.3%) suffered from anastomosis leakage, which was not significantly different. This study showed that anastomosis leakage, prolonged ileus, bleeding, surgical site infection and fascial dehiscence were not different between Hartmann's procedure and primary anastomosis, significantly,  $p < 0.05$ . Hospital stay in the Hartmann group was less than primary anastomosis group in the same admission,  $p = 0.04$ . The mortality rate was not statistically different among the two groups,  $p = 0.549$ .

**Conclusions:** Postoperative complications and mortality rate do not differ among the two groups however, the duration of hospitalization was lesser in Hartmann's procedure group.

## 1. Introduction

Volvulus represents 10–15% of all gastrointestinal obstructions in the United States. It is most common in sigmoid colon followed by caecum, transverse colon, and splenic flexure [1]. Sigmoid volvulus is an obstructive bowel disease caused by abnormal twisting of the sigmoid colon and mesentery [2]. It is the third most common cause of acute large-bowel obstruction, and its incidence is rising due to increasing life expectancy and changes in lifestyle and dietary habits [3,4]. Sigmoid volvulus begins with progressive abdominal pain, nausea, and abdominal distention and can lead to severe intestinal ischemic change, peritonitis, sepsis, and death [5–7].

The mortality rate is 11–80% among patients with severe intestinal ischemic change and 6–24% among patients with non-severe intestinal ischemic change [8,9]. Early diagnosis and intervention decrease the mortality rate, because non-severe ischemic change is reversible at an early stage [10].

The clinical and epidemiological definition of SV is well established, while an ideal method of treatment especially when non-surgical

treatments such as colonoscopy are not effective remains controversial [11]. Numerous methods have been suggested, including sigmoid resection in addition to end colostomy (Hartmann's procedure) and sigmoid resection in addition to primary colorectal anastomosis [12,13]. Primary anastomosis is not practiced in the case of obstructive, gangrenous or perforated sigmoid and especially when there is a fecaloid peritonitis [14,15]. Primary anastomosis in these cases inflicts a greater risk of anastomosis leakage and surgical failure is very high in this status [16,17]. The present study will compare the two surgical methods of primary anastomosis versus Hartmann's procedure in emergency treatment of sigmoid volvulus.

## 2. Material and methods

102 patients with confirmed sigmoid volvulus by plain abdominal x-ray (bent inner tube or coffee bean appearance) and gastrografin enema (bird's beak sign) who did not respond to colonoscopy reduction or had gangrenous and peritonitis conditions underwent elective surgery at general surgery department of (XXX). Preoperative written consent was

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<https://doi.org/10.1016/j.amsu.2021.01.019>

Received 15 November 2020; Received in revised form 10 January 2021; Accepted 10 January 2021

Available online 19 January 2021

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obtained for all the patients included in the study. All surgeries were performed by an experienced general surgeon using a standard protocol. The medical records of the patients were collected to evaluate the patients' characteristics, operative data and postoperative short-term outcomes. Age, gender, associated diseases (like hypertension, diabetes mellitus, cardiopulmonary disease and ESRD), their ASA score, duration lasted during surgery, colon gangrene or perforation, colostomy complications, anastomosis leakage, lengthy ileus, excessive bleeding, surgical site infections, hospital stay, and 30 day's mortality were recorded. All patients included in this study at first were resuscitated with fluids and electrolytes according to their central venous pressure. Nasogastric tube and foley catheter were inserted for them. All patients received ceftriaxone and metronidazole antibiotics except for those who had allergy to these antibiotics where an alternative was given. All patients were initially treated with non-surgical reduction with sigmoidoscopy, except for those with generalized peritonitis, leukocytosis and fever, which were candidate for surgery from the beginning. Patients who successfully had been reduced with sigmoidoscopy were excluded from this study. From the 102 patients who participated in this study, 56 and 46 patients were candidate for Hartmann's procedure and primary anastomosis, respectively. Hartman's procedure was conducted in patients with hemodynamic instability and had gangrenous sigmoid. In the Hartmann group, the resection of the sigmoid was first performed, then the end colostomy was embedded in the patient. In another group, after the resection of the sigmoid colon, the primary anastomosis between descending colon and rectum were performed. This study was approved by the Research Ethics Board of (XXX). The work has been reported in line with the STROCSS criteria [18].

### 3. Results

From the 102 patients were included in this study, the 56 and 46 patients were under Hartmann's procedure and primary anastomosis, respectively. The selection of the type of surgery in these patients was completely randomized and there was no condition for choosing the type of operation. The mean age of patients in the groups of Hartmann's procedure and primary anastomosis were  $68.23 \pm 13.42$  and  $70.10 \pm 12.71$ , respectively. From all of the patients, the 85 and 17 patients were male and female, respectively, Table 1. 26 patients (25%) presented with American Society of Anesthesiologists physical status (ASA PS) classification of III or IV at the time of surgery. 26 patients (46.4%) in Hartmann group and 34 patients (73.9%) in primary anastomosis group had hypertension. 20 patients (35.7%) from Hartmann group and 20 patients (43.5%) from primary anastomosis group had diabetes mellitus. 16 patients (28.6%) in Hartmann and 13 patients (28.3%) in primary anastomosis group had cardiopulmonary disease. one patient (1.8%) in Hartmann group and 5 patients (10.9%) in primary anastomosis group had end stage renal disease. 24 patients (23.1%) had gangrenous sigmoid in their operation and 10 patients (9.6%) had perforated colon. 4 patients (3.8%) received packed cell during surgery. From the 56 patients undergoing Hartmann surgery, 2 patients (3.6%) had colostomy complications after their surgery. From the 46 patients who had primary colorectal anastomosis, only 2 patients (4.3%) suffered from anastomosis leakage after the surgery. One patient (1.8%) undergoing

**Table 1**  
Gender distribution among the two groups.

	Gender	Number	Percentage	Overall percentage
Hartmann's procedure	Female	45	80.4	80.4
	Male	11	19.6	100
	Total	56	100	
Primary anastomosis	Female	40	87.0	87.0
	Male	6	13.0	100
	Total	46	100	

Hartmann's surgery died and no mortality was seen in primary anastomosis group, Table 2. Because the proportion of mortality was very rare in operation type subgroups, we used "logistf" R package to avoid separation problem [19]. The mortality Odds of primary anastomosis group was 94% less than Hartmann group. The 95% CI for log(Odds Ratio) was  $-11.98$  to  $9.74$ , therefore there was no significant difference between two groups in the mortality. ( $P = 0.549$ ).

Duration of hospitalization among the two groups was evaluated using independent T-test. The mean hospital stay in Hartmann and primary anastomosis groups were  $6.17 \pm 1.8$  and  $6.9 \pm 0.69$  days, respectively. The duration of hospitalization was significant between the two groups,  $p = 0.04$ , also illustrated using bar graph(Fig. 1). Due to the need for colorectal anastomosis in Hartmanns group, revision surgery was required which prolonged hospitalization duration. However, at first admission, the hospital stay was lower in the Hartmann group, Table 3. 27 (48.2%) and 31(67.4%) of patients in the groups of Hartmann and primary anastomosis group had prolonged ileus, respectively. But the difference between these groups was not significant ( $p = 0.07$ ). 7 (15.2%) and 8 (14.3%) patients in the groups of primary anastomosis and Hartmann had surgical site infection, respectively but the difference was not significant ( $P = 0.55$ ). 5 (10.9%) and 2 (3.6%) patients in the groups of primary anastomosis and Hartmann disease had fascial dehiscence, respectively, which was also not statistically significant ( $p = 0.14$ ).

### 4. Discussion

Patients having a sigmoid colon with a long loop and narrow base of the mesenteric attachment are at a greater risk of volvulus [20]. The sigmoid colon and mesocolon create an obstruction by twisting around the narrow base [21]. As a result of fluid and air accumulation in the proximal colon, a progressive increase is formed under intraluminal pressure, which, in turn, promotes venous and arterial obstructions in the blood supply. Multiple factors are likely to predispose the patients to SV: advanced age, high-fiber diet, medications altering intestinal motility, presence of previous surgeries, constipation, pregnancy, diabetes mellitus, and associated neurological diseases such as dementia and schizophrenia[22,23].

There is a marked overall preponderance of male patients with SV, with a reported ratio of 2.5–9:1. (12, 13). In our study, 81.7% of the patients were male which is consistent with the literature.

As confirmed in all our patients, common symptoms for acute SV include abdominal pain, nausea/vomiting, and abdominal distension caused by fecal and gaseous impaction [24]. The first step in treatment should include the implementation of detorsion with sigmoidoscopy following the correction of fluid–electrolyte imbalance[25,26]. Urgent operation should be undertaken for the patients with unsuccessful detorsion or generalized peritonitis [27]. According to the opinion of the many surgeons, a sigmoid colectomy with end colostomy (Hartmann's procedure) may be the safest operation to perform [28]. But in the present study, we examined the sigmoid resection with primary colorectal anastomosis without any intestinal preparation. This study showed that the mortality, anastomosis leakage, prolonged ileus,

**Table 2**  
Mortality status on two groups of operation type variable.

Operation type	mortality		Odds Ratio	95% Confidence Interval for log (OR)		P-value
	no	yes		Lower	Upper	
Hartman procedure (ref)	55 (98.2%)	1 (1.8%)	0.06	-11.98	9.74	0.549
primary anastomosis	46 (100.0%)	0(0%)				

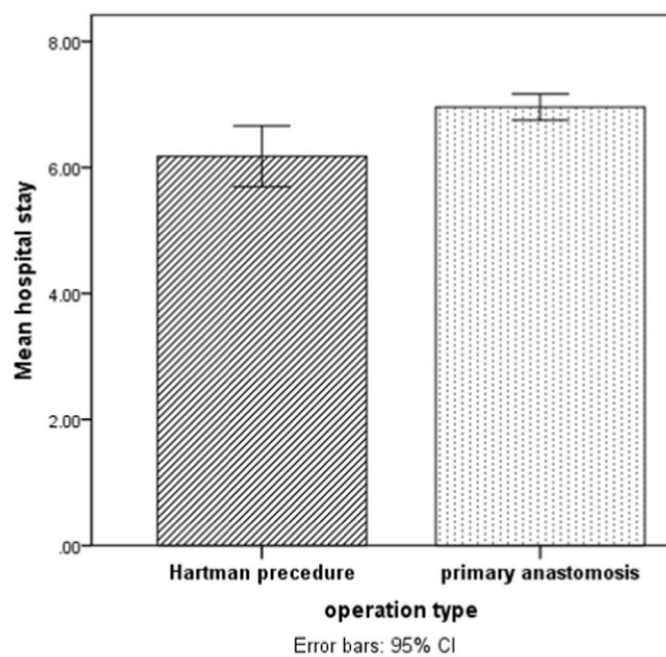


Fig. 1. Bar plot for mean hospital stay on operation type variable.

Table 3

Comparing the means of hospital stay on two groups of operation type variable.

	Operation type	N	Mean	Std. Error Mean	p-value
hospital stay	Hartman procedure	56	6.17	.24054	0.04
	primary anastomosis	46	6.9	.10289	

bleeding, surgical site infection and fascial dehiscence were not different between two groups of Hartmann's procedure and primary anastomosis, significantly [29]. And hospital stay in the Hartmann group was less than primary anastomosis group in the same admission. Halim et al. [30] analyzed the surgical outcomes from primary anastomosis and Hartmann's procedure and reported that mortality in primary anastomosis group was 40% lower than Hartmann's group. Similarly, a study by Sozen et al. [31] concluded that Hartmann's procedure was associated with increased duration of hospitalization and need of reoperation. However, incidence of complications was similar in the two group.

In a retrospective study conducted by Bhuiyan et al. [28] on 117 sigmoid volvulus patients reported that patients with gangrenous bowel with Hartmann's procedure had lower mortality and complications relative to patients with gangrenous bowel with resection and primary anastomosis. Nonetheless, results from study demonstrated that the two groups do not differ in terms of postoperative complications such as ileus, anastomotic leak, infection, cardiovascular complication and hernia. Mortality rate was also not significantly different in the two groups, similar to our study. Incidence of postoperative complications were also not statistically significant in our study. Small sample size and differences in sample distribution in the two groups could be the reasons of insignificant difference in the mortality rate among the groups, in our study.

Evaluating comorbid conditions and associated biochemical parameters can also be associated with complications and morbidities following the surgery. Therefore, future studies including these parameters are recommended.

One of the significant challenges during the study was to convince patients to evaluate them for postoperative complications. Pain and anxiety associated with the surgery hindered patients' decision to provide follow-up. Nonetheless, detailed explanation of the follow-up

procedures and their importance convinced patients to cooperate with us till the end of the study.

## 5. Conclusion

The results of our study showed that mortality rate and complications may not differ among the primary anastomosis and Hartmann's procedure group for sigmoid volvulus, however, Hartmann's procedure is associated with reduced hospitalization and the need of revision surgery. Our study does not provide the data regarding the chronicity of the pathology and sign and symptoms; therefore, further prospective studies are required to draw a better conclusion.

## Ethical approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

## Sources of funding

No funding was secured for this study.

## Author contribution

Dr. Mohammad Kazem shahmoradi: conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Parham khoshdani farahani: Designed the data collection instruments, collected data, carried out the initial analyses, and reviewed and revised the manuscript.

Dr. Masoud Sharifian: Coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content.

## Registration of research studies

1. Name of the registry: ReserachRegistry Research registry 6435.
2. Hyperlink to the registration (must be publicly accessible): N/A.
3. [https://www.researchregistry.com/browse-the-registry#home/?view\\_2\\_search=Researchregistry%206435&view\\_2\\_page=1](https://www.researchregistry.com/browse-the-registry#home/?view_2_search=Researchregistry%206435&view_2_page=1).

## Guarantor

Mohammad Kazem Shahmoradi.

## Consent

Not applicable.

## Disclosure

Approval of the research protocol: N/A Informed Consent: Informed consent was obtained from each participant. Registry and the Registration No. of the study/Trial:

<https://ethics.research.ac.ir/ProposalCertificate.php?id=49316&Print=true&NoPrintHeader=true&NoPrintFooter=true&NoPrintPageBorder=true&LetterPrint=true>.

## Human and animal rights

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

**Consent for publication**

Informed consent was obtained from each participant.

**Availability of data and materials**

All relevant data and materials are provided with in manuscript.

**Funding**

None.

**Contributors' statement page**

Dr. Mohammad Kazem shahmoradi: conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Parham khoshdani farahani: Designed the data collection instruments, collected data, carried out the initial analyses, and reviewed and revised the manuscript.

Dr. Masoud Sharifian: Coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content.

**Provenance and peer review**

Not commissioned, externally peer-reviewed.

**Declaration of competing interest**

The authors deny any conflict of interest in any terms or by any means during the study.

This study was approved by the Research Ethics Board of Lorestan University of Medical Sciences. (IR.LUMS.REC.1397.182).

**Appendix A. Supplementary data**

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2021.01.019>.

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