Outcomes of Laparoscopic Reversal of Hartmann's Procedure after Open Sigmoidectomy: Our Early Experience

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Background: Reversal of Hartmann's procedure is a demanding, difficult colorectal operation that may be associated with several postoperative complications. This can be achieved either in an open approach or laparoscopically. Laparoscopic procedure were documented to have more advantages than open one. This study was designed to assess the perioperative outcomes and safety of laparoscopic reversal of Hartmann's procedure after open sigmoidectomy among Egyptian patients.

Patients and Methods: Eligible patients operated for reversal of their Hartmann's procedure after open sigmoidectomy between 2018 and 2021 were included. Preoperative and intraoperative data were collected. Postoperative outcomes included bowel function, possible complications and length of hospital stay.

Results: Reversal of Hartmann's procedure was performed in 48 patients (17 laparoscopic and 31 open). The age of the patients was significantly lower in laparoscopic group compared to open group. All patients were comparable regarding their gender, body mass index (BMI) and the number of previous abdominal operations in the two groups. Time since Hartmann's procedure was significantly shorter among laparoscopic group (132 ± 26 vs 198 ± 54 days). Laparoscopic group had significantly longer operative time (245 ±35.3 vs 201.3 ± 31 mins), significantly shorter hospital stays and reduction in the time to restore their bowel function compared to open group. Only 5 of the laparoscopic group required conversion to laparotomy. There were fewer patients in the laparoscopic group who had postoperative complications (17.6% versus 51.6%).

Conclusion: Laparoscopic reversal of Hartmann's procedure after open sigmoidectomy was found to be safe in this study and is associated with a faster recovery time, shorter length of hospital stays and less postoperative complications. However, the findings would need to be confirmed by a large prospective cohort study.

Key words: Hartmann's, reversal, laparoscopic, sigmoidectomy.

Introduction

Reversal of Hartmann's procedure is a demanding, difficult colorectal operation that may be associated with several postoperative complications. This involves mobilization of the left colostomy, identifying the rectal stump and restoring intestinal continuity between the proximal colon and the distal rectal stump.[1]

The patients who have successfully undergone Hartmann's procedure always report an improvement in their quality of life after being free from the pain and inconvenience of stomas.[2] But there is a high perioperative morbidity rate (ranging from 3% to 50%; mean 16.3%) and a low mortality rate (mean 1%).[3] Consequently, 40% to 60% of patients never have their colostomies reversed.[4,5]

Generally, reversal of Hartmann's procedure is done through an open approach; however, laparoscopic techniques have been described.[6] Many published prospective and retrospective studies have consistently supported the idea that laparoscopic reversal of Hartmann's procedure is associated with fewer postoperative complications, a lower mortality rate, and shorter hospitalization time than open procedures.[7-21]

Aim of the work

This study was designed to assess the perioperative outcomes and safety of laparoscopic reversal of Hartmann's procedure after open sigmoidectomy among Egyptian patients.

Patients and methods

This retrospective cohort study was conducted between April 2018 and October 2021. Our process of identifying eligible patients involved searching the medical records databases for admissions that were coded with (Restoration of bowel continuity after Hartmann's procedure). All eligible patients who have been operated at Ain-Shams University Hospitals for reversal of their Hartmann's procedure during this time frame were included in the study after approval by the local ethics and research committee.

Preoperative data of patients included indications for Hartmann's procedures, time since the original procedure and previous midline abdominal operations other than open sigmoidectomy in addition to results of clinical examination for ventral hernias over the previous operations, barium enema (to delineate the length of the rectal stump in reference to the 3rd sacral piece) and full

colonoscopy from the stoma as well as the verge to exclude any synchronous lesions that were missed in the initial operation. Data from pelviabdominal CT was obtained to exclude suspicious masses in addition to reviewing both the oncological follow up records and operative dictation notes. The postoperative outcomes included restoration of bowel function and possible complications postoperatively and length of hospital stay.

Surgical technique of Laparoscopic reversal of Hartmann's procedure: The patient was positioned in the in Lloyd-Davies position, thighs were leveled with the abdominal wall, and arms alongside the body. A nasogastric tube and urinary catheter were inserted. The surgeon and camera man typically stood to the patient's right side while the assistant surgeon to the patient's left side.

The abdomen was insufflated with a veress needle at the left Palmer's point in the left hypochondrium, and a 12-mm optical port was used to access the abdomen at the right hypochondrium under direct vision. A 5-mm port was inserted at the right lumbar region. After accessing the patient's abdomen, attention was then diverted towards small bowel adhesiolysis using both sharp scissors and an energy device (Ligasure, Valleylab, Boulder, CO, USA) to clear the anterior abdominal wall for clear and safe port placement. Another 12-mm port at the right iliac fossa was inserted after any adhesions have been cleared away from the abdominal wall at that site to ensure safe port entry. The camera could thus be positioned differently to provide different angles for dissecting the adhesions if necessary.

Obtaining access to the left iliac fossa was possible by dissecting adhesions from the anterior abdominal wall. Primarily the small bowel should be cleared from the pelvis dissecting it away from the rectal stump taking carefully not to do any iatrogenic injuries. The left paracolic gutter, the pelvic brim, and the lateral pelvic wall and the posterior peritoneum had to be inspected thoroughly to identify the gonadal vessels and the left ureter. During the initial Hartmann's procedure, the proximal descending colon might have been mobilized to varying degrees, making it necessary to mobilize the posterior plane of the rectal stump, as well as the splenic flexure. then the stoma should be mobilized from the abdominal wall, afterwards the anvil of a circular stapler was inserted into the proximal colon and tightened with 2-0 prolene purse string suture and then it was returned to the abdomen and the fascia was then closed as shown in **(Figure 1b)**. Afterwards, pneumoperitoneum was

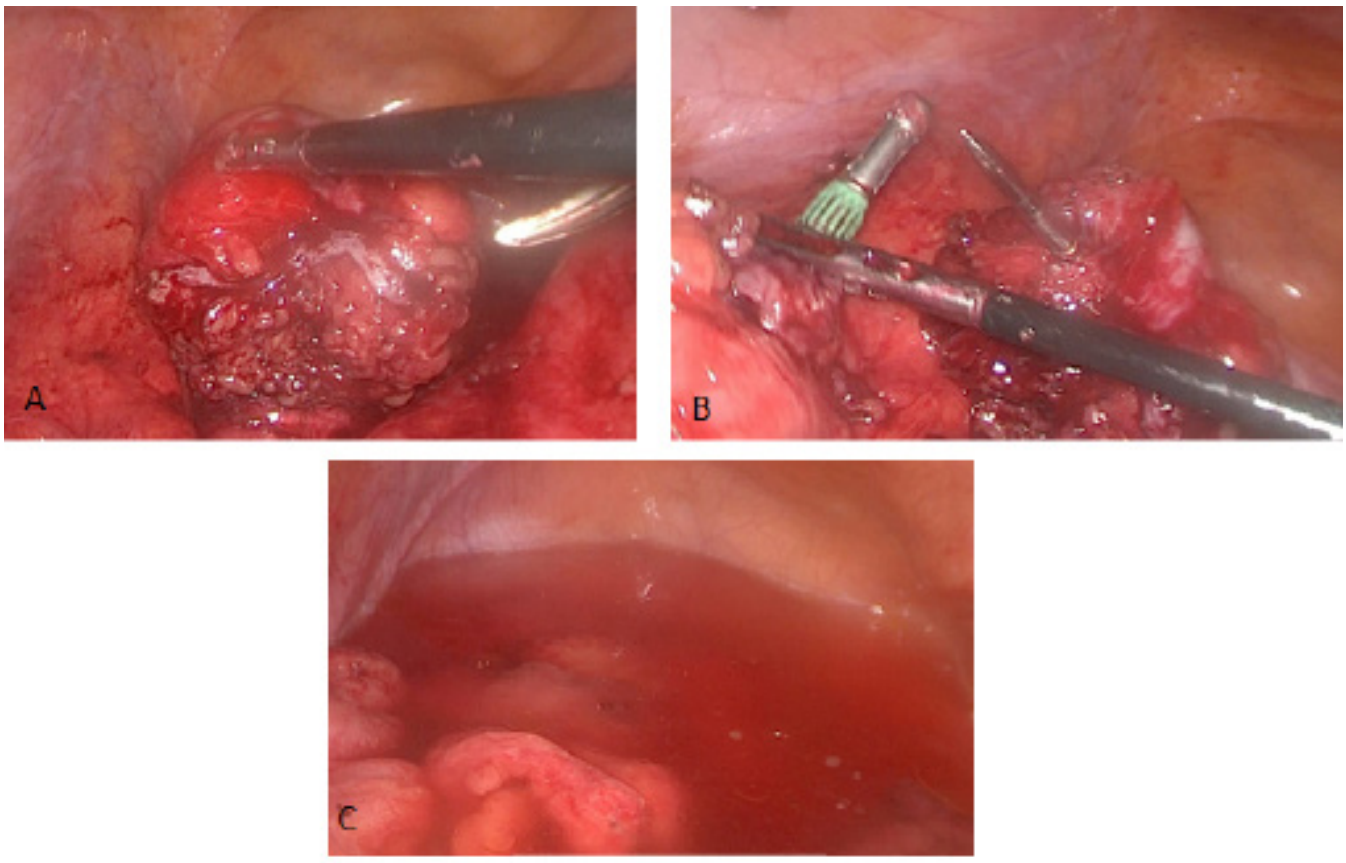

Fig 1: Surgical technique of Laparoscopic reversal of Hartmann's procedure. A: After mobilization of the rectal stump, resection of the scarred proximal rectum using laparoscopic GIA stapler and introduction of the circular stapler. B: Proximal colon with a purse string around the anvil ready to achieve the anastomosis with good reach. C: Air-leak test after achieving the colorectal anastomosis.

re-achieved.

Identification of the rectal stump sometimes was achieved using the circular stapler itself. Sometimes the rectum appeared long enough, but the proximal rectum might have been scarred and narrowed, making passage of the circular stapler difficult. At this situation the rectum was further mobilized and the proximal rectal stump was resected distal to the scarring region where the circular stapler could reach using laparoscopic GIA stapler as shown in **(Figure 1a)**. Then, the colorectal anastomosis could be performed safely using the circular stapler.

The donuts were checked, and an air-leak test was routinely done with the rectum insufflated with air to ensure an air-tight anastomosis as shown in **(Figure 1c)**. Hemostasis was confirmed after wash-out. A 20 F Nelaton tube drain was placed in the pelvis. The pneumoperitoneum was released, and the ports were removed. The fascia was then closed.

Statistical analysis: Data were collected, revised, coded, tabulated and entered to the Statistical Package for Social Science (SPSS) version 26. The following were done; qualitative data were presented as number and percentages while quantitative data were presented as range, mean and standard deviations. The comparison between two groups with qualitative data were done by using Chi-square test and/or Fisher exact test was used instead of Chi-square test when the expected count in any cell was found less than 5. add independent t-test was used to detect statistical differences between 2 continuous values.

Results

During our study period, reversal of Hartmann's procedure was performed in 48 patients (17 laparoscopic and 31 open). The senior author performed 11 operations out of the 17 laparoscopic cases (64.7%) and the other 6 (35.3%) were performed under-supervision. The choice of the technique was completely left to the surgeon's preference based on long previous experience with open reversal of Hartmann's procedure. It was found that; male patients with low BMI and long rectal stump with no complex ventral hernia or previous laparotomies other than the initial open sigmoidectomy, with shorter time interval since Hartmann's procedure and those with benign pathology for the primary procedure were the least difficult cases encouraging the laparoscopic approach.

The age of the patients was significantly lower in laparoscopic group compared to open group. All patients were comparable regarding their gender, body mass index (BMI) and the number of previous abdominal operations in the two groups as shown in **Table 1**. However, most of the patients among laparoscopic group were males (64.7%) compared to open group (45.2%). Time since Hartmann's was significantly shorter among laparoscopic group (132 ± 26 vs 198 ± 54 days).

Obstructed colon cancer was the most common cause of Hartmann's procedure accounting for 31 patients (64.5%) in both groups, complicated diverticular disease came in second place with 9 patients (18.75%). 3 patients in the laparoscopic group had Iatrogenic injuries including after gynecological procedures and iatrogenic colonoscopic perforation while 2 patients in the open group had rectal injuries due to perforated sigmoid colon after cervical dilatation and curettage and the other case was after laparoscopic ovarian cystectomy for endometriotic cyst. Other indications for Hartmann's procedure in the laparoscopic group was blunt rectosigmoid junction trauma in a patient, while in the open group, 2 patients had colonic injury due to gunshot and a leaking colorectal anastomosis for sigmoid volvulus as shown in **(Figure 2)**.

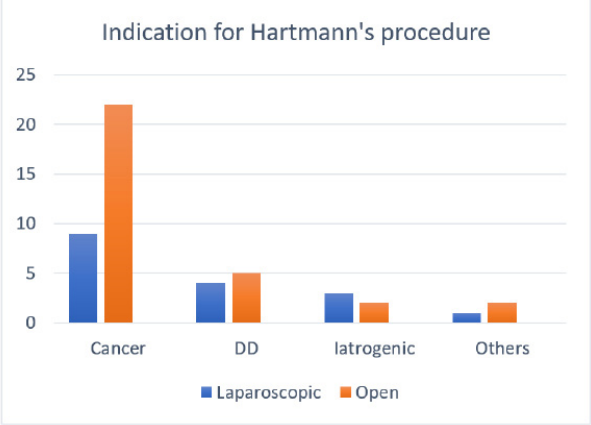

Fig 2: Indications for Hartmann's procedure.

Seven patients (14.5%) had previous abdominal operations other than the previous Hartmann's procedure; those previous operations were as follows; 1 patient in the laparoscopic group for appendectomy and 6 patients in the open group for other causes as midline hysterectomy, laparotomy for gunshot wound, stab wound in the anterior abdominal wall, small bowel resection, open midline appendectomy and traumatic rupture of the spleen.

All patients in both groups had Barium enema to delineate the length of the rectal stump in relation to the 3rd sacral piece (S3). 12 patients (70.6%) had long rectal stump above S3 in the laparoscopic group compared to 14 patients (45.2%) in the open group.

Regarding operative time, it was significantly longer

in laparoscopic compared to open technique (245 ± 35.3 vs 201.3 ± 31 mins). However, patients who underwent laparoscopic technique had significantly shorter hospital stay and significant reduction in the time to restore their bowel function compared to open group as shown in **(Table 2)**.

5 out of the 17 patients (29.4%) within the laparoscopic group had to be converted to an open approach. They all had short rectal stump below S3 and the indication for initial Hartmann's procedure was cancer in 3 patients, diverticular disease in 1 patient and iatrogenic gynecological complication in another patient. Only 1 patient of them had previous midline operation other than sigmoidectomy.

Reasons for conversion were failure to safely identify the rectal stump from the posterior vaginal wall in 1 patient and an iatrogenic injury of a short rectal stump in another patient. One patient had an iatrogenic small bowel injury due to extensive adhesions with the rectal stump and one patient had an inadequate proximal colon reach for tension free anastomosis, while the last one had a positive air-leak test following the colorectal anastomosis despite that the fundamental principles of anastomosis were achieved.

Intraoperative small bowel injury occurred in 2 patients in each group, however one of the patients in laparoscopic group had an additional ureteric injury. Significantly, only 2 patients (11.8%) in laparoscopic group had postoperative ileus compared to 6 patients (19.3%) in open group. Wound infection was seen in 7 patients in the open group; 3 of them developed wound dehiscence, while only one patient in laparoscopic group developed wound infection. One patient in open group developed postoperative abscess formation as shown in **(Table 3)**.

Upon follow up, one 75-year-old patient who underwent open technique developed fecal fistula during postoperative care and was hospitalized for secondary pleural effusion. His drain site began to discharge fecal fluid after he was resuscitated. He eventually developed a small bowel obstruction. The CT scan did not show a collection. A separate enema test showed no leakage from the anastomosis. The fistula was treated with conventional conservative therapies. Both groups had no cases of anastomotic leak or hospital mortality during the postoperative period.

Table 1: Baseline characteristics of patients undergoing reversal of Hartmann's procedure

		Laparoscopic (n= 17)	Open (n=31)	P value
Age (years)		41.7 ± 5.5	52.5 ± 7.9	0.000
Sex	Male	11 (64.7%)	14 (45.2%)	0.195
	Female	6 (35.3%)	17 (54.8%)	
BMI (kg/m²)		30 ± 2.9	29.9 ± 3.04	0.9
Time since Hartmann (days)		132 ± 26	198 ± 54	000
Indication	Obstructed Colon Cancer	9 (52.9%)	22 (71.0%)	
	Complicated Diverticular Disease	4 (23.5%)	5 (16.1%)	
	Iatrogenic injury	3 (17.6%)	2 (6.5%)	
	Others	1(5.9%)	2 (6.5%)	
Previous operations	No	16 (94.1%)	25 (80.6%)	0.396
	Yes	1 (5.9%)	6 (19.4)	
Barium enema	Above S3	12 (70.6%)	14 (45.2%)	0.091
	Below S3	5 (29.4%)	17 (54.8%)	

Table 2: Perioperative outcomes in patients undergoing reversal of Hartmann's procedure

	Laparoscopic (n= 17)	Open (n=31)	P value
Operative time (minutes)	245 ± 35.25	201 ± 31	0.00
Time to pass flatus (days)	2.7 ± 0.8	4.2 ± 0.9	0.00
Time to pass feces (days)	4.4 ± 0.9	6 ± 0.9	0.000
Length of hospital stay (days)	6 ± 1.2	8.9 ± 3.9	<0.001

Table 3: Postoperative complications in patients undergoing reversal of Hartmann's procedure

Complications		Laparoscopic (n= 17)	Open (n=31)
Intraoperative	Small bowel injury	2 (11.8)	2 (6.5%)
	Ureteric injury	1 (5.9%)	0
Postoperative	Ileus	2 (11.8%)	6 (19.3)
	Wound infection	1 (5.9%)	7 (22.5%)
	Wound dehiscence	0	3 (9.7%)
	Abcess	0	1 (3.2%)

Discussion

Reversal of Hartmann's procedure is a challenging colorectal operation that could be associated with several postoperative complications. Laparoscopic approach was documented to have more advantages than open one. This is one of the studies done to date comparing laparoscopic procedures with the open reversal of Hartmann's procedure in our institution to assess the perioperative outcomes and safety of laparoscopic reversal of Hartmann's procedure among Egyptian patients.

Only 3 patients (17.6%) in the laparoscopic group had a postoperative complication in this research, compared to the earlier studies (Range 4 to 27% 8,20). In the open group, 51.6% of patients experienced complications comparable to previous studies (Range 15 to 59%).

This study points out that laparoscopic reversal of Hartmann's procedure is associated with faster restoration of bowel function, fewer postoperative complications and shorter overall length of hospital stay compared to open reversal of Hartmann's procedure, with no difference in the rate of anastomotic leak. Laparoscopic surgery may be responsible for the differences in perioperative outcomes due to its advantages, including smaller incisions, less bowel handling, and reduced postoperative pain. The only drawback of these advantages, however, is a more extended overall operative time.

There was an estimated difference of 45 minutes between the mean total theatre time for patients in the laparoscopic group and patients in the open group in this study. Only one previous study reported a longer 'knife time' in their laparoscopic group.[17] Other studies have reported a shorter mean operative time in their group.[8–12,15,16,18–20] This result is consistent with other studies reporting differences in operative times between major laparoscopic and open colorectal procedures, where the laparoscopic group typically experiences longer operative times.[22-26] The total theatre time in this study was measured from the time a patient entered the operating room up until the time the patient departed; other studies have not defined 'operative time' similarly. The laparoscopic group's total theatre time was longer due to the extra time it took to set up the operating theatre and use surgical equipment since the laparoscopic reversal of Hartmann's procedures was a new approach with early experience. Thus, taking the total theatre time can be a reproducible measurement of operating room usage that may interest theatre staff and hospital administrators.

Interestingly our conversion rates at the beginning of our experience were as high as 3 patients in the first 4 months of our study; however, the rate had decreased due to the rising learning curve over time, and proper patient selection for the procedure making conversion rates less possible over the rest of the study period.

Zimmermann and his colleagues found that conversion from laparoscopic to open approach in their study was necessary in three of 24 patients (12.5%). They stated that profound enteric adhesions with the anterior abdominal wall and the inability to insert the optical trocar under direct vision was the reason in one patient, while inability to identify the rectal stump due to extensive adhesions of loops of small intestine within the lesser pelvis was the reason in the other 2 patients.[27]

Reviewing our data and going back to the previous medical records, it appears from our study that younger male patients with low BMI, earlier reversal of Hartman, no complex ventral hernia, as well as long rectal stump in reference to the 3rd sacral piece by barium enema and no previous abdominal operations other than the initial Hartmann's procedure were the most eligible for completion of the procedure laparoscopically pointing out those criteria.

The previous criteria were in agreement with other previous studies that had the same indications for selecting patients for the laparoscopic group. Celentano et al., have demonstrated that the indication for the Hartmann's procedure showed a trend toward more benign patients included in the laparoscopic group, and the interval time between

the index Hartmann's procedure and its reversal was significantly shorter in the laparoscopic group due to less scarring of the rectum.[28]

Conclusion

Laparoscopic reversal of Hartmann's procedure after open sigmoidectomy was found to be safe in this study and is associated with a faster recovery time, shorter length of hospital stays and less postoperative complications. However, the findings would need to be confirmed by a large prospective cohort study.

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