Reversal of Hartmann's procedure: experience in an Asian population

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INTRODUCTION With improvements in surgical techniques, instrumentation and perioperative care, Hartmann's procedure is now less frequently performed. Restoration of intestinal continuity after Hartmann's procedure has traditionally been viewed to be technically demanding and associated with significant morbidity and mortality. This is a study of outcomes after the reversal of Hartmann's procedure in an Asian population.

METHODS A prospectively collected database showed that 255 patients had undergone Hartmann's procedure from October 1989 to October 2005. Patients who subsequently underwent Hartmann's reversal were identified and their records reviewed retrospectively.

RESULTS Hartmann's reversal was attempted in 49 patients. The most common indication for Hartmann's procedure was colorectal carcinoma (49.0%). The median interval between resection and reversal was 23 weeks. Reversal was successful in 46 (93.9%) patients, with 79.6% experiencing no intraoperative complications. Failure of reversal was significantly associated with prior radiotherapy to the pelvis (p-value = 0.007). Anastomotic leak rates and re-bleeding rates were both 0.0%. 79.6% of patients made an uneventful recovery with no postoperative complications. There was no significant increase in the complication rate in older patients or patients with higher American Society of Anesthesiologists status. The overall incidence of 30-day morbidity and mortality was 20.4% and 0.0%, respectively.

CONCLUSION In our population, Hartmann's procedure is more commonly performed for colorectal cancer rather than for diverticular disease, resulting in lower rates of stoma reversal. Hartmann's reversal could be performed with acceptable morbidity and minimal mortality, although prior radiotherapy and shorter rectal stump may pose challenges during reversal surgery.

Keywords: Asia, Hartmann's procedure, stoma closure, stoma reversal
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INTRODUCTION

Hartmann's procedure was originally described in 1921 by Henri Hartmann for the resection of a sigmoid or rectal carcinoma.[1] Over time, the indications for Hartmann's procedure have extended to include a variety of situations where a primary anastomosis is deemed unsafe. These include complicated diverticular disease, traumatic colonic injuries, radiation injuries, sigmoid volvulus, colonic obstruction with ischaemia. Although single-stage procedures are increasingly preferred for patients who require surgery for complicated diverticular disease and malignancies, Hartmann's procedure may still be necessary in some patients due to technical difficulties arising in single-stage procedures, significant peritonitis or haemodynamic instability.

Re-anastomosis following Hartmann's procedure has traditionally been viewed as technically demanding and associated with significant morbidity and mortality. The reported morbidity and mortality rates with re-anastomosis are 0%–75% and 0%–28%, respectively.[2-14] Previous studies have also reported high rates of anastomotic complications.[2,7] In addition, it has been reported that 13%–69% of patients undergoing the procedure would be left with a permanent stoma, either due to unsuccessful reversal or no attempt at reversal.[2,3,7,8,15-18] However, some studies have found that in carefully selected patients, restoration of intestinal continuity after Hartmann's procedure can be performed with acceptable morbidity and mortality.[1,14,19,20]

In our population, which is predominantly Asian, there is a lower incidence of diverticular disease as compared to the West, as well as a high incidence of colorectal cancer, which is the most common cancer in Singapore.[21] Therefore, we postulated that unlike in Western populations, where the most common indication of Hartmann's procedure is diverticular disease, the demographics in our population may differ in view of the difference in disease incidence. Hence, we sought to review our experience with Hartmann's procedure and its reversal over a 16-year-period among our Asian population. We studied the rates of stoma reversal, risks of surgical and medical complications and operative mortality following restoration of intestinal continuity.

METHODS

This study was approved by the Institutional Review Board of Singapore General Hospital (SGH). The medical records of consecutive patients who underwent Hartmann's procedure or Hartmann's reversal between October 1989 and October 2005 at the Department of Colorectal Surgery, SGH were retrieved from a prospectively collected computer database. Hartmann's

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Table I. Reasons for not reversing Hartmann's procedure (n = 206).

Reason	No. (%)
Locally advanced/metastatic cancer at the time of Hartmann's procedure	148 (71.8)
Recurrence on follow-up	49 (23.8)
Residual disease/R2 resection	99 (48.0)
Death due to complications after Hartmann's procedure	13 (6.3)
Patient not keen for reversal	12 (5.8)
Convenience of nursing	3 (1.5)
Local factors	10 (4.9)
Unknown	20 (9.7)

Table II. Patient demographics (n = 49).

Demographic	No. (%)
Gender	
Male	23 (46.9)
Female	26 (53.1)
Age (yrs)	
< 30	1 (2.0)
31–40	1 (2.0)
41–50	5 (10.2)
51–60	11 (22.4)
61–70	16 (32.7)
71–80	13 (26.5)
> 80	2 (4.1)
ASA status	
1	12 (24.5)
2	30 (61.2)
3	7 (14.3)

procedure was defined as any resection of the sigmoid colon or rectum, with or without resection of any proximal colon, with closure of the distal part and end colostomy of the proximal colon.

Information retrieved included demographic characteristics, premorbid status, indications for surgery, perioperative complications as well as interval between creation and reversal of Hartmann's procedure. The end points studied were postoperative mortality (death within 30 days of surgery from any cause), intraoperative complications, medical and surgical complications after surgery, operative time and length of hospital stay. The influence of selected factors on intraoperative and postoperative complications as well as on morbidity and mortality was analysed using the Statistical Package for the Social Sciences version 16.0 (SPSS, Chicago, IL, USA). Data was analysed using Pearson's χ^2 test, Fisher's exact test and Mann-Whitney U test, where appropriate. All statistical tests were assessed at the conventional 0.05 level of significance.

RESULTS

A total of 255 patients underwent Hartmann's procedure during the 16-year period for a variety of indications. Restoration of intestinal continuity was attempted in 49 (19.2%) patients. 13 (6.3%) patients died of complications after the initial Hartmann's procedure. Among the remaining 193 patients, 173 were either not suitable for reversal or not keen for a second operation. These included 12 (5.8%) patients aged > 80 years at the time of the Hartmann's procedure and who were thus unwilling to undergo a second operation in view of age, three (1.5%) patients in whom the stoma was not reversed for the convenience of nursing, as these patients were bed-bound and faecal incontinent, ten (4.9%) patients in whom the Hartmann's procedure was performed for local factors like radiation-induced strictures and hence were not suitable for consideration for reversal, and 148 (71.8%) patients who had locally advanced and/or metastatic cancer. This last group included 99 patients with residual disease and R2 resection, and 49 patients who had evidence of recurrence on follow-up before reversal could be performed. In the remaining 20 (9.7%) patients, the reason was not known, as these patients subsequently defaulted follow-up (Table I).

Table III. Indications for Hartmann's procedure in patients who underwent reversal (n = 49).

Indication	No. (%)
Faecal or purulent peritonitis	31 (63.3)
Technical difficulties	7 (14.3)
Haemodynamic instability	4 (8.2)
Severe obstruction with ischaemic colitis	7 (14.3)

Table IV. Primary pathology requiring Hartmann's procedure (n = 49).

Pathology necessitating surgery	No. (%)
Carcinoma	24 (49.0)
Diverticular disease	9 (18.4)
Anastomotic dehiscence	6 (12.2)
Trauma	3 (6.1)
Sigmoid volvulus	2 (4.1)
Severe radiation injury	1 (2.0)
Ischaemia	1 (2.0)
Perforation secondary to tetanus	1 (2.0)
Perforation secondary to foreign body	1 (2.0)
Intussusception	1 (2.0)

Out of the 49 patients who underwent attempted re-anastomosis after Hartmann's procedure, 23 were male (46.9%) and 26 were female (53.1%). The median age of the patients was 67 (range 17.8–87.3) years, and 31 (63.3%) patients were > 60 years of age. 26 (53.1%) patients had prior comorbidities such as hypertension, diabetes mellitus and ischaemic heart disease, while 11 patients had no prior comorbidities but were classified as American Society of Anesthesiologists (ASA) grade 2 in view of their elderly status (age > 70 years). Most of the patients (75.5%) belonged to ASA 2 or ASA 3 (Table II). None of the premorbid conditions were associated with a higher risk of morbidity. Older age was also not associated with higher morbidity ($p = 0.13$). Patients who were classified as ASA 3 did not have significantly higher morbidity compared to ASA 1 or ASA 2 patients ($p = 0.232$).

The reason Hartmann's procedure was performed rather than primary anastomosis was due to peritoneal soilage in 31 (63.3%)

Table V. Type and frequency of perioperative complications (n = 15).

Type of complication	No. (%)
Intraoperative (n = 10)	
Small bowel enterotomy requiring small bowel resection	5 (10.2)
Bladder injury requiring bladder repair	4 (8.2)
Ureteric injury requiring repair	1 (2.0)
Postoperative surgical (n = 6)	
Wound infection	3 (6.1)
Intra-abdominal abscess	1 (2.0)
Colovesical fistula*	1 (2.0)
Enterocutaneous fistula†	1 (2.0)
Postoperative medical (n = 4)	
Cardiac event	2 (4.1)
Respiratory infection	1 (4.1)
Urinary tract infection	1 (2.0)

*Patient had intraoperative bladder injury. †Patient had intraoperative small bowel resection.

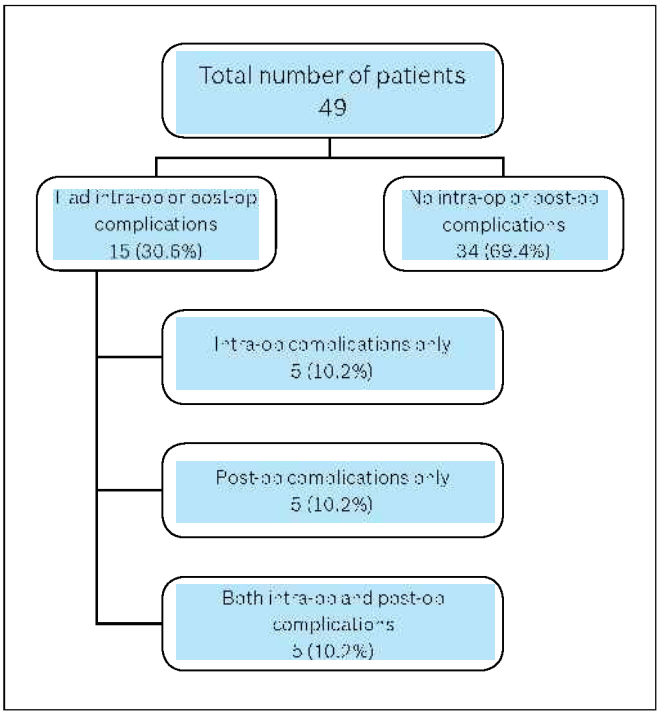

Fig. 1 Flow diagram shows perioperative complications.

patients and intraoperative haemodynamic instability in 4 (8.2%) patients and severe obstruction with ischaemic colitis in seven patients (Table III). A review of the records showed that these seven procedures were all performed as emergency cases by a surgeon who was more junior than the surgeon who subsequently attempted the reversal. The primary pathology in our patients was mostly colorectal carcinoma (Table IV). These patients accounted for 49.0% (n = 24) of the study population. In addition, six (12.2%) patients had prior surgery with a primary anastomosis performed but subsequently required a Hartmann's procedure due to anastomotic dehiscence with significant peritoneal soilage. The median interval between the creation and reversal of the Hartmann's procedure was 23 (range 8–421) weeks. Patient morbidity and mortality was independent of the timing of reversal. Also, there was no significant association between the timing of reversal and intraoperative complications (p = 0.792).

A total of 46 (93.9%) patients were successfully re-anastomosed. Three patients failed re-anastomosis as their rectal stump was densely adherent to the surrounding structures and could not be safely dissected free for anastomosis. In addition, massive bleeding from the pre-sacral plexus was encountered in one of these patients while dissecting the rectal stump, and the procedure was abandoned in view of haemodynamic instability. Pelvic packing was performed for haemostasis, and a relook laparotomy and removal of packs was performed two days later. The left ureter was also inadvertently injured in this patient, which was repaired primarily. All the patients who failed re-anastomosis had previous adjuvant radiotherapy. In total, ten (20.4%) patients had adjuvant radiotherapy prior to reversal surgery. Patients with prior radiotherapy were more likely to fail the trial of anastomosis (p = 0.007).

Nine (18.4%) patients had a defunctioning ileostomy created at the time of reversal. The indications for ileostomy were previous adjuvant radiotherapy (n = 6), low anastomosis (n = 2) and leak on testing of the anastomosis (n = 1). All but one of the patients subsequently underwent closure of the ileostomy (after a water-soluble contrast enema demonstrated that there was no anastomotic leak) without additional morbidity or mortality. The ileostomy in the last patient was not reversed as she subsequently developed advanced carcinoma of the cervix. The median operating time was 145 (range 35–325) minutes for all patients in this study. The median operative time for patients who had unsuccessful attempts at reversal was longer than that in patients who had successful reversal (215 min vs. 145 min).

Ten (20.4%) patients developed intraoperative complications (Table V), most of which happened during the course of adhesiolysis. Eight of these patients underwent successful reversal, while the remaining two procedures were abandoned for reasons already mentioned earlier. Five patients had inadvertent enterotomies requiring small bowel resection. Injury to the bladder was observed in four patients, while the last patient suffered a ureteric injury. All injuries to the urological system were repaired primarily. One patient who underwent repair of a bladder injury subsequently developed a colovesical fistula. A second patient who had resection of the small bowel developed an enterocutaneous fistula with small bowel contents discharging. Both patients were treated conservatively with bowel rest and total parenteral nutrition, and recovered well without any further surgical intervention. The remaining eight patients made a good recovery, with no additional postoperative morbidity.

In all, 39 (79.6%) patients made an uneventful recovery, with no postoperative complications (Fig. 1). Postoperative complications developed in ten (20.4%) patients, none of whom had more than one complication. The type and frequency of postoperative complications are listed in Table V. All patients recovered well without the need for any surgical intervention. In total, 34 (69.4%) patients underwent reversal of Hartmann's procedure without any morbidity (Fig. 1).

Three patients had superficial wound infections, all of whom recovered with conservative treatment with dressings. Two patients developed cardiac complications; the first developed mild congestive cardiac failure, which responded to diuretics, while the second developed atrial ectopics that resolved after treatment with anti-arrhythmics. One patient developed postoperative pneumonia, which resolved with intravenous antibiotics, and no invasive respiratory support was thus required. None of the patients suffered clinical anastomotic leaks or postoperative haemorrhage. However, as one patient developed an intra-abdominal abscess requiring percutaneous drainage and another developed a colovesical fistula, the possibility of an anastomotic leak was considered in both cases. Hence, water-soluble contrast enemas were performed in both patients; however, they did not demonstrate any obvious contrast leakage. Both patients recovered well without further surgical intervention. The median time of discharge was eight days post operation (range 5–29 days). Overall, the 30-day postoperative morbidity was 20.4% and the incidence of 30-day mortality was 0.0%.

DISCUSSION

Although primary resection with anastomosis has become increasingly popular in recent years, many surgeons may still prefer multistage procedures in the presence of complications such as diffuse peritonitis or severe obstruction. In such situations, it is more important to eliminate the septic focus in the first surgery and ensure patient survival. Restoration of bowel continuity is of lesser importance. After a suitable interval, however, it may be feasible to restore intestinal continuity. This decision depends on several factors, including patient choice, potential length of survival as well as local disease factors that may make reversal potentially difficult or impossible. The experience and skill of the surgeon also plays a major part.

Our series of 255 Hartmann's procedures over a 16-year period (average of 16 Hartmann's procedures per year) is comparable to the numbers in previous studies, which reported an average of 5–19 Hartmann's procedures performed in a year.[1,5,9,19,20,22] With regard to Hartmann's reversal, most studies quote a reversal rate of 4%–85%. Reversal rates for diverticular disease are higher (31%–85%), as compared to 4%–53% for carcinoma.[1,5,7-10,12,15,16,19,22,23] In an analysis of factors predicting the likelihood of Hartmann's reversal, Roque-Castellano et al found that a non-neoplastic aetiology was associated with a higher likelihood of reversal.[8] Unlike most other studies conducted in the Western populations, in which diverticular disease was the most common indication for Hartmann's procedure, the majority of our patients had this procedure performed for locally advanced cancer. This is likely because Asians have a lower incidence of diverticular disease, and our population has a high incidence of colorectal cancer.[21]

Similar demographics were found in a study by Leong et al, which was also conducted in an Asian population.[22] Patients with locally advanced rectal cancer have guarded prognoses with a limited survival after Hartmann's procedure, and hence, very few of these patients would survive long enough to warrant reversal of the stoma. More than 88% of the patients who survived the initial Hartmann's procedure but did not undergo reversal in our study were either not suitable or not keen for a second operation. The abovementioned reasons could explain our reversal rate of 19.2%, which is lower as compared to that quoted in the literature. Furthermore, in a specialised colorectal department with a strong preference toward primary resection and anastomosis, the threshold for subjecting a patient to a Hartmann's procedure is likely to be higher than that in a non-specialised department. As a result, only the most complicated cases would be expected to undergo Hartmann's procedure. These cases are predicted to be associated with complicated reversals, causing both the surgeon and patient to be less keen on repeat surgery.

A total of 18% of patients had a defunctioning stoma created at the same time as the reversal of Hartmann's procedure. This is comparable to the figure of 3%–26% cited in the literature.[4,9,11,13] As previously mentioned, the most common indication for Hartmann's procedure in our study was carcinoma, as compared to sigmoid diverticular disease in most other studies.[4,9,20] As such, our patients had a higher likelihood of having undergone prior radiotherapy. They were also more likely to have a low anastomosis due to prior resection of a rectal tumour. Both irradiated bowel and low anastomosis result in a higher risk of anastomotic complications. It is thus a common practice in our department to perform a defunctioning stoma for these patients. Our limited data indicates that having prior radiotherapy has a negative predictive value for successful reversal of Hartmann's procedure. Radiotherapy could have been associated with denser adhesions[24] or more aggressive pelvic tumours, as patients with more locally advanced rectal tumours were given radiotherapy. Patients with previous radiotherapy should thus be counselled appropriately. However, a larger number of patients is required to further evaluate this appropriately.

There has been no consensus regarding the timing of reversal of Hartmann's procedure. Delayed reversal has been advocated in several studies.[2,3,9] The reasons cited include less dense adhesions, lower risk of small bowel injury as well as more time to optimise the clinical and nutritional status of the patient. On the other hand, Geoghegan and Rosenberg suggested that there is a lower complication rate when reversal is performed within one month.[6] In our study, there was no identifiable relationship between the timing of reversal and complications, both intra- and postoperatively. These could, however, be confounded by the fact that most of the reversals in this study were performed relatively late, with only six (12%) patients having reversals performed before an interval of 12 weeks and none within one month. In many cases, early reversal was not an option due to the adjuvant chemoradiation administered for carcinoma after Hartmann's procedure.

Intraoperative complications such as enterotomies and injuries to the urological system are known risks of Hartmann's reversal, and significantly contribute to the morbidity associated

with this procedure. The underlying reason is adhesions from previous surgery. During adhesiolysis of an adherent peritoneal cavity, inadvertent injuries may be difficult to prevent even with meticulous and careful techniques. However, these injuries were manageable in our review. With the exception of two patients who developed fistulas, all the other patients suffered no additional postoperative morbidity as a result of these injuries. The majority of studies in the literature did not specifically mention the incidence of intraoperative complications. In the few papers that did mention the incidence of intraoperative complications, such as ureteric injury and small bowel injury, it ranges from 0% to 16%.[5,9,25] More importantly, the postoperative morbidity of 20.4% in our series is comparable with the morbidity rates quoted in the literature, which shows that despite the intraoperative complications, the postoperative course was still acceptable.

The clinical anastomotic leak rate in our series was 0.0%. However, as one patient developed an intra-abdominal abscess and a second patient developed a colovesical fistula, the presumed leak rate could possibly be 4.1%. Water-soluble contrast enemas performed in both patients, however, did not demonstrate any obvious contrast leakage to support this inference. The anastomotic leak rate in our series could thus be presumed to be 0.0%–4.1%, a figure that is comparable to those previously reported in the literature.[5,7,19]

Hartmann's reversal has traditionally been viewed as a complex surgical procedure with significant morbidity and mortality. The reported morbidity and mortality rates in the literature after Hartmann's reversal varies from 0%–75% and 0%–28%, respectively.[2-14] In our series, reversal of Hartmann's procedure was successful in 93.9% of the patients. Morbidity and mortality were acceptable at 20.4% and 0.0%, respectively. These were also comparable to the morbidity and mortality rates of 25%–40% and 1%–20%, respectively, for single-stage procedures reported in the literature.[26,27] However, caution must be exercised in cases where dense adhesions in the pelvis may be suspected. These may include patients with previous radiotherapy or severe infections. In these patients, the success of reversal may be lower and the rate of complications higher.[5,11,24] Appropriate preoperative counselling and assessment in this group of patients is thus crucial.

Laparoscopic or laparoscopic-assisted reversal of Hartmann's procedure has recently gained popularity as surgeons become more skilled in laparoscopy. Several studies have shown that the laparoscopic approach was associated with either improved or similar outcomes in terms of hospital stay, return of bowel function and morbidity rates.[25,28-31] Hence, it may be the preferred option for a surgeon who is well-versed in laparoscopic surgery. For most of the duration of this study, our institution was not performing laparoscopic colorectal surgery. However, in the last few years, we have started performing a larger number of laparoscopic colorectal resections and laparoscopic reversal of Hartmann's procedure.

In conclusion, our Asian population has a high incidence of colorectal cancer, and hence, Hartmann's procedures are more commonly performed for colorectal cancer rather than for diverticular disease. This difference in demographics results not only in a difference in the reversal rates of stoma, but also challenges related to prior radiotherapy and shorter rectal stump during reversal surgery. Keeping these in mind, reversal of Hartmann's procedure in our population can still be performed with acceptable morbidity and minimal mortality.

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