Laparoscopic, robotic and transanal reversal of Hartmanns: pitfalls and challenges

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Abstract: The Hartmann procedure is the gold standard surgical intervention for a variety of emergencies, it comprises of a sigmoid colectomy and formation of an end colostomy followed by closure of the rectal stump within the pelvis. Reversal of Hartmann's remains a complex procedure and restoration of intestinal continuity occurs in a significantly low percentage of patients leading to a negative impact on their quality of life. With the advent of minimally invasive colorectal surgery, there is increasing evidence that a combined laparoscopic, robotic and transanal approach to reversal of Hartmanns seems to be a safe and feasible technique. Our aim was to outline the common pitfalls and difficulties, describe a combined laparoscopic, robotic and transanal approach and suggest operative techniques in particularly difficult reversals.

Keywords: Transanal total mesorectal excision (taTME); transanal; laparoscopic; Hartmann's reversal; rectal cancer

Introduction

A Hartmann's procedure (HP) was first introduced by a French Surgeon Dr. Henry Albert Hartmann in 1921 (1). It was initially described for the treatment of malignant colonic obstruction. Due to a high risk of anastomotic leak, the concept was to resect the offending pathology and form a colostomy, leaving a rectal stump in the pelvis. Although the primary pathology for a HP was for left sided colorectal cancer, this has been broaden to complicated diverticulitis (Hinchey grade III and IV), colonic trauma, and ischemic colitis (2,3). The avoidance of morbidity and mortality associated with anastomotic leak is key, as a temporising measure in the emergency setting (4) with the option reversing the colostomy at a stage where the risk profile is lower (5-7). Traditionally an open procedure, this is no longer the case with the advent use of minimally invasive

technique (MIS). In a select group of patients requiring emergency HP, laparoscopic and robotic surgery can yield an equivalent morbidity and mortality rate compared to open procedure whilst preserving the benefits of MIS such as earlier return of normal bowel function, resumption of regular diet and less post-operative pain (7-9).

The first published report of a laparoscopically assisted Hartmann's reversal was by Anderson *et al.* in 1993 (10) and since then there have been multiple studies showing laparoscopic technique a safe and feasible alternative to open Hartmann's reversal (11-15). This was confirmed by a meta-analysis of level III evidence (16), which showed laparoscopic Hartmann's procedure (LHR) was associated with less overall post-operative morbidity, length of stay, wound infection, and ileus. Patients with colostomies may have significant intra-abdominal adhesions, hence gaining access to the peritoneal cavity using a previous midline
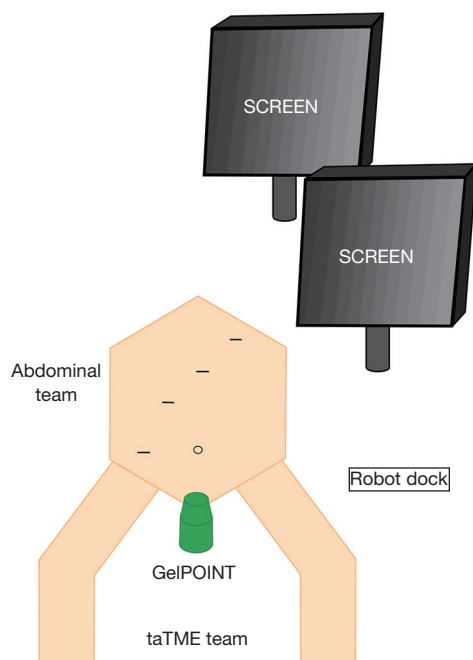
Figure 1 "Cecil" approach with taTME—set up of patient, equipment and surgical teams.

incision may increase likelihood of inadvertent bowel injury. Therefore the recommendation is to wait six months before a reversal is undertaken, however this can be shortened to three months in patients who will be favourable for a LHR (4,13).

LHR remains challenging in patients that are obese, those with narrow or frozen pelvis and fibrotic rectal stumps. Therefore, the conversion rate to open surgery can be up to 50% (16). The main reasons cited for conversion are adhesions, difficulty identifying the rectal stump or risk of injury to the rectum during its dissection (16). In the setting where the rectum have been divided below the peritoneal reflection and dense adhesions have occurred around the surrounding adjacent pelvic structures, a transanal total mesorectal excision (taTME) approach is a potential alternative as it allows for better visualization in virgin surgical territory with the additional pneumorectal dissection that helps open the plane (17).

Laparoscopic, robotic and transanal reversal of Hartmann's procedure

Patients received standardized bowel preparation day prior. The rectal stump was cleaned pre-operatively with an enema. All patients received antibiotic prophylaxis with 2g of cefazolin. Patients were fixed and placed in Lloyd Davies position with legs in padded, adjustable stirrups. Rectum was further irrigated with diluted iodine solution. A urinary catheter was placed under sterile conditions. Surgical team were organised into a two-team procedural approach ("Cecil") as depicted in *Figure 1*.

Abdominal component

Standard Optiport™ entry was utilised and abdominal ports were placed with robotic arms positioned for a routine low anterior resection with the da Vinci® Si Surgical System. The taTME approach was set up synchronously. A pericolostomic incision was made and the colostomy was dissected free into the peritoneal cavity. We suggest a completion left colectomy to the level of the descending colon at a minimum. To achieve additional colonic length and a tension-free anastomosis the left colon can be mobilised by taking down the splenic flexure, in so doing, the inferior mesenteric vein may need to be ligated again. If further length is needed, the hepatic flexure can also be mobilized. A purse-string suture is placed in the proximal bowel and the anvil is secured into place.

Transanal component

A Lone Star retractor is placed and the rectal stump is identified, a Hegar dilator may be utilised if necessary. The transanal access platform is introduced through the anal canal with a 10 mm AirSeal trochar used to create pneumorectum and provide smoke evacuation. Initially an Olympus 0-degree camera is used with a CO_2 pressure of 5 mmHg to create a planned mucosal mark with the use of hook diathermy. This was followed by full thickness circumferential rectotomy through both mucosal and muscle layers. Pressure was then increased to 12 mmHg and camera changed to 30-degree laparoscope. A flexible tip endoscope was used and the proximal part of the rectal stump was circumferentially dissected with diathermy, adjacent to the previous stapler line. Once advanced into the presacral space, the mesorectum is mobilised. This avascular plane of dissection is extended medially and laterally to enable circumferential rectal mobilisation. The peritoneal reflection is then identified and divided to aid proximal stump removal, the resected tissue is then exteriorised through the anus. In patients with diverticular disease, it is important to ensure that the residual sigmoid

colon is resected, at least, to the level of the rectosigmoid junction, we suggest resection to upper/mid rectum as it further reduces pressure on the anastomosis. The rectum is prepared for anastomosis with a circumferential prolene purse-string suture. The proximal colon with the attached anvil is connected to the circular stapler and an end-to-end anastomosis is performed within 10 cm of the anal verge. The anastomosis may be reinforced with sutures. The anastomosis position is confirmed laparoscopically, avoiding any tension. An air-leak test was performed to check anastomotic integrity. In our experience, without a loop ileostomy, healing rates of a tension free, well vascularised low pressure anastomosis with or without suture reinforcement is close to 100%.

We have utilised this technique in a patient with a long standing Crohn's stump who was previously assessed, by two leading colorectal surgeons, as having a frozen pelvis abdominally and was deemed to have had a "permanent colostomy" for 20 years. Improvements in Crohn's medical therapy meant his colonic health/colitis was better optimised pre-operatively. An open approach confirmed the presence of a frozen intraperitoneal pelvis. A synchronous transanal approach was utilised for this gentleman for a perineal primary approach to allow for restoration of intestinal continuity. He is now 2 years post reversal, and fully functional and working full time with good quality of life.

Pitfalls to reversal of Hartmann's procedure

HP is usually performed in an emergency setting, often in medically co-morbid, frail and/or septic patients and is associated with relativity high morbidity and mortality. In current literature, reversal rates are variable but show a trend of being lower than 50% (18-20). Closure rates are higher if the HP is performed for a benign condition, such as perforated diverticulitis, as opposed to patients with a malignancy (21,22). This, at least in part, may be attributed to worse pre-morbid characteristics, need for further medical therapy and worse prognosis in patients with cancer.

Difficulty in reversal of Hartmann's procedure can be classified into three stages: abdominal adhesiolysis, identification and dissection of rectal stump and performing the anastomosis. Previous peritonitis and its resultant adhesions can complicate not only entry into the peritoneal cavity but also subsequent colonic mobilization. Following Hartmann's procedure, the rectal stump undergoes

shrinkage and, with time, changes of diversion colitis (23). Several techniques have been described to help identify the rectal stump, some authors advocate implanting the rectal stump above the fascia and just under the skin during the original Hartmann's procedure, this has the added benefit of minimizing the potential for rectal scarring and formation of small bowel adhesions around the stump. Others suggest the use of flexible sigmoidoscopy as it can assess for strictures, it noted, endoscopic balloon dilatation may be necessary. It is important to assess the health of the rectal stump prior to creating the anastomosis, if the end of the rectal stump is uneven, atrophic or fibrosed, this may need to be stapled off to ensure a safer anastomosis. Beware of proximal handsewn joins with long remnant stumps, there is a temptation to rejoin without further resection as they are matched, but, in our experience, we've found the pressure in these anastomoses along with the potential of anastomotic leakage to be much higher.

Tips and tricks for difficult reversal of Hartmann's procedure

In extended left hemicolectomies, achieving a tension free anastomosis is often difficult as the residual colon is too short to reach the rectal stump. In such cases, we suggest performing a laparoscopic/or robotic retro-ileocolic colorectal anastomosis. Once flow is confirmed in the marginal artery, we advise ligation of the MCA high to aid with mobilizing the hepatic flexure and allowing the reflection of the right colon from the right paracolic gutter. Such a manoeuvre may be facilitated with a handport if difficult through conventional methods. A window is then created in an avascular area of the ileal mesentery underneath the ileocolic artery and the residual transverse colon is placed through the window to reach the anal canal, this reduces tension on the subsequent colorectal anastomosis.

In very low colorectal anastomoses, we suggest ureteric stenting and in select cases where the stump is below the rectovaginal septum (*Figure 2*) we have had to perform an en-bloc hysterectomy to enable identification of the anorectal stump from above. If the rectal stump is truly extra-peritoneal, we suggest that the anorectal sphincter should be dissected out to find the remnants of the stump. Obviously in such cases this can be performed through an open, laparoscopic or robotic approach. If it is still difficult a transanal approach can be utilised easily, depending on surgeon familiarity.
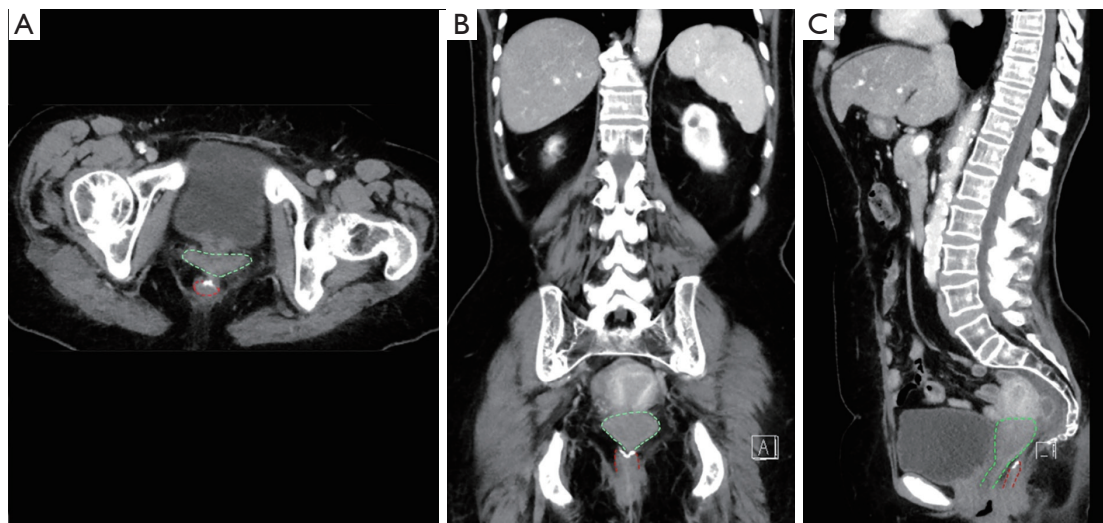
Figure 2 Axial (A), coronal (B) and sagittal (C) CT slices of the patient showing a very low rectal stump largely below the rectovaginal septum. Green border outlines the uterus extending inferiorly to the vaginal canal (C) and red border outlines the rectal stump.

Acknowledgments

Footnote

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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