CASE SERIES

Laparoscopic colostomy reversal after a Hartmann procedure: a prospective series, literature review and an argument against laparotomy as the primary approach

Hai Huynh, MD
Daniel C. Trottier, MD
Claudia M. Soto, MD
Husein Moloo, MD
Eric C. Poulin, MD
Joseph Mamazza, MD
Robin P. Boushey, MD, PhD

From the Minimally Invasive Surgery Research Group, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

Presented as a poster at the Society of American Gastrointestinal and Endoscopic Surgeons meeting, Apr. 22–25, 2009, in Phoenix, Ariz.

Accepted for publication
June 1, 2010

Correspondence to:
Dr. R.P. Boushey
The Ottawa Hospital — General Campus
501 Smyth Rd., CCW 1617
Ottawa ON K1H 8L6
rboushey@ottawahospital.on.ca

DOI: 10.1503/cjs.013510

Background: Open restoration of bowel continuity after a Hartmann procedure has been associated with significant morbidity, including anastomotic leak, incisional hernia, wound infections and inability to re-establish intestinal continuity. Few studies have examined the role of laparoscopy in performing a Hartmann reversal. The aim of this study was to review our laparoscopic Hartmann reversal (LHR) experience with an emphasis on intra- and postoperative adverse events.

Methods: A prospectively collected laparoscopic colorectal database involving 3 surgeons in 4 academic centres between 1991 and 2008 was reviewed. Factors evaluated were patient demographics, diagnosis, duration of surgery, intra- and postoperative complications, recovery of bowel function and length of stay in hospital.

Results: Twenty-eight consecutive patients (13 men, 15 women) with a mean age of 61.1 (standard deviation [SD] 15.3) years and a mean weight of 72.3 (SD 20.1) kg underwent LHR. The diagnosis at initial surgery was complicated diverticulitis in 19 patients (67.9%), cancer in 6 patients (21.4%) and "other" in 3 patients (10.7%). The median duration of surgery was 166.2 (SD 74.4) minutes. There were no conversions. There was 1 major intraoperative complication (bleeding; 3.6%). There were 3 postoperative complications (10.7%): 1 abscess, 1 prolonged ileus and 1 wound hematoma. Only 1 patient with an abscess required readmission. There were no observed clinical anastomotic leaks. All patients underwent successful reanastomosis. The median time to return of bowel function was 4 (interquartile range [IQR] 3–4) days. The median length of stay in hospital was 5 (IQR 3–6) days. There was no mortality.

Conclusion: Laparoscopic colostomy reversal after a Hartmann procedure is safe and feasible in experienced hands. It is associated with low morbidity, quick return of bowel function and short stay in hospital.

Contexte : Le rétablissement chirurgical ouvert de la continuité intestinale après une intervention de Hartmann a été associé à une morbidité importante, y compris une fuite à l'anastomose, une hernie à l'incision, des infections de la plaie et l'incapacité de rétablir la continuité intestinale. Peu d'études ont porté sur le rôle de la laparoscopie dans l'inversion d'une intervention de Hartmann. L'étude visait à revoir notre expérience de l'inversion par laparoscopie de l'intervention de Hartmann (ILIH) en insistant sur les événements indésirables intraopératoires et postopératoires.

Méthodes : On a étudié une base de données recueillies de façon prospective sur la laparoscopie colorectale effectuée par 3 chirurgiens dans 4 centres universitaires entre 1991 et 2008. Les caractéristiques démographiques des patients, le diagnostic, la durée de l'intervention chirurgicale, les complications intraopératoires et postopératoires, le rétablissement de la fonction intestinale et la durée de l'hospitalisation ont été les facteurs évalués.

Résultats : Vingt-huit patients consécutifs (13 hommes, 15 femmes) âgés en moyenne de 61,1 (écart-type [ET] 15,3) ans et d'un poids moyen de 72,3 (ET 20,1) kg ont subi une ILIH. Le diagnostic à l'intervention chirurgicale initiale indiquait une diverticulite compliquée chez 19 patients (67,9 %), un cancer chez 6 patients (21,4 %) et « d'autres problèmes » chez 3 patients (10,7 %). La durée médiane de l'intervention chirurgicale s'est établie à 166,2 (ET 74,4) minutes. Il n'y a pas eu de conversion. Il y a eu 1 complication intraopératoire importante (saignement; 3,6 %). Il y a eu

3 complications postopératoires (10,7 %) : 1 abcès, 1 iléus prolongé et 1 hématome à la plaie. Un seul patient qui avait un abcès a dû être réhospitalisé. On n'a pas observé de fuite à l'anastomose clinique. Tous les patients ont subi une reperméabilisation réussie. La durée médiane du rétablissement de la fonction intestinale s'est établie à 4 (plage interquartile [PIQ] 3–4) jours. La durée médiane de l'hospitalisation a été de 5 (PIQ 3–6) jours. Il n'y a pas eu de mortalité.

Conclusion : L'inversion d'une colostomie par laparoscopie après une intervention de Hartmann est sans danger et faisable par un chirurgien chevronné. On l'associe à une faible morbidité, à un rétablissement rapide de la fonction intestinale et à un bref séjour à l'hôpital.

Open restoration of bowel continuity after a Hartmann procedure is technically challenging and has been associated with significant morbidity (13%–50%), including anastomotic leakage (0%–15%), incisional hernia and wound infections.[1–5] The mortality rate for the open approach remains high at 5%–10%.[1–4] Because of the relatively high morbidity and mortality rates and associated patient comorbidities, up to 60% of patients never have intestinal continuity re-established.[1,2] Few studies have examined the role of laparoscopy in performing colostomy reversal after a Hartmann procedure since it was initially reported in 1993.[6] Small series report conversion rates as high as 25% because of multiple and dense adhesions and difficulty in identifying the rectal stump.[7,8] Hand-assisted techniques have also been described.[8]

The aim of this study was to review our experience with laparoscopic colostomy reversal after a Hartmann procedure with an emphasis on intra- and postoperative adverse events.

Methods

Consecutive patients undergoing laparoscopic colostomy reversal after a Hartmann procedure (LHR) between 1991 and 2008 were reviewed in our prospectively collected database. The Ottawa Hospital Research Ethics Board approved the password-protected electronic database and its use for research. All patients were offered a minimally invasive approach by the 3 study surgeons. No selection took place on the basis of body habitus or previous abdominal surgery. Two surgeons were involved with the accrual of patients for the first 7 years of this database, with a third surgeon added after 1998. All procedures had direct operative involvement of surgical trainees and fellows. Factors evaluated were patient demographics (age, sex and weight), diagnosis, duration of surgery, intra- and postoperative complications, recovery of bowel function and length of stay in hospital. Preoperative mechanical bowel preparation was given to all patients. All procedures were done by a totally laparoscopic technique. No hand-assist devices were used.

Operative technique

All patients are placed in a modified lithotomy position using Allen Yellofin stirrups (Allen Medical Systems). A bean bag is used to prevent patient slippage, and both arms are tucked in on the sides. Patients routinely receive preoperative antibiotics and subcutaneous heparin. The surgeon stands on the right of the patient and the assistant on the left. The first trocar entry is through the umbilicus under direct visualization with a 12-mm trocar (Hasson technique). A 12- to 15-mm Hg pneumoperitoneum is then created and a 30° laparoscope used. Other port entry sites are dependent on the shape of the abdominal dome and the location and extent of intra-abdominal adhesions. Our usual configuration consists of a 12-mm trocar in the right lower quadrant area and a 5-mm trocar in the right superior paramedian position. A 5-mm trocar in the left upper quadrant is added if necessary. All ports are inserted after prior localization with a 25-gauge needle and infiltration of the peritoneum and skin site with a mixture of 0.25% marcaine and epinephrine. Lysis of adhesions is performed with sharp scissor dissection and minimal use of electric current to prevent any injury to the bowel and to minimize vascular injury during pelvic dissection. During pelvic dissection, the small bowel is mobilized from the pelvis, permitting better visualization of the rectal stump. Minimal dissection and mobilization of the rectal stump should be done, and identification of the remaining rectum can be facilitated by transanally inserting a circular stapler, Hegar dilators or a rigid sigmoidoscope. The rectal stump is mobilized only as much as required to expose an adequate and appropriate surface for the circular stapler to be applied. Once the rectal stump is mobilized sufficiently, dissection of the intra-abdominal part of the colostomy, proximal colon and take-down of the splenic flexure are done. This last step is usually performed to ensure that the anastomosis is tension-free. A circumferential incision around the skin at the stoma site completes the colostomy mobilization. The edge of the stoma and proximal colon is revised to take away excessive scar tissue, and an appropriately sized anvil of a circular stapler is secured with a purse-string polypropylene suture. Any residual distal sigmoid should be resected to prevent ischemic insult to the anastomosis. Once placed back into the abdominal cavity, the fascia of the old stoma site is closed with a polypropylene suture, the pneumoperitoneum is re-established, and an end-to-end colorectal anastomosis is created with an appropriately sized endoluminal circular stapler. If possible,

a stapler with a diameter less than 28 mm is avoided. The stoma wound is either left open or closed with a purse-string suture using an absorbable suture, permitting only insertion of the 5th finger. This cavity is then packed and home care is arranged (Fig. 1).

Results

Laparoscopic colostomy reversal after a Hartmann procedure was performed in 28 consecutive patients from 1991 to 2008. All had left-sided colostomies. Fifteen of 28 (53.6%) patients were women. The mean age for all patients was 61.1 (SD 15.3) years and the mean weight was 72.3 (SD 20.1) kg. The mean body mass index (BMI) was 25.47 (SD 1.28) kg/m^2 in 7 patients who underwent surgery between 2005 and 2008. Body mass index was not available in our database before 2005 (Table 1).

Indications for the initial Hartmann procedure included complicated diverticulitis in 19 patients (67.9%), obstructive sigmoid cancer in 6 patients (21.4%) and "other" in the remaining 3 patients (10.7%): 1 sigmoid volvulus, 1 Crohn distal colitis with perforation and 1 undetermined colitis. All primary procedures had been performed in an open fashion.

The mean duration of surgery for LHR procedures was 166.18 (SD 74.41) minutes. The size of the opening at the stoma site varied depending on whether it was left open or closed with a purse-string. The timing for the reversal for all patients was more than 3 months after the initial procedure, with most of them being more than 6 months later.

There was 1 intraoperative complication (3.6%): bleeding from the mesentery, which was controlled laparoscopically. There were no conversions to open surgery. There were 3 postoperative complications (10.7%): 1 abdominal wall hematoma treated conservatively, 1 prolonged ileus and 1 infected pelvic hematoma drained percutaneously.

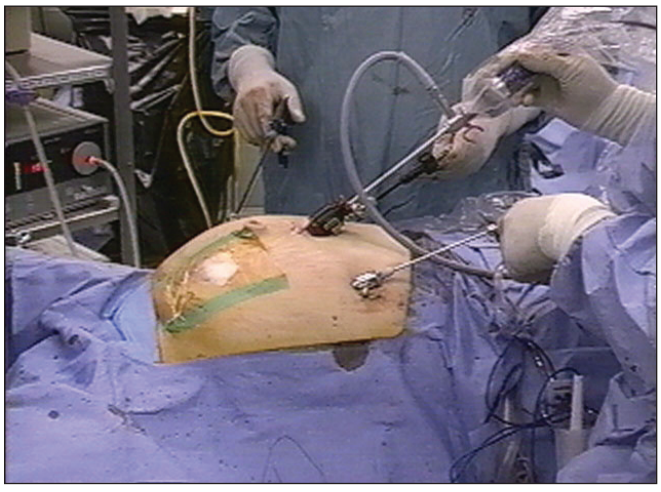

Fig. 1. Ports placement: 12-mm umbilical port introduced under direct visualization, 12-mm trocar at the right lower quadrant area, 5-mm trocar at the right lower quadrant area and 5-mm trocar at the left upper quadrant added if necessary.

There was no 30-day mortality. The median time to recovery of bowel function was 4 days, and the median time to discharge was 5 days.

Discussion

Results from this study demonstrate that LHR can be performed after an open primary procedure with outcomes that compare favourably to the open surgery literature and corroborate the laparoscopic surgery literature. When patients were selected for LHR in this study, reversal was possible in every case. This would seem to indicate that the case for nonreversal of a Hartmann procedure is made with the patient and family on other grounds (e.g., age, comorbidities, morbid obesity). Therefore, all patients who were deemed appropriate candidates for reversal were offered a laparoscopic approach.

In our series of 28 patients, intra- and postoperative adverse events (3.6% and 10.7%, respectively) compared favourably with that reported in the open surgery (13%–50%)[1–5] and laparoscopic surgery (9%–25%)[6–23] literature for reversal of a Hartmann procedure. No clinical leaks were encountered, and there was no mortality. No conversions were necessary, as all operations were completed laparoscopically. Recovery of bowel function was good (median of 4 d) and time of discharge was early (median of 5 d). Although only 28 patients were included in our study, it is still one of the largest series in the literature, even 15 years after the first LHR was reported. This attests to the difficulty and technical challenge of this procedure. Open restoration of bowel continuity can be easier but appears to be associated with significant morbidity and mortality.[1–5]

A review of the literature reveals that only a few small

Table 1. Summary of results in 28 patients who underwent a laparoscopic reversal of a Hartmann procedure

Factor	All patients (1991–2008), *n* = 28
Female sex, no. (%)	15 (53.6)
Age, mean (SD) yr	61.11 (15.3)
Weight, mean (SD) kg	72.3 (20.1)
Diagnoses, no. (%)	
Diverticulitis	19 (67.9)
Cancer	6 (21.4)
Other	3 (10.7)
Operating room time, mean (IQR) min	166.18 (74.41)
Intraoperative events, no. (%)	
Intraoperative complications	1 (3.6)
Conversion	0
Postoperative events, no. (%)	
Postoperative surgical complications	3 (10.7)
Postoperative medical complications	0
Mortality	0
Days to diet as tolerated, median (IQR)	4 (3–4)
Days to discharge, median (IQR)	5 (3.5–6)

IQR = interquartile range; SD = standard deviation.

case series and no randomized controlled trials on LHR have been published.[6–23] The largest study was that of Vacher and colleagues[13] and consisted of 38 patients. Their conversion rate was 15.8% (6 of 38), the morbidity rate was 23.5% and the mortality rate was 2.7%. Rosen and colleagues[11] published a series involving 22 patients with a conversion rate of 9%, complication rate of 18% and no mortality. In a recent series by Carus and colleagues,[15] 28 patients had a conversion rate of 17.9% (5 of 28), a complication rate of 17.9% and no mortality. Macpherson and colleagues[10] had no conversions in their series of 12 patients. Most of the previous studies refer to LHR after a primary open Hartmann procedure. Interestingly, Chouillard and colleagues[17] published a series of 27 patients who underwent LHR after a primary laparoscopic Hartmann procedure. The conversion rate was 15%, the morbidity rate was 15%, and there was no mortality. Table 2 summarizes the results in the open surgery and laparoscopic surgery literature.

Laparoscopic Hartmann reversal is a valuable alternative to its open counterpart in an attempt to achieve the benefits traditionally associated with minimally invasive surgery. One of the limitations of this study is the absence of an open surgery cohort for comparison. Referral has a big part to play. Selection bias is also an issue with this study; however, almost all patients deemed fit for reversal are approached laparoscopically by this group, which could help minimize this bias. The only patients who would not be considered appropriate candidates are the morbidly obese patients (BMI > 40 kg/m^2) and patients who could not tolerate a pneumoperitoneum. A randomized controlled trial will likely not be undertaken in this area, and case series such as this (with prospectively collected data) are helpful to surgeons looking for information on this topic.

One technical point for discussion is the location of the first trocar. Our group has used the umbilicus for first entry, even with prior midline incisions, provided a very careful dissection is done in the subfascial planes. Other possible sites described are the right lower quadrant,[14] the left upper quadrant[11] or the stoma site.[11,14] This decision depends on the operating surgeon's judgment and level of comfort. Our series shows that going through the umbilicus is a reasonable option. There were no trocar-related injuries, as insertion was never made unless direct visualization was achieved. Further trocars were placed under direct vision, as mentioned in the methods section. The most common reason for varying from these port placements is for lysis of adhesions. Obviously, the most technically demanding portion of the surgery relates to the extensive lysis of adhesions that is often required to visualize the pelvis (and the rectal stump). Patience and precautions are necessary assets.

A further technical issue relates to the extent of dissection of the rectal stump. Once there is enough rectal stump available to perform a safe anastomosis, further dissection is not done to avoid injury to the rectum or compromise

Table 2. Summary of the studies on Hartmann procedure reversal in the open surgery and laparoscopic surgery literature

Country	Study	Year	Procedure	No. cases	Conversions, no. (%)	Morbidity, %	Mortality, %	LOS, d
UK	Roe et al.[3]	1991	Open	69	—	30.0	3.0	—
UK	Pearce et al.[1]	1992	Open	80	—	16.0	4.0	—
UK	Wigmore et al.[2]	1995	Open	178	—	10.6	0.6	—
France	Kunin et al.[4]	1992	Open	23	—	47.8	4.3	—
Australia	Keck et al.[5]	1994	Open	50	—	26.0	2.0	—
USA	Anderson et al.[19]	1993	Laparoscopic	2	0	0	0	—
USA	Sosa et al.[9]	1994	Laparoscopic	18	4 (22.2)	14.3	0	4.3
USA	Costantino et al.[20]	1994	Laparoscopic	3	0	0	0	5.3
USA	Vernava et al.[7]	1995	Laparoscopic	2	0	0	0	4.0
UK	Macpherson et al.[10]	1996	Laparoscopic	12	0	8.0	0	8.0
Brazil	Regadas et al.[21]	1996	Laparoscopic	20	3 (15.0)	41.0	0	4.0
Spain	Delgado et al.[22]	1998	Laparoscopic	11	1 (9.1)	0	0	7.0
Germany	Kohler et al.[12]	1999	Laparoscopic	18	2 (11.1)	16.7	0	7.5
Ireland	Holland et al.[23]	2002	Laparoscopic	4	1 (25.0)	0	0	7.0
France	Vacher et al.[13]	2002	Laparoscopic	38	6 (15.8)	23.5	2.7	10.0
USA	Rosen et al.[11]	2005	Laparoscopic	22	2 (9.1)	18.0	0	4.2
France	Mutter et al.[18]	2006	Laparoscopic	6	0	0	0	8.5
Israel	Khaikin et al.[14]	2006	Laparoscopic	27	4 (14.8)	33.0	0	6.0
France	Chouillard et al.[17]	2007	Laparoscopic	27	3 (11.1)	15.0	0	12.0
Germany	Carus et al.[15]	2008	Laparoscopic	28	5 (17.9)	14.3	0	8.6
UK	Slawik et al.[16]	2008	Laparoscopic	28	2 (7.1)	17.9	7.0	3.0
Canada	Huynh et al.	2010	Laparoscopic	28	0	10.7	0	5.0

LOS = length of stay in hospital; UK = United Kingdom; USA = United States.

vascular supply. We believe this reduces the risk of leak due to poor blood supply. At times, a more extensive dissection is required if the rectum is lying at an angle that precludes passage of the stapler. Finally, if there is some distal sigmoid that is still present, this is usually resected to decrease the chance of recurrent diverticulitis, ensure that there isn't a vascularly compromised segment of colon used for the anastamosis and make it easier to pass the stapler up to the end of the stump to perform the anastomosis.

One reason that can serve to explain the good outcomes of this study may be the timing of LHR. It is likely helpful to wait at least 6 months before the secondary procedure. At time of laparoscopy, it is often surprising how few adhesions there are, if a long enough grace period is used between procedures. Therefore, it is worth introducing a laparoscope in all patients to assess the feasibility of doing the reversal laparoscopically, especially considering the benefits to the patient. The usual reason for conversion is inability to take down adhesions adequately enough to define the abdominal–pelvic anatomy. Experience of the study surgeons also plays some part. However, we feel that any general surgeon who has experience with laparoscopic colorectal surgery could undertake this procedure safely if the guidelines we have laid out here are followed. Many of the skills used in those procedures can be transferred to reversal of a Hartmann procedure. It is also important that at the first surgery the splenic flexure not be mobilized and pelvic dissection under the sacral promontory not be performed if possible. Avoiding these makes the reversal less technically challenging for both the open and laparoscopic approaches.

Conclusion

Laparoscopic colostomy reversal after a Hartmann procedure is safe and feasible in experienced hands. It is associated with low morbidity, quick return of bowel function and short stay in hospital. Although extensive lysis of adhesions is often necessary, conversion to an open procedure is uncommon. A minimally invasive approach should be considered a good alternative to a laparotomy for Hartmann reversals.

Competing interests: Drs. Moloo, Poulin, Mamazza and Boushey are part of the Minimally Invasive Surgery Research Group at The Ottawa Hospital, supported by unrestricted educational grants from Covidien Canada and Storz Canada. Dr. Mamazza declares having received speaker fees from both Covidien and Storz. There are no other conflicts of interest or financial ties to disclose.

Contributors: Drs. Huynh, Trottier, Poulin, Mamazza and Boushey designed the study. Drs. Huynh, Soto, Poulin and Boushey acquired the data, which Drs. Huynh, Trottier, Soto, Moloo, Poulin, Mamazza and Boushey analyzed. Drs. Huynh, Poulin and Boushey wrote the article, which Drs. Huynh, Trottier, Soto, Moloo, Poulin, Mamazza and Boushey critically reviewed. All authors approved publication.

References

1. Pearce NW, Scott SD, Karran SJ. Timing and method of reversal of Hartmann's procedure. *Br J Surg* 1992;79:839-41.
2. Wigmore SJ, Duthie GS, Young IE, et al. Restoration of bowel continuity following Hartmann's procedure: the Lothian experience 1987–1992. *Br J Surg* 1995;82:27-30.
3. Roe AM, Prabhu S, Ali A. Reversal of Hartmann's procedure: timing and operative technique. *Br J Surg* 1991;78:1167-70.
4. Kunin N, Letoquart JP, La Gamma A, et al. Restoration of colonic continuity after Hartmann's operation. *J Chir (Paris)* 1992;129:526-30.
5. Keck JO, Collopy BT, Ryan PJ, et al. Reversal of Hartmann's procedure: effect of timing and technique on ease and safety. *Dis Colon Rectum* 1994;37:243-8.
6. Gorey TF, O'Connell PR, Waldron D, et al. Laparoscopically assisted colostomy closure after Hartmann's procedure. *Br J Surg* 1993;80:109.
7. Vernava AM III, Liebscher G, Longo WE. Laparoscopic restoration of bowel continuity after Hartmann procedure. *Surg Laparosc Endosc* 1995;5:129-32.
8. Lucarini L, Galleano R, Lombezzi R, et al. Laparoscopic assisted Hartmann's reversal with the Dexterity Pneumo Sleeve. *Dis Colon Rectum* 2000;43:1164-7.
9. Sosa JL, Sleeman D, Puente I, et al. Laparoscopic-assisted colostomy closure after Hartmann's procedure. *Dis Colon Rectum* 1994;37:149-52.
10. Macpherson SC, Hansell DT, Porteous C. Laparoscopic-assisted reversal of Hartmann's procedure: a simplified technique and audit of twelve cases. *J Laparoendosc Surg* 1996;6:305-10.
11. Rosen MJ, Cobb WS, Kercher KW, et al. Laparoscopic restoration of intestinal continuity after Hartmann's procedure. *Am J Surg* 2005; 189:670-4.
12. Kohler L, Lempa M, Troidl H. Laparoscopically guided reversal of Hartmann's procedure. *Chirurg* 1999;70:1139-43.
13. Vacher C, Zaghloul R, Borie F, et al. Laparoscopic re-establishment of digestive continuity following Hartmann's procedure. Retrospective study of the French Society of Endoscopic Surgery. *Ann Chir* 2002;127:189-92.
14. Khaikin M, Zmora O, Rosin D, et al. Laparoscopically assisted reversal of Hartmann's procedure. *Surg Endosc* 2006;20:1883-6.
15. Carus T, Bollman S, Lienhard H. Laparoscopic reversal of Hartmann's procedure: technique and results. *Surg Laparosc Endosc Percutan Tech* 2008;18:24-8.
16. Slawik S, Dixon AR. Laparoscopic reversal of Hartmann's rectosigmoidectomy. *Colorectal Dis* 2008;10:81-3.
17. Chouillard E, Maggiori L, Toufic A, et al. Laparoscopic two-stage left colonic resection for patients with peritonitis caused by acute diverticulitis. *Dis Colon Rectum* 2007;50:1157-63.
18. Mutter D, Bouras G, Forgione A, et al. Two-stage totally minimally invasive approach for acute complicated diverticulitis. *Colorectal Dis* 2006;8:501-5.
19. Anderson CA, Fowler DL, White S, et al. Laparoscopic colostomy closure. *Surg Laparosc Endosc* 1993;3:69-72.
20. Costantino GN, Mukalian GG. Laparoscopic reversal of Hartmann procedure. *J Laparoendosc Surg* 1994;4:429-33.
21. Regadas FS, Siebra JA, Rodrigues LV, et al. Laparoscopically assisted colorectal anastomose post-Hartmann's procedure. *Surg Laparosc Endosc* 1996;6:1-4.
22. Delgado Gomis F, Garcia Lozano A, Domingo del Pozo C, et al. Laparoscopic reconstruction of intestinal continuity following Hartmann's procedure. *Rev Esp Enferm Dig* 1998;90:499-502.
23. Holland JC, Winter DC, Richardson D. Laparoscopically assisted reversal of Hartmann's procedure revisited. *Surg Laparosc Endosc Percutan Tech* 2002;12:291-4.