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Reversal of Hartmann's Procedure after Perforated Diverticulitis through the Stomal Side without Additional Incisions: The SIR Procedure

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Key Words

Hartmann's procedure · Perforated diverticulitis · Stomal incision reversal procedure, minimal invasive

Abstract

Aims: Reversal of Hartmann's procedure (HP) is a complex operation and only performed in 50–60% of the patients. Stomal incision reversal (SIR), a new minimally invasive procedure for HP reversal, was assessed and compared to the standard surgical approach. ***Methods:*** 16 patients who had undergone HP for perforated diverticulitis underwent HP reversal by SIR. The only incision in SIR is the one to release the end colostomy. Intra-abdominal adhesiolysis is done manually. A stapled end-to-end colorectal anastomosis is created. The 16 patients who underwent SIR were compared with 32 control patients who were matched according to gender, age, American Society of Anesthesiologists (ASA) classification and Hinchey stage. ***Results:*** The operation time was shorter after SIR than after reversal by laparotomy [75 min (58–208) vs. 141 min (85–276); $p < 0.001$]. Patients after SIR had a shorter hospital stay than patients after laparotomy [4 days (2–22) vs. 9 days (4–64); $p < 0.001$]. The numbers of total postoperative surgical complications (early and late) were not different ($p = 0.13$). The anastomotic leakage rate was similar in both groups (6%). The conversion rate in the SIR group was 19% (n = 3). ***Conclusion:*** SIR compared favorably with HP reversal by laparotomy in terms of operation time and hospital stay, without increasing the number of postoperative complications.

Introduction

In 1923, Henri Albert Hartmann [1] described a new surgical procedure for the treatment of rectosigmoid carcinoma. Hartmann's procedure (HP) consists of a colonic resection with an end colostomy and closed rectal pouch. The procedure was designed to reduce hemorrhage during the perineal stage of the operation. He advocated that patients should not undergo restoration of bowel continuity because of the difficulty of this procedure.

Today, the HP is considered a two-stage procedure and often used in the treatment of perforated diverticulitis

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[2]. Nevertheless, the second stage (reversal of the end colostomy) is only performed in 50–60% of the cases [3], since restoration of bowel continuity after HP is still considered as a technically challenging operation, associated with significant morbidity, with reported anastomotic leak rates of 4–16% and a mortality of up to 4% [4, 5]. These rates can be as high as 30 and 14%, respectively, after stoma reversal in patients who had undergone a HP for complicated diverticulitis [6, 7].

The standard surgical approach to the restoration of continuity has been by laparotomy. In this procedure a large midline incision is used, next to an incision for releasing the end colostomy. Minimally invasive surgery has gained popularity because of less postoperative pain and disability, a shorter postoperative hospital stay, better cosmetics and a more rapid return to work [8–10]. However, also in laparoscopic HP reversal all adhesions in the midline and pelvis need to be dissected. This may increase morbidity, i.e. postoperative paralytic ileus and small bowel lacerations.

Previously, we described a new minimally invasive method of Hartmann's reversal performed through the stomal side [11]. As no additional incisions have to be made besides the one at the stomal side, we have called this procedure 'stomal incision reversal' (SIR). SIR of HP has the advantage that the amount of adhesiolysis is limited to the paracolic pathway to the rectal stump. By significantly reducing the operative trauma, reports have shown decreased postoperative recovery time and surgically related stress [12].

The object of this study was to assess outcome after restoration of bowel continuity after HP in terms of operative time, hospital stay and morbidity. The outcome was prospectively assessed in a consecutive series of 16 patients who underwent SIR and was compared to an historic age-, sex-, American Society of Anesthesiologists (ASA)- and Hinchey stage-matched control group of 32 patients who underwent HP reversal by laparotomy. The results are discussed in the context of primary surgery for acute perforated diverticulitis.

Patients and Methods

Between August 2005 and June 2009, a total of 22 consecutive patients underwent SIR at the Sint Franciscus Hospital Rotterdam and the Laurentius Hospital Roermond, The Netherlands. Of these patients, 16 had undergone prior HP because of perforated diverticulitis. Data of these 16 patients and results of the procedure were recorded prospectively and compared with 32 well-matched controls (1:2). Selecting 2 patients who had undergone HP reversal by laparotomy for every single SIR patient formed the control group. These patients were selected from a historic group of patients treated for perforated diverticulitis and who had subsequently undergone HP reversal by laparotomy. The data of this group was analyzed retrospectively. The control group was matched in terms of the following matching criteria: gender, age, ASA classification and severity of primary disease (Hinchey stage [13]). HP reversal in the patients of the control group was performed between February 1995 and October 2006. All 48 patients had undergone emergency HP to treat complicated perforated diverticulitis.

All SIRs were performed by two consultant surgeons (G.H.H.M., J.W.A.L.), both experienced in colorectal and minimally invasive surgery. Prior to surgery the patients underwent colonoscopy to evaluate the descending colon and rectal stump. The indication for restoration of bowel continuity was set by a specialist colorectal surgeon. The only exclusion criterion for SIR was an accompanying symptomatic abdominal wall hernia that needed (open) correction. A brief description of the surgical procedure of SIR is stated below [11].

After the stoma is released, adhesions to the left colon are loosened through the stoma side by sharp dissection to create enough length of the descending colon to reach the pelvic cavity. In a similar manner, adhesions in the pathway to the distal (rectosigmoid) stump are loosened. Next, the surgeon's right hand is placed intra-abdominally through the former stoma defect. The rectal stump is identified using an anal rigid club and gently cleared from adhesions. In case of firm adhesions that cannot be lysed manually in a safe manner, the operation is converted to an open (laparotomy) procedure. An anvil of the circular stapler is placed intraluminally in the descending colon, consecutively the circular stapler is introduced into the rectal stump. Finally, a manually controlled, stapled end-to-end colorectal anastomosis is performed and the stapler doughnuts are checked. Finally, to make sure, a laparoscope is introduced through the stoma side to exclude iatrogenic small bowel lesions.

The outcomes of patients who underwent SIR and HP reversal by laparotomy were compared. Primary endpoints were operation time and hospital stay. Secondary endpoints were the incidence of postoperative complications and the time period between the primary procedure and HP reversal. Some data of 8 patients who underwent SIR has been used in a feasibility study before [11]. Data are represented as median (range) unless indicated otherwise. Comparisons between the two groups were made with Mann-Whitney U test for quantitative variables or graded outcomes and the χ^2 test for categorical data. Differences were considered significant at a two-tailed p value <0.05.

Results

Of the 22 patients who had undergone SIR, the procedure was successfully performed in 16 cases (72%). Of the 22 patients, 5 underwent conversion to an open procedure (because of firm adhesions (n = 2), doubt about the quality of doughnuts (n = 2) or iatrogenic small bowel laceration during stomal release (n = 1)) and 1 patient,

Table 1. Patient characteristics, severity of previous disease and surgical procedure in patients who underwent restoration of bowel continuity

	Type of HP reversal		p
	SIR	laparotomy	
Patient characteristics			
Male/female	8/8	16/16	1
Age, years (range)	54 (35–81)	57 (32–85)	0.72
ASA classification			0.67
I/II	11 (69)	26 (81)	
III/IV	5 (31)	6 (19)	
Hinchey stage			0.20
I/II	7 (44)	11 (34)	
III/IV	9 (56)	21 (66)	
Surgical procedure			
Conversion to laparotomy	3 (19)	–	–
Operation time, min (range)	75 (58–208)	141 (85–276)	<0.001
Postoperative surgical complications	4 (25)	16 (50)	0.13
Follow-up			
Delay between procedures, months (range)	5.7 (2.9–18.3)	8.7 (0.4–19.9)	0.18
Postoperative hospital stay, days (range)	4 (2–22)	9 (4–64)	<0.001
Postoperative follow-up, months (range)	18 (1.6–48)	69 (2.1–136)	<0.001

Values in parentheses are percentages, unless indicated otherwise. HP = Hartmann's procedure; SIR = stomal incision reversal; ASA = American Society of Anesthesiologists.

who had undergone HP because of a colovesical fistula, developed a recurrent fistula after HP reversal by SIR. One patient, who underwent conversion to an open HP reversal procedure, developed an anastomotic leakage. None of the patients in which SIR was successfully performed without conversion developed an anastomotic leakage.

Of the 22 patients, 16 had undergone HP because of perforated diverticulitis in the past. These 16 patients were included in this study. The characteristics of the patients after HP for perforated diverticulitis, who underwent restoration of bowel continuity by SIR (n = 16) and by laparotomy (n = 32) are listed in table 1. Both groups were matched and hence not different concerning gender, age, ASA classification and Hinchey stage during initial surgery for perforated diverticulitis.

Delay between HP for complicated perforated diverticulitis and its reversal was also not different between both groups. Postoperative follow-up of the laparotomy group was significantly longer than follow-up of the SIR group ($p < 0.001$), as the first form an older cohort.

The median operation time was significantly shorter when performing SIR compared to HP reversal by laparotomy (table 1). Besides, patients after SIR had a shorter hospital stay than patients after laparotomy. The numbers of total postoperative surgical complications (early and late) were not different between both groups (table 2; SIR 25 vs. laparotomy 50%; p = 0.13). Midline incisional hernia, as a long-term surgical complication, was observed in 8 patients after laparotomy. Correction took place in 6 patients using a prosthetic mesh. The other 2 patients could be treated conservatively without surgical correction. Only 1 patient after SIR developed an incisional hernia at the former stoma defect 12 months postoperatively, which did not need surgical correction.

Of the 16 patients who were assigned for HP reversal by SIR, 3 needed conversion to an open procedure (laparotomy) due to very firm adhesions at the pelvic side (n = 1) and doubt about the quality of doughnuts after performing a colorectal anastomosis using the circular stapler device (n = 2). The postoperative course of these 2 patients was uncomplicated. The patient who underwent

Table 2. Postoperative complications after restoration of bowel continuity

	Type of HP reversal		p
	SIR	laparotomy	
Total surgical complications	4 (25)	16 (50)	0.13
Early surgical complications	3 (19)	8 (25)	0.73
Anastomotic leakage/abscess	1 (6)	2 (6)	1
Ileus	–	1 (3)	1
Wound infection	1 (6)	5 (16)	0.65
Acute urine retention	1 (6)	–	0.33
Late surgical complications	1 (6)	8 (25)	0.24
Incisional hernia	1 (6)	8 (25)	0.24
Medical complications	0	2 (6)	0.55
Pulmonary infection	–	1 (3)	1
Cardiac decompensation	–	1 (3)	1
Mortality	0	1 (3)	1

Values in parentheses are percentages. HP = Hartmann's procedure; SIR = stomal incision reversal.

direct conversion to an open procedure because of firm adhesions not suitable for manual lysis developed an anastomotic leakage. This patient underwent a reoperation with abdominal lavage of the abdominal cavity, placement of drains in the pelvic cavity and the performance of a diverting loop transversostomy. The anastomotic leakage rate was similar in both groups (6%). All patients with anastomotic leakage underwent reoperations. One patient died after HP reversal by laparotomy due to ongoing abdominal sepsis after anastomotic leakage.

For completeness' sake, the results of the remaining 6 patients who had undergone SIR were comparable to the 16 patients after perforated diverticulitis who underwent SIR and were described in this study.

Discussion

There is growing evidence that patients with perforated diverticulitis can be treated with a single-stage procedure, but HP is still performed most frequently in this category of patients [2, 7, 14, 15]. Although HP is considered a two-stage procedure, the second stage (reversal of colostomy) will never be performed in a large number of patients [3, 6]. The main reason for this is that restoration of bowel continuity after HP is a technically challenging operation in this group with predominantly older patients: The higher the complexity of Hartmann's reversal, the higher the risk on peri- and postoperative complications. HP reversal in patients after perforated diverticulitis is known to be a very complex operation [6, 7].

Although minimally invasive surgery has shown to be related with less postoperative pain, better cosmetics, a decreased postoperative recovery time, a shorter postoperative hospital stay and a more rapid return to work [8, 10, 12], the standard surgical approach to the restoration of continuity after HP still remains by midline laparotomy. In the present study, the results of a new minimally invasive HP reversal procedure, SIR, was found to have better results compared to the standard in patients after perforated diverticulitis.

A similar technique like SIR, but laparoscopically-assisted, has been published before [11, 16]. In contrast with other laparoscopic HP reversal procedures, SIR was found to have a shorter operation time compared to HP reversal by laparotomy. The postoperative hospital stay was comparable with those reported after laparoscopic-assisted reversals of HP [8, 10, 17], but much shorter than after HP reversal by laparotomy (this study). Besides, as no additional incisions had to be made in order to place trocars, the SIR supposes to improve esthetics.

With all new procedures, but especially in SIR in which a part of the procedure is done without direct vision, the main question is if it is a safe procedure. Intra-abdominal adhesions are manually lysed by crushing them between the thumb and the index finger. In extensive adhesiolysis there is a theoretical risk of small bowel lacerations and postoperative paralytic ileus, due to contusion of the small bowel and intra-abdominal blood loss. The amount of adhesions that needs to be lysed during SIR is limited compared to HP reversal by laparotomy, because only adhesiolysis within the paracolic pathway to the rectal stump is needed. These adhesions are generally found to be very loose as prior resection has been performed in this area. Only the adhesions at the rectal stump, that needs to be lysed, can be firm. As the need for adhesiolysis is limited, the chance of small bowel lacerations is lowered. Nevertheless, it remains a delicate maneuver, preferably performed by a specialist gastrointestinal surgeon, especially in patients after perforated diverticulitis wherein HP reversal can be very difficult [6, 7]. In the present study, no small bowel laceration, major bleeding or postoperative ileus was observed after SIR.

The smaller extent of the surgical procedure is probably the main reason why hospital stay was shorter after SIR than after HP reversal by laparotomy. The surgical wound after SIR is relatively small and intra-abdominal adhesiolysis is limited, resulting in less postoperative discomfort and probably a faster discharge from the hospital. But when assessing the difference in hospital stay, one must keep in mind that the postoperative management has been changed radically during the last years which might also influence hospital stay. For instance, half of the HP reversals of the control group were performed before 2002.

Other postoperative complications, including anastomotic leaks (6%), were not different between both groups and are in comparison with the existing literature [4–7, 18, 19]. In the long term, more incisional hernias were observed after HP reversal by laparotomy. All incisional hernias after laparotomy were situated in the midline. Obviously, this was not observed after SIR, as in this procedure a laparotomy is withheld. This was the reason why an accompanying symptomatic abdominal wall hernia was seen as a relative contraindication for SIR. In case of HP reversal with accompanying abdominal wall correction surgery by laparoscopy or laparotomy is advised. Nevertheless, the difference in number of incisional hernias was not significant and probably related with the longer follow-up of the laparotomy group. This longer follow-up is a result of the used long time period in which the patients underwent HP reversal by laparotomy. It is known that the reversal rate of patients after perforated diverticulitis is low [3, 6]. Therefore, it was necessary to use such a long time period in order to be able to form an appropriate case-matched control group.

In HP reversal, SIR seemed to be a fast and safe procedure compared to the standard surgical approach by laparotomy. Nevertheless, one must always be cautious and gentle during manual adhesiolysis. To be sure, the operative area is checked by laparoscopic view through the stoma side at the end of the procedure. When in doubt, one must not hesitate to convert towards open surgery or laparoscopic assistance.

In our experience, when adhesions are very firm it is better to convert directly to an open procedure instead of a laparoscopic attempt. In the present study, conversion was performed in 3 patients. In 2 of them the consulting surgeon had doubts about the integrity of the anastomotic doughnuts after firing the circular stapler device. After inspection during mini-laparotomy the anastomosis was found to be sufficient in both patients. The third patient needed conversion to laparotomy because of firm adhesions that could not be lysed manually without direct vision. The conversion rate of 19% in this small series is comparable to the reported 9–22% conversion rate after laparoscopic-assisted reversal of HP [8, 10, 17]. Besides, it is likely that a learning curve is involved and the conversion rate will be lowered with more experience in SIR.

In conclusion, in patients who underwent HP for perforated diverticulitis, restoration of bowel continuity by SIR compared favorably with HP reversal by laparotomy in terms of operation time and hospital stay, without increasing the number of postoperative complications. SIR can be considered a good and safe alternative in all patients, as conversion to laparotomy can be easily performed when necessary.

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