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Early Laparoscopic Ileostomy Reversal After Rectal Cancer Surgery – Technique and Outcomes

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Rezumat

Reintegrarea precoce după rezecție rectală pentru cancer - technică operatorie și rezultate

Ileostomia derivativă temporară (IDT) este realizată la un număr semnificativ de pacienți operați pentru patologie colorectală. Alegerea momentului ideal pentru reintegrarea în tranzit a acesteia, precoce sau tardivă, precum şi a tehnicii operatorii de închidere sunt controversate. Obiectivul studiului nostru este de a descrie aspectele particulare ale abordului laparoscopic de reintegrare a ileostomiei şi de a analiza rezultatele închiderii precoce (în 30 de zile).

Metodă: Toți pacienții care au fost supuşi intervenției de reintegrare a ileostomiei după chirurgie rectală pe cale minimal invazivă între 2015 şi 2018 în cadrul Ponderas Academic Hospital au fost analizați retrospectiv. Niciun pacient nu a fost exclus din studiu. Rezultatele reintegrării precoce a ileostomiei derivative (la mai puțin de 30 zile) au fost analizate şi comparate cu cele ale închiderii standard.

Rezultate: 21 pacienți, (10 bărbați), cu media de vârstă de 57 ani (între 33-77 ani) şi media IMC de 21.6 kg/m² (între 14.4 şi 34), au fost incluşi în studiu. Toate intervențiile chirurgicale au fost efectuate pe cale laparoscopică. Toți pacienții au beneficiat de urmărire postoperatorie. Închiderea ileostomiei a fost efectuată în medie la 50.4 zile (cuprinsă între 7 si 150 zile), după rezecție de rect prin abord clasic (1 pacient) sau prin abord laparoscopic (20 de pacienți). 12 pacienți au urmat RCT preoperatorie (48%), 17 au beneficiat de o anastomoză colorectală joasă şi 3 dintre aceştia de o anastomoză coloanală. La 11 pacienți (52%) reintegrarea a fost realizată precoce, după 23.6 zile (7-30 zile),

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iar la 3 dintre ei, aceasta a fost efectuată în primele 7-10 zile din cauza complicațiilor apărute în urma ileostomiei derivative. A fost consemnata o complicație postoperatorie dupa închire precoce – hemoragie intestinală – tratată conservator cu success. Nu s-au înregistrat diferențe semnificative de morbiditate (complicații intra sau postoperatorii) între cele două subgrupuri care au beneficiat de reintegrarea ileostomiei derivative, precoce sau tardivă pe cale laparoscopică.
Concluzii: Închiderea ileostomiei prin abord laparoscopic poate fi considerată prima opțiune pentru ileostomia derivativă temporară după rezecțiile colorectale. Reintegrarea precoce este sigură şi rezultatele postoperatorii sunt îmbunătățite la pacienții selectați. Se impune însă, investigarea riguroasă a pacienților selectați pentru închiderea precoce a ileostomiei derivative

Cuvinte cheie: ileostomie derivative, închidere precoce, minimal invaziv, rezecție colorectală

Abstract
Background: A temporary diverting ileostomy (TDI) is performed in a significant number of patients undergoing colorectal surgery. The best timing for ileostomy reversal (IR), early or late after its formation and the proper technique used for its closure are controversial.The objective of the present study is to describe the particular aspects of the laparoscopic technique of ileostomy reversal and to analyze the outcomes of its early closure.
Methods: A retrospective analysis on all the patients who underwent laparoscopic ileostomy reversal (LIR) after MIS rectal surgery between 2015 and 2018 in Ponderas Academic Hospital was performed. No patient was excluded from the study. The outcomes of the early laparoscopic closure of the diverting ileostomy (less than 30 days) were analyzed and compared with the standard closure ones.
Results: Twenty-one patients, (10 males), average age and BMI of 57 years (range 33-77) and 21.6 kg/m^2 (range 14.4-34) were included into the study. All the procedures were completed laparoscopically. No patient was lost from follow-up. The laparoscopic ileostomy reversal was performed at 50.4 days (range 7-150) from the open (1 patient) or laparoscopic (20 patients) rectal cancer resection. Twelve patients had preoperative RCT (48%), 17 low colorectal anastomosis and the coloanal one was performed in three patients with TDI. Eleven patients (52%) had an early ileostomy reversal after 23.6 days (7-30 days). A very early LIR (7-10 days) was necessary in 3 patients with complicated evolution after TDI. No significant intra-operative or postoperative complications between the two subgroups of early or late LIR was encountered. The hospital stay (LOS) after LIR was 3.9 days (2-5) with no difference between the two subgroups. We encountered one postoperative complication (5%), - enteral bleeding conservatively treated.
Conclusions: Laparoscopic ileostomy reversal may be considered as a primary option for temporary diverting ileostomy after colorectal resection. The early ileostomy reversal is safe and improved postoperative outcomes in are demonstrated selected patients. Careful investigation and rigorous selection of the patients for EIR is mandatory

Key words: diverting ileostomy, early reversal, minimally invasive, colorectal resection

Introduction

A temporary diverting ileostomy (TDI) is performed in a significant number of patients undergoing minimal invasive (MIS) or open rectal cancer surgery, aiming to mitigate the consequences of the anastomotic dehiscence. Despite its proven related benefits, medical or

surgical complications are often associated with both laparoscopic or open ileostomy creation (1-3).

Moreover, the best timing for ileostomy reversal, early or late after its formation and the proper technique used for its closure are still unclear and controversial (4-10). Regardless the surgical technique, a significant morbidity can be associated with the reversal procedure (8,11).

In our hospital, MIS (laparoscopic or robotic) is the first surgical option for rectal cancer surgery with a very low conversion rate.

Aiming to reduce the morbidity associated with the ileostomy after MIS rectal cancer resections in the Colorectal Surgery Department of Ponderas Academic Hospital, an early (less then 30 days) laparoscopic approach for its closure was introduced in 2015.

The objective of the present study is to describe the particular aspects of the laparoscopic technique of ileostomy reversal and to analyze the outcomes of its early closure.

Method

All the patients who underwent laparoscopic ileostomy reversal (LIR) after MIS rectal surgery between 2015 and 2018 in Ponderas Academic Hospital were selected for the present study. A retrospective analysis of the patients' intraoperative and postoperative data extracted from the institutional prospectively maintained colorectal surgery database was performed. No patient was excluded from the study.

The protocol of early laparoscopic closure of the diverting ileostomy (less than 30 days) was approved by the Institutional Board (IRB) and it is described below. All the patients who were qualified for this approach have signed an informed consent. The present study design and its objectives had the IRB approval too. The intraoperative particular aspects of LIR, as well the postoperative complications and outcomes of early and late reversal (after 30 days) LIR were registered and analyzed.

Statistical Analysis

Descriptive statistics were used to summarize patient demographics and for a preliminary analysis of data. Comparisons were made using the Relative Risk (RR) and Fishers's Exact Test. The data analysis program used MedCalc.

Surgical Strategy

All the patients who underwent laparoscopic or robotic assisted rectal cancer surgery, with or without diverting ileostomy, receive a rectoscopy before the hospital discharge (on the POD 3). As the endoscopic examination reveals an uneventful healing process at the site of the colorectal or coloanal anastomosis, the patient is scheduled for early laparoscopic reversal (EIR), within the next 30days.

If local ischemia or anastomotic dehiscence is revealed, the patient is considered for a salvage procedure (i.e.left colostomy) or for an active endoscopic and clinical surveillance, thus postponing the ileostomy reversal as medically it is needed.

On the opposite, if the postoperative evolution associates obstructive complications (small bowel twist or stenotic inflammatory adherences) and a MIS exploration is decided, a very early laparoscopic ileostomy reversal (within the first postoperative weeks) can be considered if the clinical and endoscopic assessment of the colorectal anastomosis is normal.

Preoperative Work-up

A complete medical evaluation is necessary in all the patients having TDI. Significant nutritional and mineral imbalances may be associated with high intestinal flow (over 500 ml/day) and they should be carefully corrected before anysurgical intervention.

Careful inspection of the stoma site is necessary to exclude or treat any local site infection, serious inflammation or skin erosion.

A rectoscopy and a set of blood count tests,

including C Reactive Protein (CRP) and Procalcitonin are performed to excludeany anastomotic or postoperative complication. An Endoscopic Ultrasound examination and/or MRI are sometimes necessary to exclude any suspected pelvic collection.

If any postoperative diagnostic or interventional colonoscopy was planned before (i.e. for colonic polyps left in place before the MIS rectal resection for a stenotic tumor) it will be performed at least two days before the laparoscopic ileostomy reversal. This strategy avoids the bowel distension during laparoscopy and gives time to monitor the evolution after polypectomy. With this exception, mechanical preparation is not necessary before laparoscopic ileostomy reversal.

Surgical Technique

Laparoscopic ileostomy reversal (LIR) is performed under general anesthesia, with orotracheal intubation. Prophylactic antibiotherapy using Cefazoline (1-2 g at induction) and deep venous thrombosis prevention protocol by means of using intraoperative mechanical sequential compression devices and 3 weeks postoperative low molecular therapy are part of our routine protocol.

The patient's position on the operative table is in dorsal decubitus, with both arms and the legs abducted and secured on the dedicated supports. (French position). We recommend atraumatic supports for the shoulders to allow the safely change the operative table's position during the surgery. The ideal patient's positioning for LIR is Trendelenburg, slightly tilted to the left, facilitating the mobilization of the small bowel toward the left quadrant and freeing up the surgical working space in the lower right quadrant.

This patient's position should provide easy perineal access during the surgery. Before LIR is decided, a careful visual, digital and endoscopic inspection of the anorectal region is performed under general anesthesia. We have found the use of Troidl rectoscope (Karl Storz, Germany) significantly facilitating the rectal exploration endoscopic maneuvers. Any suspicion of delayed, inadequate or incomplete healing at the anastomosis site should resume the intervention and postpone the LIR.

Trocar placement. A12-14 mmHg pneumoperitoneum is created through insufflation of CO2 on a Veress needle or by an open assisted peritoneal cavity access. Three access ports are usually needed for LIR. A 10 mm optical canula is inserted in the left abdominal flank for the 30- or 45-degrees laparoscope. Two 5 and12 mm working ports are inserted along the left mid-clavicular line, in the left inferior quadrant and below the left costal margin, respectively. The trocar placement scheme may be adapted to the patient's anatomy and the history of abdominal surgery.

A careful laparoscopic exploration, including the inspection of all the small bowel loops and colon is performed and, if normal aspect is demonstrated, the LIR is performed.Adhesiolysis, by means of scissors' sharp dissection, is preferredif postoperative intraperitoneal adherences are present. The diverting ileostomy afferent and efferent enteral loops are identified and carefully inspected (*Fig 1*). Based on the provided information on the loops' length and aspect, a site-to-site ileal anastomosis is simulated in order to delimitate the ileal segmental resection.

An energy device – i.e. LigaSure (Medtronic, US) or Harmonic (Ethicon, US) - is used to divide the mesentery and to per-

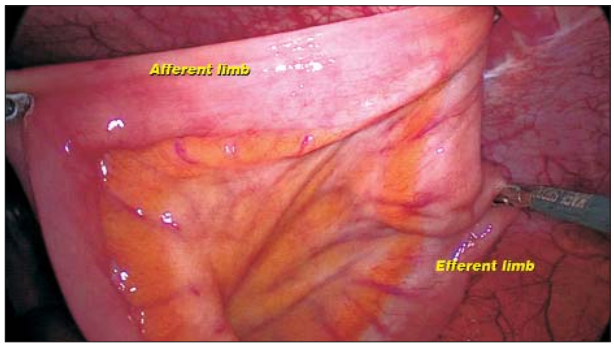

Figure 1. Laparoscopic view of the diverting ileostomy

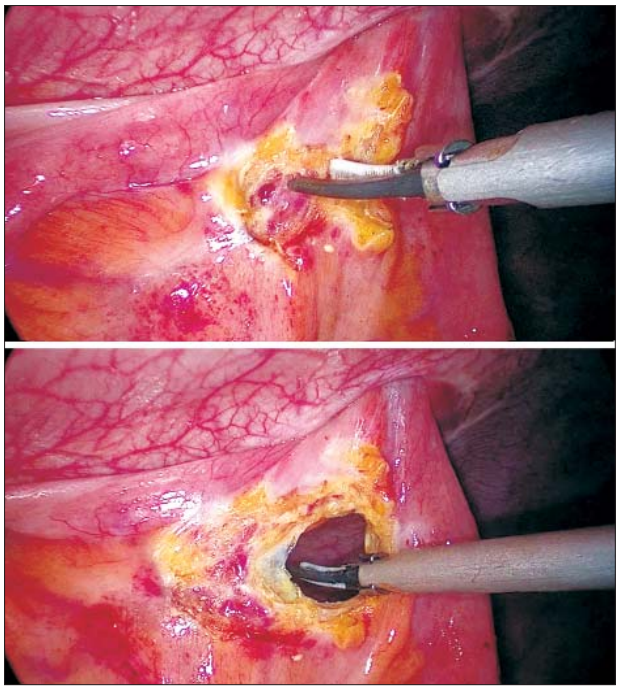

Figure 2. Dividing the mesentery with the energy device

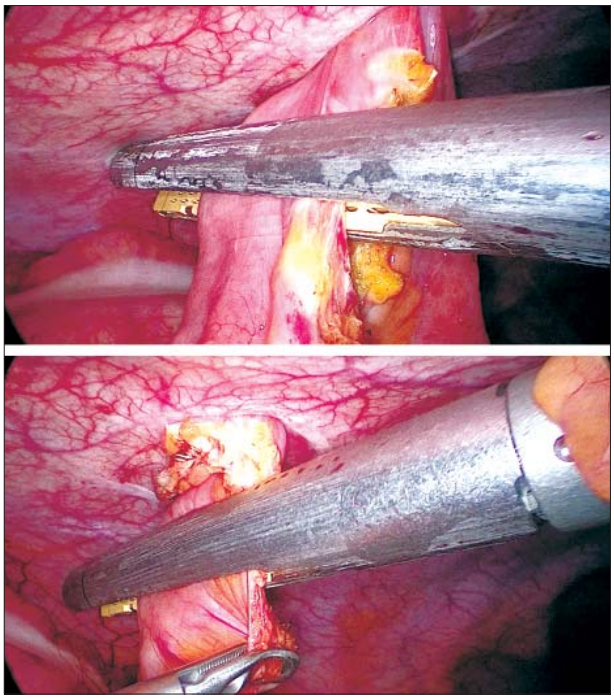

Figure 3. Dividing the afferent and efferent small bowel loops with linear staplers

form a small window siding the peritoneal aspect of the ileostomy (*Fig. 2*).

Both enteral arms of the ileostomy are then transected using stapling devices introduced through the 12 mm disposable trocar. White linear cartridges (60/2.5) are recommended the most for this surgical step. The staplers' height is to be increased if the digestive wall is thicker then usual (*Fig. 3*). *At this phase, the ileum, missing of a 5-7 cm small bowel segment, is falling in the peritoneal cavity while the rest of the ileostomy remains hanged to the anterior right abdominal wall (Fig. 4). The stapled lines at the proximal and distal ileum are inspected for potential bleeders or anastomotic gaps.*

A 2.0 monofilament stay-stitch passed at the distal end of the site-to-site enteral anastomosis is useful to secure its isoperistaltic approximation and for its temporary suspension to the abdominal wall (*Fig. 5*). Small enterotomies are performed on both enteral partner using monopolar diathermy. A 60 mm linear stapler is used to perform the enteral anastomosis (*Fig. 6*). Careful

Figure 4. The divided ileostomy remains hanged to the anterior right abdominal wall

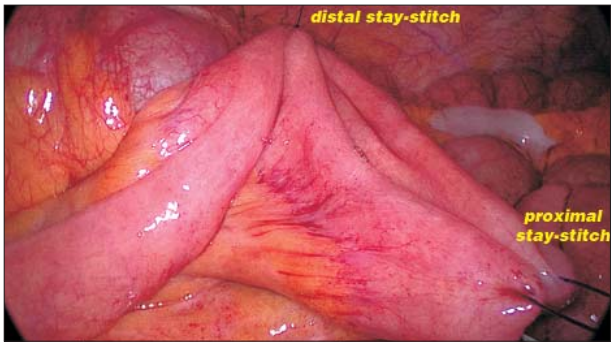

Figure 5. A 2.0 monofilament stay-stitch passed at the distal end of the site-to-site isoperistaltic enteral anastomosis. It is used for its temporary suspension to the abdominal wall

Figure 6. Laparoscopic ileostomy reversal -A 60 mm linear stapler is used to perform the enteral anastomosis

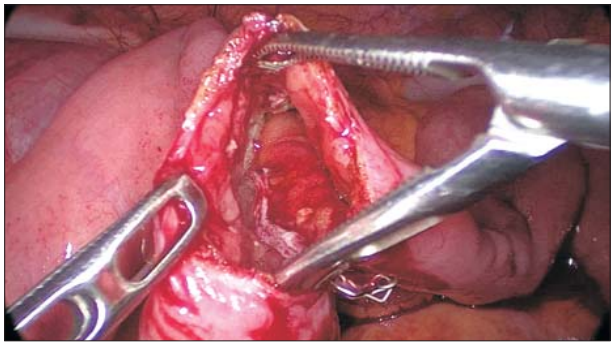

Figure 7. Endo-luminal inspection of the entire stapled line looking for bleeders after 30% rising up the blood pressure

endo-luminal inspection of the entire stapled line looking for bleeders after 30% rising the blood pressure is part of our routine protocol to reduce the risk of postoperative hemorrhage (*Fig. 7*). The hemostasis on any stapled line is performed with medium-large titanium clips.

The anastomosis is completed by closing the enterostomy with resorbable 3.0 monofilament continues suture (*Fig 8*). The mesenteric gap is always closed with non-resorbable 3.0 stitches (*Fig. 9*). At this point the temporary suspending stitch is divided, the anastomosis is released in the abdomen and a final inspection of the small bowel loops is performed. Before changing the Trendelenburg position, a spiral drainage tube is placed in Douglas for 24 hours. Then after, the surgery table is placed in a neutral position, thus achieving a physiologic positioning of the viscera. The remaining ileostomy is excised via a direct open approach caring out a limited circumferential correction of the skin. The laparoscopic visualization assists the entire open resection and the following closure of the abdominal wall. This approach provides the advantage of a limited surgical site aggression, without any additional enlargement of the wound,regardless the thickness of the abdominal wall.

The postoperative care includes the continuation of the anti-thrombotic prophylaxis with low molecule heparin, the early patient's mobilization and oral feeding. The

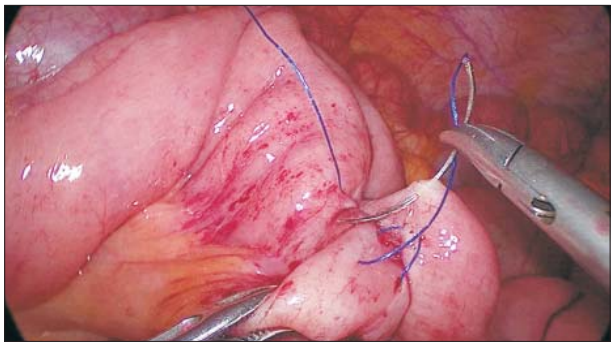

Figure 8. Laparoscopic Ileostomy reversal – closure of the enterostomy with 3.0 monofilament stitch

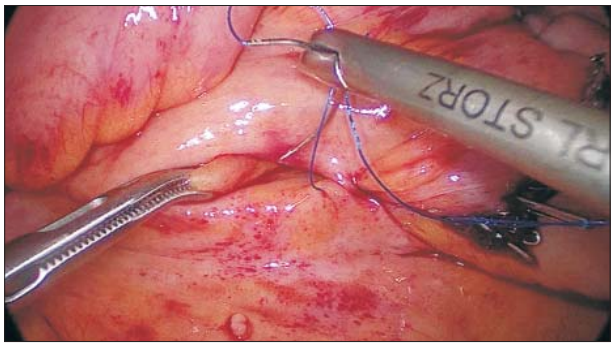

Figure 9. Laparoscopic Ileostomy reversal – closure of the mesenteric gap with monofilament non-resorbable stitch

hospital discharge is planned when the bowel movements are demonstrated.

Results

Twenty-one patients, (10 males), were included

into the present study. The average age in this cohort was 57 years (range 33-77) and while the BMI was 21.6 kg/m^2 (range 14.4-34).

All the procedures were completed laparoscopically. No patient was lost from follow-up, ranging from 2 to 39 months (average 24).

The laparoscopic ileostomy reversal was performed at 50.4 days (range 7-150) from the rectal cancer resection. One patient underwent open rectal resection while the rest (20 patients, 95%) had MIS colo-rectal resection before. Twelve patients had preoperative RCT (48%), 17 low colorectal anastomosis and the coloanal one was performed in three patients with TDI.

Eleven patients (52%) had an early ileostomy reversal after 23.6 days (7-30 days), 8 of them had preoperative radio-chemotherapy and three coloanal anastomosis. A very early LIR (7-10 days) was necessary in 3 patients with complicated evolution after TDI (enteral obstruction and uncontrolled high enteral flow). The morbidity was rapidity improved while the postoperative evolution was uneventful.

No significant intra-operative or postoperative complications between the two subgroups of early (11 patients) or late LIR (10 patients) was encountered. The intraoperative complications were bleeding (1 patient of 11) and bleeding and bowel injury (2 patients of 10). The postoperative complications were bleeding (1 patient of 11) and bleeding and incisional hernias (2 patients of 10). The relative risk value for the intraoperative complications and postoperative complicationsis RR=0.454 (C.I.=[0.048, 4.280]), with no significant statistical difference between the two subgroups. The hospital stay (LOS) after LIR was 3.9 days (2-5) with no difference between the two subgroups (p=0.729, Fisher's Exact Test)

We encountered one postoperative complication (5%) following early reversal of protective ileostomy - a hematochezia occurred on the third day postoperatively in a 25-year-old female patient controlled by conservative treatment. The patient previously underwent RCT and a low colorectal resection with site-to-end coloanal mechanical anastomosis for rectal adenocarcinoma.

Discussions

The temporary diverting ileostomy (TDI) is often considered in colorectal surgery, aiming to protect the low colorectal or coloanal anastomosis and to minimize the consequences of the anastomotic leak or dehiscence. Besides these benefits and its perception of a technically simple procedure, the open or laparoscopic stoma formation can associate a significant rate of surgical complications (21–70%) including leakage, prolapse, parastomal hernia and retraction (1-3). Considering these aspects, a good selection of the patients for TDI and an adequate surgical technique used for the stoma creation are mandatory.

Some of the medical and surgical TDI complications are related to its prolonged stay: protein or mineral imbalances, small bowel obstructions, skin site infections or parastomal hernia (2). As a consequence, an early ileostomy reversal (within 3-4 weeks) was proposed in the late '90ies for selected patients and a shorten hospital stay without additional morbidity was demonstrated (12). The same open approach was used in Romania in the last decade with very good results (13).

However, the best timing for ileostomy reversal, early (EIR) or late (LIR) after its formation as well the surgical technique and approach used for its closure (laparoscopic or open) are still unclear. Moreover, regardless the surgical technique and timing, a significant rate of complications can be associated with the reversal procedure (6,8,11,14).

Several studies found advantages of the early ileostomy closure after minimally invasive LAR and ERAS (15) prooving a shortened hospital stay and reduced rate of stoma-related (16) and postoperative complications as compared to the standard late reversal (4). The Early closure (8-13 days) of a temporary stoma was compared to late closure (>12 weeks) in the EASY randomized controlled trial. The study demonstrated safety and efficacy of the early approach,

supportingits routine use in selected patients without signs of anastomotic leakage (7).

On the opposite, the early closure of ileostomy after radical rectal resection was found not safe in a RCT comparing early closure (30 days after creation) and standard closure (90 days after creation). The overall 30 days postoperative morbidity rate was dramatically higher in the EIR group (27.9% vs 7.9%; P=0.024) the authors concluded that EIR should not be performed (5).

Regarding the surgical techniques, a recently published meta-analysis (17) compared the hand-sewn with stapled anastomotic technique for closure of the loop ileostomy and found no significant difference in the rate of anastomotic leakage between the two options, but the rate of small-bowel obstruction was higher in the hand-sewn group (17). Zhou, et al. found that the length of hospital stay was shorter in the hand-sewn anastomoses than in the stapled anastomoses' group (10). Further on, comparing different ways of performing the enteral anastomosis during ileostomy reversal, Prassas D,et al. found that, overall, the 30-days morbidity and postoperative length of stay were significantly higher for the end-to-end anastomotic option (8).

Looking to the approach, the laparoscopic ileostomy reversal with intracorporeal anastomosis was associated with shorter length of stay without increased overall direct cost (9). and this advantage to the open aproach is more important in the obese patients (18,19).

Considering all this controversial information, we have decided to investigate the use if MIS approach for the early ileostomy reversal (within 30days), aiming to reduce the morbidity associated with the ileostomy after MIS rectal cancer resections. The protocol was introduced in the Colorectal Surgery Department of Ponderas Academic Hospital in March, 2015. Since then, all the reversal ileostomies were performed laparoscopically, and 52.4% of the patients were selected for an early closure.

A low rate of complications was demonstrated for the laparoscopic approach of ileostomy reversal after rectal cancer in our series (5%). The intraluminal bleeding complication was controlled with conservative treatment. It is interesting to mention that this type of complication did not occur later as a carefully hemostasis on the stapled line was introduced as a part of the routine protocol (as described).

Interestingly, we have found no other major complication in the EIR group, despite the high rate of RCT (8 patients, 72.4%) and the performed coloanal anastomosis (all the 3 patients).

The laparoscopic very early IR (7-10 days) improved the postoperative morbidity in 3 patients with complicated evolution after TDI (enteral obstruction and uncontrolled high enteral flow).

The MIS may also explain the low morbidity and reduced LOS of 3.9 days (2-5) after both early or late IR. All these data support the use of laparoscopic ileostomy reversal as a primary surgical option after TDI. The advantages of EIR in selected patients is also demonstrated.

We consider the detailed descriptionof the surgical strategy and operative technique of LIR a strength of the present study. Besides its limitations (small sample size and retrospective nature) the present study clearly demonstrated very good outcomes for the early laparoscopic ileostomy reversal.

Conclusions

Laparoscopic ileostomy reversal may be considered as a primary option for temporary diverting ileostomy after colorectal resection. The early ileostomy reversal is safe and improved postoperative outcomes in are demonstrated selected patients. Careful investigation and rigorous selection of the patients for EIR is mandatory.

Author's Contributions

All authors contributed equally to the manuscript.

Conflict of Interest

The authors declare no conflicts of interests.

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