Laparoscopic intersphincteric resection: indications and results

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Abstract Surgical treatment of distal rectal cancer has long been based only on abdominoperineal excision, resulting in a permanent stoma and not always offering a definitive local control. Sphincter saving surgery has emerged in the last 20 years and can be offered also to patients with low lying tumours, provided that the external sphincter is not involved by the disease. An intersphincteric resection (ISR) is based on the resection of the rectum with a distal dissection proceeding into the space between the internal and the external anal sphincter. Originally described as an open procedure, it has also been developed with the laparoscopic approach, and also this technically demanding procedure is inscribed among those offered to the patient by a minimally invasive surgery. Indications have to be strict and patient selection is crucial to obtain both oncological and functional optimal results. The level of distal dissection and the extent of internal sphincter resected are chosen according to the distal margin of the tumour and is based on MRI findings: accurate imaging is therefore mandatory to better define the surgical approach. We here present our actual indications for ISR, results in terms of operative time, median hospital stay for ISR in our experience and review the updated literature.

Keywords Distal rectal cancer · Intersphincteric resection · Laparoscopy · Low anastomosis

Introduction

Management of lower rectal cancer requires special expertise and surgeon is the leading professional of a multidisciplinary team involving several disciplines (surgery, medical oncology, radiotherapy, endoscopy, pathology radiology). Until the 1980s, abdominoperineal excision was the elective procedure for tumor lying in the distal rectum [1]. This was mainly a consequence of the theory that the surgical distal clear margin had to be at least of 5 cm [2]. Thus, considering that anal canal is 3–5 cm in length, it was practically impossible to hypothesize a sphincter preserving procedure for cancers located below 6 cm from the anal verge. The re-evaluation of the surgical distal free margin to 2 cm and even less [3], together with the introduction of stapler devices, offered the surgeon the opportunity to perform even a low anastomosis, considered almost impossible in many difficult pelvis [4]. Eventually, the introduction of neoadjuvant chemoradiation and the concept of downsizing and downstaging, led to the increasing use of sphincter preserving procedures [5]. As an ultimate evolution of this conservative surgery, in the 1990s the intersphincteric resection (ISR) was proposed for tumors located at the level of the anorectal ring or within the anal canal [6–8]. Indeed, considering as good a distal free margin of 1–2 cm, an intersphincteric approach, that is a resection proceeding into the space between the internal and the external anal sphincter, can guarantee a radical tumor resection. It was reported that a partial or total intersphincteric resection can be performed according to the tumor site, respectively at the anorectal ring or within the anal canal [9, 10]. An accurate selection of the patients candidated to ISR is mandatory. Optimal staging of the tumor is required before and especially after the neoadjuvant treatment.
MRI is the most important diagnostic tool to assess the involvement of external sphincter or levator ani or a positive circumferential resection margin (CRM), that is a relevant negative prognostic factor [11]. On the other hand, another exclusion criteria for ISR is a sphincter insufficiency prior to surgery: it is related with a certain failure of functional results and poor quality of life [12]. Therefore a preoperative assessment of anal continence is recommended.

Laparoscopic surgery has progressively gained a clear role in colon cancer treatment [13]. The road to development of rectal cancer laparoscopic surgery has been more hard, due to the technical and anatomical difficulties related to this approach. It has been quite definitively shown that oncological and short term outcomes are equivalent to open surgery, given the well-recognized advantages of laparoscopy in terms of faster recovery and cosmesis [14]. Laparoscopic approach to rectal cancer, and specifically lower rectal cancer, requires special expertise and should be performed in high volume colorectal cancer centers, since the surgeon is one of the most relevant factor for the outcome [15, 16] and a long learning curve is needed [17, 18].

With respect to open surgery, laparoscopy enables a better vision in the pelvis. This is important in order to achieve a good nerve sparing technique and an appropriate total mesorectal excision, with a clear exposure of the plane between the rectum and the vagina or the seminal vesicles and the prostate, and, finally, of the pelvic floor. This is more true also for an ISR, since an accurate and bloodless up to down dissection can be carried out between the pelvic diaphragm hiatus and the rectum, thus entering in the intersphincteric space. From the beginning of this century several experiences of laparoscopic ISR are reported in literature [6–8, 19, 20].

Results are promising both for safety and for oncological outcome. An additional cosmetic advantage is achieved by pulling out the specimen per anally and performing a hand-sewn anastomosis, thus avoiding any abdominal incision for rectal extraction.

Methods

We have retrospectively reviewed the surgical activity of the Division of Colorectal Surgical Oncology at the National Cancer Institute of Naples. From January 2010 until January 2015 a total of 444 patients with rectal cancer were referred to our Division. All patients with a locally advanced non metastatic middle or lower rectal cancer underwent neoadjuvant treatment (short course radiation or chemoradiation with different schedules), on the basis of preoperative diagnostic work-up. Every patient was staged before the neoadjuvant therapy and prior to surgery by means of endoscopy, EUS, rigid proctoscopy, MRI, CT scan. A multidisciplinary consultation addressed the patient to his own tailored treatment, according to the classification in low, moderate or high risk tumor, depending on the distance of the tumor from the anal verge. T stage, nodal status, CRM distance from the cancer. Surgery was performed from 10 to 12 weeks after the end of neoadjuvant treatment. Low or ultralow anterior resection, Hartmann’s operation, abdominoperineal excision, local excision (conventional or videoassisted, as TEM or TAMIS) were the procedures carried out. The total number of operations with low or ultralow anastomosis was 177. Out of these, 57 were intersphincteric resection with colorectal anastomosis. In this group the mean distance of the neoplasm from the anal verge was 4.6 cm. All but three patients, [two with giant distal rectum adenoma and one for salvage surgery after failure (pT2) of local excision] received a preoperative neoadjuvant radiation or chemoradiation. Fourteen patients had a ISR followed by a stapled anastomosis; 21 patients had a hand-sewn colorectal anastomosis, while 22 patients received a delayed colorectal anastomosis (D-CAA) with a two stage procedure, the former having a pull-through of the colon beyond the anal verge, the latter having the exceeding colon cut and the hand-sewn anastomosis fashioned. Additionally, in the same period, 16 ISR were carried out as part of a protocolectomy for familiar polyposis, with adenoma or cancer involving the distal rectum.

Laparoscopic approach has gradually become more frequent in our experience. To date about 75 % of rectal surgery is videoassisted. As it concerns the ISR, videoassisted ISR was performed in 11/16 patients undergoing protocolectomy and 27/57 patients undergoing ultralow anterior resection. Of these 27 procedures, 10 were totally laparoscopic with a ultralow stapled anastomosis, 10 were two steps procedures, laparoscopic and perineal for transanal dissection, 2 were laparoscopic with transanally performed total mesorectal excision (ta-TME), 5 were robotic ISR. It is relevant that, regarding the last 22 ISR for lower rectal cancer, 17 were carried out by a minimal invasive approach.

Surgical technique

Lap-ISR is a two-step procedure performed by a single or double surgical team. There is a laparoscopic abdominal and pelvic approach and a perineal transanal phase. In case of ultralow intersphincteric stapled anastomosis the perineal phase is characterized by the simple stapling time. This is an option for tumor lying just near the anorectal ring or the upper edge of the surgical anal canal. This is named
as partial IRS, in which the internal sphincter is partially removed above or at the level of the dentate line. In lower tumor within the anal canal a total ISR has to be performed, under the dentate line in the intersphincteric groove, and an immediate or delayed hand-sewn coloanal anastomosis is required in the perineal phase.

The transanal step can be the first phase of the surgical procedure; otherwise it follows the end of the laparoscopic time, on the basis of the surgeon’s choice. In our experience we prefer to have a double surgical team, one for the laparoscopic phase and the other for the transanal intersphincteric dissection, both working simultaneously. The patient is under general anesthesia in a Lloyd–Davis position with the perineum slightly projecting beyond the end of the operating table. The laparoscopic surgeon stays to the patient’s right with the monitor placed in front of him, while the first assistant is placed to the surgeon’s left. The perineal surgeon is between patient’s legs positioned in dedicated stirrups. A umbilical incision provides a Hasson trocar introduction into the abdomen, and a 12 mm optic port is placed through this opening. After pneumoperitoneum is obtained at an intra-abdominal pressure of 12–15 mmHg and an accurate inspection of the entire abdomen is performed to exclude metastatic lesions, a 12 mm port is placed in the planned right ileostomy site. A third 12 mm port is placed in the upper right abdominal space and a 5 mm port is placed in the left lower abdomen. A further pubic port is required in selected cases to help retraction of anterior pelvic organs during demanding pelvic dissection. Operating table is turned in a Trendelenburg’s right sided position to displace the small intestine to the right side and to improve the exposure of the aortic plane and the pelvis.

With the identification of the inferior mesenteric vein, the plane between left mesocolon and retroperitoneal fascia is entered by means of a cautery or energy devices. A bloodless medial-to-lateral dissection is carried out along this space, finally reaching the splenic flexure of the colon that is completely freed from the mesocolon root and the reflection between the colon and the abdominal wall. A high ligation of the inferior mesenteric vein and artery is performed. The dissection proceeds in the same plane towards the pelvis and a total mesorectal excision is carried out all around the rectal circumference. Dorsally the plane between rectal fascia and Waldeyer fascia is respected and the pelvic parasympathetic nerves are identified. Ventrally rectum is dissected along the Denonvilliers’ fascia with the exposure of the seminal vesicles and the prostate or the vaginal wall. It is mandatory to avoid any damage of the neuromuscular bundle. The dissection continues on both sides, cutting the lateral ligaments, to reach the pelvic floor at the level of levator ani muscles (Fig. 1). The intersphincteric space is dissected as low as possible. Finally, in case of a stapled anastomosis, the rectum is cut by means of a linear stapled device and, after the specimen extraction and resection, a transanal ultralow anastomosis is laparoscopically performed under direct vision. In case of hand sewn anastomosis, the laparoscopic phase stops, according to the surgeon’s choice, in the distal rectum or in the intersphincteric space.

The perineal step begins by putting a self-retaining retractor (Lone Star Retractor®; Lone Star Medical Products Inc., Houston, TX, USA) into the anal canal as to gain a comfortable access to this space. A circumferential incision of mucosa and internal sphincter is made (Fig. 2). As we have mentioned, the level of this incision depends on the distal tumor margin, keeping in mind that a free margin of 1–2 cm is required. Therefore, a total or a partial ISR can be carried out. The dissection in the
intersphincteric space allows a detachment between the internal and the external sphincter. It is important to close with stitches the anorectal stump to avoid the spillage of tumor cells. The dissection goes down to up towards the puborectalis muscle to reach the rectal fascia to enter in the presacral space. Some authors report a higher dissection, until the peritoneal reflection. This has been taken as background to the initial concept of the transanal total mesorectal excision (ta-TME) [21, 22].

When the pelvic and the perineal dissection planes are in conjunction the specimen is completely freed and can be pulled out through the anus and then resected. In case of bulky tumor, delivering the specimen per anally can be difficult or risky because of mesorectal fascia disruption and tumor implantation. Thus a small abdominal incision is required and it can be performed both transverse at the suvrapubic line or at the site of the stoma. Restoration of the bowel continuity is performed with an immediate or delayed hand-sewn coloanal anastomosis.

When an immediate coloanal anastomosis is fashioned, a colonic J-pouch or a transverse coloplasty is constructed in the attempt to create a neorectum. Alternatively a straight hand-sewn coloanal anastomosis is achieved with interrupted stitches. When a delayed coloanal anastomosis is chosen, the colon is pulled out the anus for 6–8 cm and fixed to the upper edge of the anal canal and at the anal verge with interrupted stitches (Fig. 3). After 7–20 days the colon is cut and the coloanal anastomosis is fashioned. In case of delayed coloanal anastomosis the temporary ileostomy is avoided. Otherwise, a loop ileostomy with the skin bridge technique is performed at the right lower port site as the final step of the laparoscopic procedure [23].

**Results**

A median operative time of 190 min was recorded in the laparoscopic ISR group; in two patients having a ta-TME combined with a laparoscopic step the mean operative time was 270 min, while it was 255 min in the five patients undergoing a robotic ISR. Patients were all entered into an enhanced recovery program (removal of the nasogastric tube at the end of the procedure, reduced intravenous liquid infusion, early mobilization, liquid and solid oral intake respectively on postoperative day 1 and 2, removal of the urinary catheter on day 1 or 2. A mean hospital stay of 7.5 days was recorded, with a difference between the open ISR group (8.3 days) and the lap ISR group (6 days). There was not a significant difference in the hospital stay between the group with immediate coloanal anastomosis and loop ileostomy (7.1 days) and the group with delayed coloanal anastomosis having a colon transanal pull-through and no ileostomy (7.8 days).

Median follow up was 37 months. The average clear distal margin was 1.8 cm. No patient had either a distal resection margin or the CRM involved in the tumor. Only three patients had a local relapse (5.26 %); the first as an anal verge implantation and consequently underwent an abdominoperineal excision; the second had an anastomotic relapse and failed rapidly for metastatic disease in the bones and the lung; the third had a colonic ischemia and underwent a reoperation for resection and colostomy; he showed a pelvic relapse and died five months later for peritoneal carcinomatosis. Distant metastases occurred in five patients (8.7 %); three patients are alive today, having received, respectively, liver resection, lung resection and chemotherapy. Cancer related mortality was 3.5 % (2/57). Perioperative mortality was 0 %. Major complications requiring a reoperation occurred in five patients (8.7 %): three had a colonic ischemia after a pull-through procedure, one suffered from a bowel obstruction and required a laparotomy for adhesiolysis, the last one suffered from a anal-vaginal fistula after a stapled anastomosis technique, requiring a colostomy. One patient, with a loop ileostomy, had a stapled anastomosis subclinical dehiscence, treated conservatively. Three patients (5.26 %) had a pelvic abscess requiring a CT scan guided drainage. Late complications requiring a surgical revision were one anorectal sepsis, following a late hand-sewn anastomosis fistula, requiring a colostomy, four colonic prolapse (7 %), two in the immediate and two in the delayed coloanal anastomosis group and 5 (8.7 %) anastomosis stricture, three after immediate and two after delayed coloanal anastomosis. Looking at functional results 14 patients (24.5 %) complained of a major fecal incontinence (grade 3–4 of the Kirwan scale), the remaining reporting sporadic episodes.
Discussion

The reappraisal of the 5 cm rule of distal excision for rectal cancer meant, in some countries, a significant reduction of the number of abdominoperineal excisions and an increasing rate of sphincter preserving procedures. Intersphincteric resection for lower rectal tumors, involving the anorectal ring or even the anal canal, is the ultimate evolution of this concept of function sparing surgery. The new rule of 1–2 cm distal free margin has widely spread. External sphincter infiltration remains the only oncological absolute indication to abdominoperineal excision. Ueno reported an intramural distal spread in 10.6% of the rectal specimens. This was mainly associated with histologic “tumor budding” in the submucosal region at the distal edge or with or more tumor annularity [24]. Shirouzu in 2009 identified some parameters related to tumor infiltration beyond the internal sphincter into the intersphincteric groove and the external sphincter [25]. They were tumor located at or below the dentate line, poorly differentiated adenocarcinoma and mucinous carcinoma.

Schiessl in 1994 described the technique of ISR, presenting a series of 38 patients, with a reported local recurrence of 10.5% [26]. In 2005 the updated series of 121 ISR had 5.1% of anastomotic fistula and 5.3% of local recurrence [8]. Watanabe in 2000 described in a technical note 7 cases of laparoscopic ISR with an operative time ranging from 280 to 450 min [27]. Rullier, who has one of the most relevant reported experience in ISR, published in 2005 a series of 92 cases of ISR, 45 by open surgery and 47 by laparoscopy. The local recurrence rate was 2%, the R0 resection 89%, the anastomotic leakage 10.8% [3]. In 2010 Laurent published the updated series from the same surgical team, with 110 laparoscopic and 65 open ISR, reporting a cumulative local recurrence of 3.5% [28]. A systematic review by Martin in 2012 on outcomes after intersphincteric resection for low rectal cancer included 14 studies (1289 patients). R0 resection was achieved in 97%: The rate of local recurrence was 6.7% and the 5-year disease free survival was 78.6% [29].

In our series, we report a 100% of R0 resections, with a median distal clear margin of 1.8 cm, and a local recurrence rate of 5.26%, very close to that reported in literature.

Laparoscopic ISR is intended as a two steps procedure, abdominal and perineal. It can be performed by a single or a double surgical team. In our experience two surgical teams working contemporarily allow a shorter time for the procedure. Some authors prefer to begin with the laparoscopic phase, some other prefers a perineal phase as first step, describing an intersphincteric dissection as deep as possible, posteriorly taken along the puborectalis and the presacral fascia and ventrally up to the prostate and the seminal vesicles or the vaginal wall, in order to make the lower pelvic dissection easier in the laparoscopic step. We agree with the definition given from some author of a partial or total ISR according to the rate of internal sphincter removal. No need to say that the role of neoadjuvant radiation or chemoradiation remains crucial for the locally advanced cases and make this approach possible with a good oncological outcome. In our experience, almost all patients underwent to a neoadjuvant treatment for locally advanced lower rectal cancer: none had a distal margin or CRM involved in the tumor.

Laparoscopic ISR provides an excellent vision of the operative field in all the steps of the procedure; this is a relevant factor to avoid any accidental damage to the left ureter, the hypogastric nerves, the pelvic plexus. The magnification of all the pelvic details helps the surgeon to stay in the right embryological plane, thus favoring, theoretically, an optimal total mesorectal excision. Even the lowest dissection in the pelvis benefits from a better vision in laparoscopy, so that the pelvic floor can be well exposed and an intersphincteric dissection can be accomplished from the top, at least for a partial ISR.

Nevertheless, laparoscopic stapling can be very demanding owing to the unavoidable angle between the linear stapler device and the rectum. In a narrow pelvic cavity, for a low bulky tumor, in an obese patient, laparoscopic approach can be anyway challenging in the distal pelvis. That is why perineal dissection is recommended and this leads to the background of the transanal total mesorectal excision (ta-TME) [21, 22].

The role of Robotic surgery in ISR is under evaluation. Park in 2013 published a series comparing 40 patients receiving a laparoscopic ISR and 40 receiving a robotic ISR. In the robotic group there was a higher rate (8 vs 2) of total transabdominal ISR, for a lower deeper dissection in the intersphincteric space [30]. This is probably due to the advantages of robotic surgery, namely a three dimensional magnified vision, a surgeon-controlled camera platform and improved instruments range-of-motion to emulate hand movements.

Laparoscopic ISR followed by hand-sewn anastomosis has the further advantage to avoid any abdominal incision
for the specimen extraction. Thus the resection is completed after pulling the rectum and the colon per anally and, loop ileostomy can be fashioned in the lower right port site. Per anally extraction, that is a NOSE technique, is associated with less analgesic requirement. The pull-through of a bulky tumor can be really demanding and sometime impossible at risk. Risk of specimen disruption and colonic damage can theoretically occur [31]. In this case alternative extraction sites are the supra pubic incision, a small periumbilical incision or the site of ileostomy, after enlarging the trocar site incision. Literature reports seem to indicate ileostomy site retrieval as less painful than Pfannenstiel, but with a higher rate of incisional hernia [32, 33].

Once the colorectal specimen has been resected a neorectum reservoir construction can be carried out, as an alternative to a straight coloanal anastomosis. A colonic J pouch or a transverse coloplasty have been described, the latter seeming to be related with a higher rate of complications, mainly as neorectum fistula [34].

When stapled anastomosis is indicated after a laparoscopic or robotic partial IRS, rectal cutting with a linear stapler is better carried out by introducing the device in a suprapubic port. A forceful traction of the distal rectum is demanded to have a good exposition of the intersphincteric plane in order to put the device as distally as possible to the tumor. A single fire stapling is the ideal but rarely is obtained and multiple firing is needed. Neutzling, in a Cochrane database systematic review of stapled vs handsewn colorectal anastomosis published in 2012, assessed no statistically significant superiority of one over the other [35]. Anastomotic stricture is more likely to occur in handsewn technique [36].

A colonic pull-through with delayed coloanal anastomosis, according to the Turnbull–Cutait technique, is a re-evaluated option with the advantage of no stoma need. In a recent review of the literature Hallet reported a low rate of pelvic morbidity and good functional results in 80% of patients [37]. In our experience we have adopted this technique in 22 out of 57 ISR (38.5%), reporting 3 cases of colonic pull-through ischemia requiring a reoperation for pelvic sepsis and a permanent stoma. Given that anastomotic leakage is rarely a dramatic complication, due to the protective ileostomy usually performed, colonic ischemia is the only one really life threatening event to be afraid of. In our opinion, this is likely to occur due to a mesenteric compression into the anal canal, especially in case of male patients with longer and higher pressure canal.

Functional results of ISR are not less important than oncological outcomes, but they are not always reported. In his review Martin reported a mean daily number of bowel movements of 2.7; a perfect continence in 51.2%, fecal soiling in 29.1%, urgency in 18.6% [29]. In our experience about 75% of patients had a good or acceptable continence; 18 patients underwent a pelvic floor rehabilitation by means of muscular exercises, electrostimulation and biofeedback. In conclusion ISR is a safe and effective procedure for sphincter saving approach to distal rectal cancer. Careful preoperative staging is mandatory in order to select patients for ISR. Preoperative assessment must include also the study of anal sphincter function and patients with poor continence have to be excluded. Surgeon’s experience is one of the most relevant factor for a good outcome and a dedicated expertise in rectal cancer surgery is required, especially for minimally invasive approaches. Patients operated on with a ISR have to be strictly followed up both for functional and for oncological outcomes. Pelvic floor rehabilitation has to be considered after ISR.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures in our paper were in accordance with the ethical standards of the institutional as well as national research committee and with the 1964 Helsinki declaration and its later amendments.

Research involving human participants and/or animals This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent For this type of study formal consent is not required.

References


