Laparoscopic Versus Open Approach for Intersphincteric Resection—Results from a Tertiary Cancer Center in India

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Received: 3 September 2016 / Accepted: 8 June 2017 / Published online: 21 June 2017
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Abstract The study aims to compare open intersphincteric resection (OISR) with laparoscopic intersphincteric resection (LISR) in terms of short-term oncological and clinical outcomes. This is a retrospective review of a prospectively maintained database including all the patients of rectal cancer who underwent intersphincteric resection (ISR) at Tata Memorial Centre between 1st July 2013 and 30th November 2015. Short-term oncological parameters evaluated included circumferential resection margin involvement (CRM), distal resection margin involvement, and number of nodes harvested. Perioperative outcomes included blood loss, length of hospital stay and 30-day postoperative morbidity and mortality. Chi-square test was used to compare the results between the two groups. Thirty nine cases of OISR and 34 cases of LISR were included in the study. Median BMI was higher in LISR group; otherwise, the two groups were comparable in all aspects. There were no conversions in LISR group. CRM involvement was seen in four patients (10%) in the conventional group compared to none in the LISR group. Median hospital stay was comparable between the two groups. Laparoscopic ISR is

safe and can be performed with low conversion rate in selected group of patients.

Keywords Intersphincteric resection · Laparoscopic surgery · Rectal carcinoma

Introduction

Intersphincteric resection (ISR) is a sphincter-preserving surgery which aims to avoid the need for a permanent stoma in patients with very low lying rectal cancer. ISR was first described by Schiessel et al. in 1994 [1]. Over last two decades, a number of studies have shown that ISR is technically feasible and safe, with no compromise in the oncological outcomes [2, 3]. Studies comparing ISR with abdominoperineal resection (APER) and low anterior resection (LAR) have found insignificant differences in their outcomes, though one of the studies did show superior oncological outcomes with ISR compared to APER [4, 5]. A recent systematic review has shown that ISR should be ideally applied for T1–3 tumors which are located within 3–3.5 cm from the anal verge [6].

Conventionally, laparoscopic rectal cancer surgery has been regarded as complex owing to difficulties in pelvic exposure, rectal dissection, and sphincter preservation [7]. Oncological safety of the laparoscopic rectal cancer surgery in properly selected patients has been established by the prospective randomized trials [8, 9]. Compared with open surgery, laparoscopic surgery offers a number of benefits including earlier return of bowel function, less postoperative pain, shorter hospital stays, and a better quality of life [10]. With advances in modern laparoscopic technology, many skilled surgeons across the world who have overcome the learning curve for laparoscopic surgery have expanded their indications for laparoscopic rectal cancer surgery.

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Laparoscopic intersphincteric resection (LISR) is one such complex laparoscopic rectal cancer surgery. Since the first description of the procedure by Watanabe et al., a number of studies have reported on its feasibility and safety [11–13]. Although a number of prospective randomized studies have compared the results of laparoscopic surgery with open surgery for rectal cancer, very few studies have specifically looked at the subset of patients who have undergone ISR [14, 15]. We looked at our own short-term results of ISR comparing open surgery with laparoscopic surgery.

Material and Methods

This is a retrospective review of a prospectively maintained database in the Division of Colorectal Surgery at the Tata Memorial Centre, Mumbai. Between July 1st 2013 and November 30th 2015, all patients undergoing ISR for carcinoma of the rectum were identified from this database.

All patients underwent complete colonoscopy with biopsy to confirm the diagnosis of cancer. Local regional staging was achieved with a baseline magnetic resonance imaging of pelvis (MRI 1). Contrast enhanced computed tomography (CECT) of the thorax and abdomen was performed to rule out metastatic disease. Determination of serum carcinoembryonic antigen (CEA) level was done in all the patients as a prognostic marker. Neoadjuvant chemo radiotherapy (NACTRT) was administered to all patients with a threatened CRM and/or enlarged mesorectal nodes. All treatment decisions were taken by a multidisciplinary team (MDT) comprising of a colorectal surgeon, a medical oncologist, a radiation oncologist, a gastroenterologist, and a radiologist. Response assessment MRI (MRI 2) was performed after 6–10 weeks of completion of NACTRT, just prior to definitive surgery. All the patients who were planned for surgery received extensive counseling regarding the procedure, its risks and consequences. The choice of a laparoscopic or open approach was based purely on the availability of facilities for laparoscopic surgery on that day.

Technique of ISR ISR comprises of abdominal and perineal parts of dissection. Surgery is begun with abdominal part of the dissection.

Abdominal Part For the open ISR, a midline vertical incision extending from pubic symphysis to the umbilicus is used. Superior extent of the incision is determined by the ease of splenic flexure mobilization. In the laparoscopic procedure, five ports are placed. Initial exploration of the peritoneal cavity is performed to ensure absence of peritoneal and liver metastasis. In the open approach, initial dissection involves scoring of the white line of Toldt to mobilize the descending and sigmoid colon from their lateral attachment. In the laparoscopic approach, medial to lateral dissection is performed to

expose the inferior mesenteric pedicle first to be followed by colonic mobilization. Level of ligation of inferior mesenteric pedicle depends on the length of the colon. Standard total mesorectal excision (TME) is performed till the levator muscle is exposed circumferentially. The endopelvic fascia is then incised at the anorectal junction to open the superior aspect of the intersphincteric plane.

Perineal Part Lone Star retractor system (Cooper Surgical Inc., Trumbull, CT, USA) is used to facilitate better exposure. Dilute saline adrenaline solution is injected to minimize bleeding and a mucosal incision is taken about 1 cm distal to lower end of tumor. The incision is then deepened through the submucosa and internal anal sphincter and then the dissection is continued between the internal and external sphincters in intersphincteric plane until the abdominal plane of dissection is met. The TME specimen is then delivered through the anal canal. Intraoperative frozen section is performed to ensure that the distal resection margin is free of tumor. A neo rectum is created by pull-through of the descending colon and hand-sewn coloanal anastomosis is performed with interrupted absorbable sutures.

A defunctioning ileostomy or colostomy was performed in all the patients. Stoma reversal was done at the end of adjuvant therapy or 6 weeks after the primary surgery with prior confirmation of anastomotic integrity (X-ray loopogram) and adequate sphincter function (anal manometry).

The oncological outcomes measured for comparison between the open and laparoscopic groups included distal resection margin, circumferential resection margin (CRM) involvement, and number of nodes harvested. The clinical parameters measured for comparison between the open and laparoscopic groups included operating time, estimated blood loss, length of hospital stay, and 30-day perioperative morbidity and mortality. Conversion was defined as any extension of the incision to complete the procedure for reasons other than specimen extraction and the indications for conversion were recorded. Anastomotic leakage was defined clinically as presence of feculent discharge from the drain, or clinical features of intra-abdominal sepsis and radiologically as anastomotic leakage of contrast or any perianastomotic collection requiring drainage.

Statistics

Statistical analysis was performed using SPSS 20.0 for Windows (SPSS, Inc., Chicago, IL). χ^2 test or Fisher's exact test, as appropriate, were used to compare variables. The difference was considered significant if the *p* value was less than 0.05.

Results

There were 80 cases of ISR performed during the study period. Seven patients underwent robotic ISR and hence were excluded from the final analysis. As a result, there were 73 cases included in the study, 39 cases of open ISR (OISR), and 34 cases of LISR. Irrespective of the operative approach, partial ISR was performed in all the patients. Baseline characteristics of the patients included in the two groups is mentioned in Tables 1 and 2. The two groups were comparable in all parameters except body mass index (BMI) and ASA grade. Patients undergoing LISR had higher median BMI than OISR though it did not reach significance (p value 0.193). LISR was performed in high risk patients more often than OISR though it did not reach significance (p value 0.231).

Oncological and clinical outcomes are mentioned in Table 3. CRM involvement was seen in 10% patients in the OISR group and none in the LISR group (p value 0.055). Median distal resection margin was 1 cm in OISR and 1.5 cm in LISR. Two patients in OISR group had involved distal resection margin and hence underwent APER. Both these patients had distal resection margin of 1.5 and 0.5 cm, respectively, but had poorly differentiated histology with acellular mucin reaching up to the margin. Other oncological parameters including the number of retrieved nodes as well as histology were comparable between the two groups.

Although median blood loss was higher in OISR group compared to LISR, it did not reach significance (p value 0.188). Median hospital stay was comparable between the two groups. In the LISR, there were no conversions to open surgery. Ten patients in OISR group developed perioperative complications compared to four patients in the LISR group. Perioperative complications developed in 14 patients overall (19%). Four patients had anastomotic leakage (5.5%), three patients had surgical site infection (4.1%), two patients had stoma related complications (8.2%), and one patient each had

Table 2 Comparison of tumor stage between two groups

Tumor stage	Open ISR ($n = 39$)	Laparoscopic ISR ($n = 34$)
pTx	8 (20.51%)	9 (26.47%)
pT1	5 (12.82%)	6 (17.64%)
pT2	11 (28.20%)	7 (20.58%)
pT3	15 (38.46%)	12 (35.29%)
pT4	0	0

colonic prolapsed, pelvic hematoma, chyle leak, high stoma output, and prolonged catheterization.

Among the four patients with anastomotic leakage, three underwent perineal exploration, saline irrigation and re suturing of the coloanal anastomosis. The fourth patients had ischemia of the distal portion of the colon. Hence, laparotomy was done with resection of the ischemic portion of the colon followed by re anastomosis between remnant colon and anal canal. As he developed ischemia of the distal colon in post-operative period for the second time, permanent stoma was created. Stoma related complications included necrosis of the ileostomy in one patient and parastomal hernia in the other. Both patients were re explored and fresh stoma was created. All three patients with surgical site infection were managed conservatively with use of antibiotics and secondary suturing of the wound. One patient who developed pelvic hematoma was found to have bleeding from a branch of internal pudendal artery. Angio embolization of the concerned vessel controlled the bleeding and hence exploration was avoided. The patient with prolapsed colon had redundant colon and hence underwent transanal resection of the redundant colon followed by neo coloanal anastomosis.

Stoma reversal has been performed overall in 27 patients. Among these patients, basal pressure was normal in 18 patients, whereas it was reduced in the rest on anal manometry. However, all but one patient had sustained squeeze with

Table 1 Demographic characteristics

Characteristics	Open ISR ($n = 39$)	Laparoscopic ISR ($n = 34$)	p value
Age (in years) (median) (range)	42 (22–69)	47 (23–73)	0.738
Sex			0.623
Male	25 (64%)	24 (70.6%)	
Female	14 (36%)	10 (29.4%)	
BMI (median) (range)	22 (18–31)	23 (19–27)	0.193
ASA			0.154
1	31 (79.4%)	22 (64.7%)	
≥ 2	8 (20.5%)	12 (35.3%)	
Distance from anal verge (median) (range)	3 cm (1–5 cm)	3 (1–7)	0.231
Pre op NACTRT	33 (84.6%)	28 (82.4%)	0.795
Gap between RT and surgery (median)	9 weeks (1–14)	9 (5–32)	0.292

ISR intersphincteric resection, BMI body mass index, ASA American Society of Anesthesiologist, NACTRT neoadjuvant chemoradiotherapy, RT radiotherapy

Table 3 Comparison of oncological and clinical parameters between OISR and LISR

Parameters	Open ISR (<i>n</i> = 39)	Laparoscopic ISR (<i>n</i> = 34)	<i>p</i> value
Median blood loss (In ml) (median) (range)	500 (50–3500)	200 (50–900)	0.188
Median hospital stay (in days) (median) (range)	8 (5–24)	8 (6–14)	0.139
30-day perioperative morbidity	10 (25.7%)	4 (11.8%)	0.151
Grade of tumor			0.872
Well differentiated	4 (14.3%)	4 (11.8%)	
Moderately differentiated	28 (71.8%)	25 (73.5%)	
Poorly differentiated	7 (17.9%)	5 (14.7%)	
Signet ring cell histology	2 (5.1%)	5 (14.7%)	
Mucinous histology	11 (28.2%)	13 (38.2%)	
CRM involvement	4 (10%)	0%	0.055
Distal resection margin involvement	2 (5.1%)	0%	0.922
Nodes dissected (median) (range)	11 (1–35)	11 (3–36)	0.404
Tumor regression grade (median) (range)	3 (1–5)	2 (1–5)	0.390

CRM circumferential resection margin

adequate squeeze pressure. Among the 15 patients who have been followed up for more than 6 months after stoma reversal, 11 are fully continent and 4 have partial incontinence with intermittent seepage of mucus stools being the common complaint in this subgroup.

Discussion

The management of rectal cancer is continuously evolving over the past few decades. In the present day clinical practice, there are two main objectives of rectal cancer surgery—to achieve complete resection (R0) and to ensure good quality of life. With recognition of shorter safe distal resection margins, neoadjuvant chemoradiotherapy and improvement in surgical techniques, ISR has become the preferred surgical option for low rectal cancers. Several retrospective studies have shown that ISR is oncologically safe and has added advantage of sphincter preservation [3, 5, 16–18]. Perioperative mortality is 0.8% and morbidity is 25.8% [2]. The 5-year overall and disease-free survival rate of 86.3 and 78.6%, respectively, have been noted in the literature [19]. Although laparoscopic rectal surgery has been adopted widely after the results from randomized trials proving its oncological safety, laparoscopic ISR is still not an established technique. It is regarded as technically more demanding in view of difficulties with pelvic exposure, dissection, and sphincter preservation. Recently, several studies have shown that LISR is feasible and safe [11–13].

The precise and magnified view during laparoscopic surgery facilitates complete mesorectal excision with adequate circumferential and distal margins. In the present study, none of the patients in the laparoscopic group had involved CRM or distal margin compared to 10% CRM positivity and 5.1% distal margin involvement in the open group. Although the

difference did not reach statistical significance, these results point towards improved short term oncological outcomes with laparoscopic surgery as both groups had tumors of identical stage and grade. These results are similar to other studies comparing OISR with LISR [14, 20].

Traditionally, it has been shown that laparoscopic surgery offers several benefits, such as less blood loss, earlier return of bowel function, less postoperative pain, shorter hospital stays, and a better quality of life [8, 9]. Even in the present study, blood loss was lower in laparoscopic group compared to open group though it did not reach statistical significance. However, hospital stay was similar between the two groups which are consistent with other studies reported on laparoscopic ISR [15, 21]. Probable reason being similar postoperative course between the two groups in terms of removal of drain as well as starting on oral intake (both groups had proximal diverting ileostomy). The postoperative morbidity was not significantly different between the two groups (*p* value 0.151). This is consistent with the literature and is expected because the critical steps of the procedures are essentially the same [22].

Intraoperative conversion from laparoscopic to open surgery is considered as a surrogate marker of the feasibility of the procedure. Conversion rates for laparoscopic rectal surgeries in general have varied from 0.6 to 34% [8, 10]. It has been observed that more complex the laparoscopic resection, greater is the conversion rate. In the present series, there were no conversions to open resection. This is because of the vast experience as well as the advanced training of the primary surgeon with the minimally invasive surgery. Kuo et al. have also reported 0% conversion rate in their study on LISR [15].

This study had several limitations. First, it was a retrospective review of a prospectively maintained database and hence is amenable for all the biases of a retrospective study. Second, enhanced recovery after recovery could not be strictly

followed during this study period which may explain similar hospital stay for both the groups. Finally, the functional outcomes were not assessed longitudinally at different fixed time points after ileostomy closure and hence it was difficult to compare the two groups in terms of functional outcomes.

Conclusion

Reduced intraoperative blood loss, magnified intraoperative view, fewer postoperative morbidity, and similar oncological outcomes point towards laparoscopic approach being better than open approach for intersphincteric resection for low rectal cancers.

Compliance with Ethical Standards

Conflicts of Interest The authors declare that they have no conflict of interest.

References

- Schiessel R, Karner-Hanusch J, Herbst F, Teleky B, Wunderlich M (1994) Intersphincteric resection for low rectal tumours. *Br J Surg* 81(9):1376–1378
- Martin ST, Heneghan HM, Winter DC (2012) Systematic review of outcomes after intersphincteric resection for low rectal cancer. *Br J Surg* 99(5):603–612
- Akagi Y, Shirouzu K, Ogata Y, Kinugasa T (2013) Oncologic outcomes of intersphincteric resection without preoperative chemoradiotherapy for very low rectal cancer. *Surg Oncol* 22(2):144–149
- Portier G, Ghouti L, Kirzin S, Guimbaud R, Rives M, Lazorthes F (2007) Oncological outcome of ultra-low coloanal anastomosis with and without intersphincteric resection for low rectal adenocarcinoma. *Br J Surg* 94(3):341–345
- Saito N, Sugito M, Ito M, Kobayashi A, Nishizawa Y, Yoneyama Y et al (2009) Oncologic outcome of intersphincteric resection for very low rectal cancer. *World J Surg* 33(8):1750–1756
- Akagi Y, Kinugasa T, Shirouzu K (2013) Intersphincteric resection for very low rectal cancer: a systematic review. *Surg Today* 43(8):838–847
- Hartley JE, Mehigan BJ, Qureshi AE, Duthie GS, Lee PW, Monson JR (2001) Total mesorectal excision: assessment of the laparoscopic approach. *Dis Colon Rectum* 44(3):315–321
- Kang S-B, Park JW, Jeong S-Y, Nam BH, Choi HS, Kim D-W et al (2010) Open versus laparoscopic surgery for mid or low rectal cancer after neoadjuvant chemoradiotherapy (COREAN trial): short-term outcomes of an open-label randomised controlled trial. *Lancet Oncol* 11(7):637–645
- van der Pas MH, Haglind E, Cuesta MA, Fürst A, Lacy AM, Hop WC et al (2013) Laparoscopic versus open surgery for rectal cancer (COLOR II): short-term outcomes of a randomised, phase 3 trial. *Lancet Oncol* 14(3):210–218
- Guillou PJ, Quirke P, Thorpe H, Walker J, Jayne DG, Smith AMH et al (2005) Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. *Lancet* 365(9472):1718–1726
- Watanabe M, Teramoto T, Hasegawa H, Kitajima M (2000) Laparoscopic ultralow anterior resection combined with per anum intersphincteric rectal dissection for lower rectal cancer. *Dis Colon Rectum* 43(10 Suppl):S94–S97
- Fujimoto Y, Akiyoshi T, Kuroyanagi H, Konishi T, Ueno M, Oya M et al (2010) Safety and feasibility of laparoscopic intersphincteric resection for very low rectal cancer. *J Gastrointest Surg* 14(4):645–650
- Pai VD, Desouza A, De Menezes JL, Saklani AP (2015) Laparoscopic intersphincteric resection and hand-sewn coloanal anastomosis: a natural orifice specimen extraction technique. *J Laparoendosc Adv Surg Tech A* 25(5):396–400
- Park JS, Choi G-S, Jun SH, Hasegawa S, Sakai Y (2011) Laparoscopic versus open intersphincteric resection and coloanal anastomosis for low rectal cancer: intermediate-term oncologic outcomes. *Ann Surg* 254(6):941–946
- Kuo L-J, Hung C-S, Wang W, Tam K-W, Lee H-C, Liang H-H et al (2013) Intersphincteric resection for very low rectal cancer: clinical outcomes of open versus laparoscopic approach and multidimensional analysis of the learning curve for laparoscopic surgery. *J Surg Res* 183(2):524–530
- Weiser MR, Quah H-M, Shia J, Guillem JG, Paty PB, Temple LK et al (2009) Sphincter preservation in low rectal cancer is facilitated by preoperative chemoradiation and intersphincteric dissection. *Ann Surg* 249(2):236–242
- Spanos CP (2012) Intersphincteric resection for low rectal cancer: an overview. *Int J Surg Oncol* 2012:241512
- Pai VD, De Souza A, Patil P, Engineer R, Arya S, Saklani A (2015) Intersphincteric resection and hand-sewn coloanal anastomosis for low rectal cancer: short-term outcomes in the Indian setting. *Indian J Gastroenterol* 34(1):23–28
- Rullier E, Sa Cunha A, Couderc P, Rullier A, Gontier R, Saric J (2003) Laparoscopic intersphincteric resection with coloplasty and coloanal anastomosis for mid and low rectal cancer. *Br J Surg* 90(4):445–451
- Yamamoto S, Fujita S, Akasu T, Inada R, Takawa M, Moriya Y (2011) Short-term outcomes of laparoscopic intersphincteric resection for lower rectal cancer and comparison with open approach. *Dig Surg* 28(5–6):404–409
- Yoo B-E, Cho J-S, Shin J-W, Lee D-W, Kwak J-M, Kim J et al (2015) Robotic versus laparoscopic intersphincteric resection for low rectal cancer: comparison of the operative, oncological, and functional outcomes. *Ann Surg Oncol* 22(4):1219–1225
- Chapman AE, Levitt MD, Hewett P, Woods R, Sheiner H, Maddern GJ (2001) Laparoscopic-assisted resection of colorectal malignancies: a systematic review. *Ann Surg* 234(5):590–606