Intersphincteric Resection for Low Rectal Cancers

Subjects: Surgery | Gastroenterology & Hepatology | Oncology
Contributor: Seon Hahn Kim

Intersphincteric resection is an anus-preserving technique for low rectal cancers described by Schiessel et al. in 1994 as a combination of two techniques: the intersphincteric rectal excision for inflammatory bowel disease and the coloanal anastomosis for low rectal resections.

Keywords: advanced rectal cancer ; intersphincteric resection ; minimally invasive surgery ; anus-preserving surgery ; laparoscopic surgery ; robotic surgery ; local recurrence ; anorectal function ; low rectal cancer ; abdominoperineal resection

1. Intersphincteric resection (ISR)

Intersphincteric resection (ISR) is characterized by two distinct phases: abdominal and perineal. ISR allows extension of the caudal dissection plane to allow a safe distal margin for very low-lying rectal cancer without excising the sphincter complex (external anal sphincter (EAS)/levator ani muscle (LAM)) as in the abdominoperineal resection. The oncological safety of the ISR derives from the knowledge that lymphatic spread of low rectal cancers occurs especially in the oral direction within the mesorectum with local spread present only in few millimeters [1][2].

ISR was originally classified as subtotal and total according to the partial or complete resection of the IAS [3]. However, the Japanese experience on ISR has modified the original classification into three types (**Figure 1**) [4][5]: (1) Total ISR (complete removal of the internal anal sphincter at the intersphincteric groove); (2) Subtotal ISR (the resection line lays between the dentate line (DL) and the intersphincteric groove (ISG); (3) Partial ISR (the resection is at the level of the DL. The choice of the dissection line depends on the lower border of the tumor in order to obtain an adequate distal clearance (distal resection margin (DRM) ≥ 1 cm).

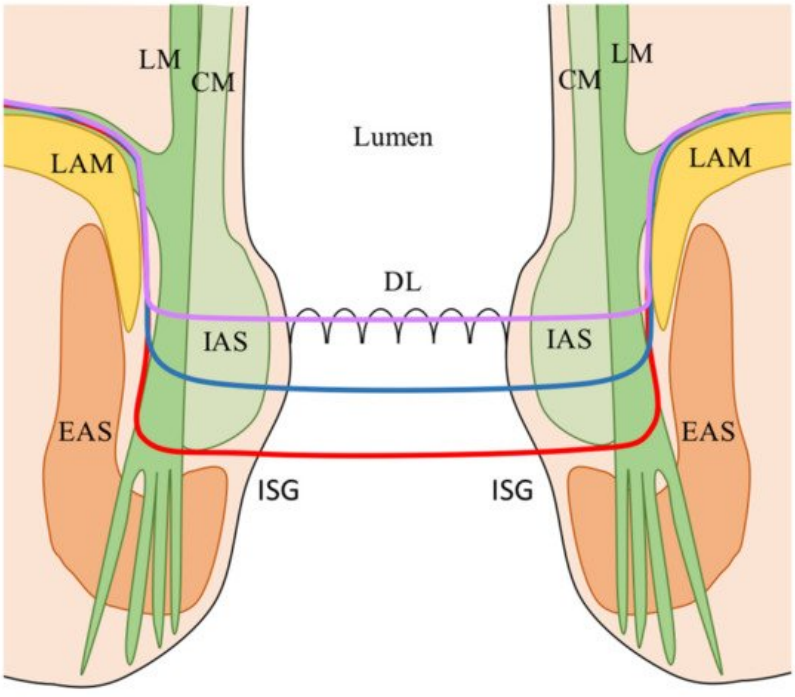

Figure 1. ISR classification according to the extension of dissection [4][5]. Red line: total ISR (complete resection of the IAS at the (ISG); Blue line: subtotal ISR (resection line between the DL and the (ISG); Purple line: partial ISR (resection at the level of the (DL). CM: Circular muscle of the anal canal; DL: Dentate line; EAS: External anal sphincter; IAS: Internal anal sphincter; ISG: Intersphincteric groove; LAM: levator ani muscle; LM: Longitudinal muscle of the anal canal.

The intersphincteric dissection for ISR is usually started in the transabdominal phase and completed during the perineal phase [6][7][8][9][10][11][12][13][14][15][16][17][18][19][20][21]. However, some authors perform the intersphincteric dissection in toto only during the perineal phase [22][23][24][25][26][27][28][29][30]. Park et al. and Kim et al. have reported the use of the robotic platform to perform total/near-total single-stage transabdominal ISR with no need for a perineal intersphincteric dissection [31][32].

2. Indication of ISR

ISR is a surgical technique for treating patients with LRC, generally defined as tumors with the caudal edge within 4–5 cm from the anal verge (AV) or 2 cm above the DL. Surgical indications for ISR have changed since the standardization of the technique [3] (**Table 1**). However, a precise preoperative staging with the combination of rectal MRI, thoracic-abdominopelvic computed tomography (CT) scan, anal EUS, rigid proctoscopy, and digital rectal examination (DRE) remains crucial for a correct surgical indication [33]. Restaging should be done after neoadjuvant chemoradiation (nCRT), and surgical indications must be always re-checked and re-discussed with the patient. The final decision to perform an ISR or convert to APR is done by the surgeon in the operating theatre, before starting surgery, while performing DRE under anesthesia to access tumor mobility and relationship to the anal sphincters [13][24].

The reviews of Martin et al. [33], Akagi et al. [4], and Shirouzu et al. [34] have critically discussed the indication criteria for ISR. They all agreed that ISR should be indicated for well/moderately differentiated T1–3 tumors located within 5 cm from the AV, independently to IAS invasion. Poorly differentiated, T4, fixed tumors (at DRE), with EAS/LAM infiltration and/or untreatable distant metastases should be contraindicated to ISR. Moreover, ISR should not be indicated to patients with poor anal function, severe preoperative pathologies (cardiac failure, liver cirrhosis, renal dysfunction, and respiratory dysfunction), or psychiatric disease. These indications were confirmed by a national-based questionnaire from the Japanese Society for Cancer of the Colon and Rectum (JSCCR) [35].

Rullier et al. implemented the indication criteria for LRC, through an MRI-based classification [36]. They classified LRC into four types to assist decision-making between anus-preserving surgery and APR. Type I are LRC defined as supra-anal tumors (lesions >1 cm from the anorectal ring). Type II are defined as juxta-anal tumors (lesions ≤ 1 cm from the anorectal ring). Type III are defined as intra-anal tumors (lesions with IAS invasion). Type IV are defined as transanal tumors (lesions with EAS or LAM invasion). They indicated ISR for type II and III. Furthermore, some authors have proposed to combine ISR with partial resection of the EAS for type IV tumors [5][37][38]. Rullier's classification is very intuitive and of easy use, however, it evaluates the tumor position, from MRI images, in relation to the LAM and EAS in a frontal view without considering the circumferential position of the tumor on the anal clock. Through a retrospective analysis of surgical specimens, Kang et al. analyzed the circumferential tumor location, reporting that the anterior aspect most frequently involves the circumferential resection margin (CRM) and exhibits a deeper tumor invasion [39]. Further studies are needed to define if the circumferential tumor location may in the future play a role in the treatment strategy, such as stronger indication for preoperative radiotherapy or choice of surgical approach.

The indication criteria for ISR have been recently discussed by two studies. Park et al. [20] have examined the role of the tumor's response to nCRT on restaging pelvic MRI as indication criteria for ISR. They reported the ymrT stage and ymrCRM status as key factors for deciding between ISR and APR. Moreover, ISR indication was extended also to patients with cT4 LRS that downstaged after CRT (i.e., ymrT0–3). Poor responders (i.e., ymrT3) with suspicious tumor invasion of the CRM should instead undergo APR.

Piozzi et al. reported a study on 161 ISR where indication criteria were extended. In this study patients with post nCRT clearance of EAS/LAM infiltration were indicated to ISR independently to T stage if curative resection was considered technically feasible at the pre-operative MRI staging [21].

Clinical indications to ISR have changed in the last three decades however an international consensus should be taken to critically define them in order to perform standardized ISR with comparable results throughout the colorectal community.

Table 1. Indications for ISR according to the literature.

Authors, Year	Indications	Contraindications
Schiessel, 1994–2012 [3][6][1]	-T1–T3 LRC -Tumor diameter >1 cm -Big villous adenomas -Mucosectomy/RT residual tumors -Low carcinoids/hemangiomas	-Undifferentiated tumors -EAS infiltration -T4 stage -Preoperative insufficient sphincter function -Distant metastases
Vorobiev, 2004 [22]	T2–3 (EUS) Well/moderately diff. adenoca. Fecal continence	-EAS/LAM infiltration -N+ (EUS) -M+
Rullier, 2005 [9]	-≤4.5 cm AV -Distant metastases	-EAS/LAM infiltration -Fixed tumors (except partial vaginal fixity) -Fecal incontinence > 6 months before diagnosis
Hohenberger, 2005 [10]	-≥0.5 cm from DL (rectoscopy) -T1–2 (EUS) -T3 (above puborectal sling) -G1–2 -Patients with possibly distinct invasion of the pelvic floor musculature underwent prior nCRT	-EAS infiltration -Fecal incontinence
Chin, 2006 [11]	-T2 -T3–4 (after nCRT) -≤5 cm (maximal diameter) -1–3 cm from DL	-Distant metastases
Chamlou, 2007 [12]	-T1–3 -T4 if invasion is distant from the tumor's lowest part/sphincter, and is resectable -Resectable distant metastases -uT1 with adverse pathologic features after transanal local excision	-EAS/LAM infiltration -Fecal incontinence
Krand, 2009 [23]	-(Study on ISR with partial IAS) -Distal excision at the DL or 1–2 mm distal to it -T2–3 -Well/moderately diff. adenoca.	-Total IAS for achieving acceptable DRM -Fecal incontinence -EAS/LAM infiltration -Poorly diff. adenoca. -Distant metastases (except resectable liver metastases)
Han, 2009 [24]	-T1–2 (IAS) -T1-T2 after nCRT -Tumor diameter > 1 cm but <5 cm -Well/moderately diff. adenoca. -Sufficient anal function (DRE, manometry)	-Infiltration of pelvic floor -Tumor diameter > 5 cm -Poorly diff. adenoca. -Insufficient anal function (DRE, manometry) -Distant metastases -Intestinal obstruction
Kuo, 2011 [26]	-T1–3	-Infiltration EAS/LAR (even if submitted to nCRT with radiological clearance)
Martin, 2012 [33] (Review)	-≤1 cm from anorectal ring	-T4 tumors -EAS/LAM infiltration -Fixed tumors at DRE -Poorly diff. adenoca. -Fecal incontinence -Distant metastases
Tokoro, 2013 [16]	-T1–3 -Resectable metastases	-T4 tumors -Poorly diff. adenoca. -Infiltrating gross appearance -Fecal incontinence
Akagi, 2013 [17]	-T1–3 (mobile tumors) -≤4 cm from AV -Well/moderately diff. adenoca. -ECOG PS 0–2 -Good anal function	-T4 tumor -Fixed tumors -Untreatable distant metastases -Poorly diff. adenoca. -Psychiatric disease -Poor anal function (no discernable tone at DRE or the maximum squeeze pressure < 50 mmHg before operation) -Liver cirrhosis, renal dysfunction, cardiac failure, and respiratory dysfunction

Authors, Year	Indications	Contraindications
Akagi, 2013 [4] (Review)	-T1–3 tumors -30–35 mm from AV -Independently to IAS invasion	-As for Schiessel et al.
Saito, 2014 [28]	-T1–4 -≤5 cm from AV	-EAS/LAM infiltration -Fecal incontinence
Shirouzu, 2017 [34] (Review)	-T1–3 -1–5 cm AV -Well-moderately diff. adenoca.	-T4 -Fixed tumors -EAS/LAM infiltration -Untreatable distant metastases -Poorly diff. adenoca. -Poor anal function -Severe preoperative pathologies (cardiac failure, liver cirrhosis, renal dysfunction, respiratory dysfunction) -Psychiatric disease
Park, 2019 [20]	-Tumor's response to nCRT on restaging MRI -Evaluation of ymrT stage and ymrCRM status	-Poor nCRT responders
Piozzi, 2021 [21]	-≤4 cm from AV -After nCRT for cT3-T4 -(y)cT4 if curative resection is technically feasible at the pre-operative MRI -Conversion from an ultra-low AR in case of involvement/threatening of the distal gross margin in the resected specimen or in case of stapler failure for any reason	-EAS/LAM infiltration (at restaging MRI after nCRT) -Abundant mucinous component -Anal canal involvement below DL (requiring total ISR) -Fecal incontinence -Patient's refusal

AV: Anal verge; DL: Dentate line; DRE: Digital rectal examination; DRM: Distal resection margin; EAS: External anal sphincter; ECOG PS: Eastern Cooperative Oncology Group scale of Performance Status; EUS: Endoscopic ultrasound; IAS: Internal anal sphincter; ISR: Intersphincteric resection; LAM: levator ani muscle; LRC: Low rectal cancer; MRI: Magnetic resonance imaging; nCRT: Neoadjuvant chemoradiotherapy; RT: Radiotherapy.

References

1. Schiessel, R. Surgical technique of intersphincteric resection. In Intersphincteric Resection for Low Rectal Tumors; Schiessel, R., Metzger, P., Eds.; Springer: Vienna, Austria, 2012; pp. 73–84.
2. Kang, D.W.; Kwak, H.D.; Sung, N.S.; Yang, I.S.; Baek, S.J.; Kwak, J.M.; Kim, J.; Kim, S.H. Oncologic outcomes in rectal cancer patients with a ≤1-cm distal resection margin. Int. J. Colorectal Dis. 2017, 32, 325–332.
3. Schiessel, R.; Karner-Hanusch, J.; Herbst, F.; Teleky, B.; Wunderlich, M. Intersphincteric resection for low rectal tumours. Br. J. Surg. 1994, 81, 1376–1378.
4. Akagi, Y.; Kinugasa, T.; Shirouzu, K. Intersphincteric resection for very low rectal cancer: A systematic review. Surg. Today 2013, 43, 838–847.
5. Saito, N.; Moriya, Y.; Shirouzu, K.; Maeda, K.; Mochizuki, H.; Koda, K.; Hirai, T.; Sugito, M.; Ito, M.; Kobayashi, A. Intersphincteric resection in patients with very low rectal cancer: A review of the Japanese experience. Dis. Colon Rectum 2006, 49, S13–S22.
6. Schiessel, R.; Novi, G.; Holzer, B.; Rosen, H.R.; Renner, K.; Holbling, N.; Feil, W.; Urban, M. Technique and long-term results of intersphincteric resection for low rectal cancer. Dis. Colon Rectum 2005, 48, 1858–1865; discussion 1865–1867.
7. Kohler, A.; Athanasiadis, S.; Ommer, A.; Psarakis, E. Long-term results of low anterior resection with intersphincteric anastomosis in carcinoma of the lower one-third of the rectum: Analysis of 31 patients. Dis. Colon Rectum 2000, 43, 843–850.
8. Tiret, E.; Poupardin, B.; McNamara, D.; Dehni, N.; Parc, R. Ultralow anterior resection with intersphincteric dissection--what is the limit of safe sphincter preservation? Colorectal Dis. 2003, 5, 454–457.
9. Rullier, E.; Laurent, C.; Bretagnol, F.; Rullier, A.; Vendrely, V.; Zerbib, F. Sphincter-saving resection for all rectal carcinomas: The end of the 2-cm distal rule. Ann. Surg. 2005, 241, 465–469.
10. Hohenberger, W.; Merkel, S.; Matzel, K.; Bittorf, B.; Papadopoulos, T.; Gohl, J. The influence of abdomino-peranal (intersphincteric) resection of lower third rectal carcinoma on the rates of sphincter preservation and locoregional recurrence. Colorectal Dis. 2006, 8, 23–33.

11. Chin, C.C.; Yeh, C.Y.; Huang, W.S.; Wang, J.Y. Clinical outcome of intersphincteric resection for ultra-low rectal cancer. World J. Gastroenterol. 2006, 12, 640–643.

12. Chamlou, R.; Parc, Y.; Simon, T.; Bennis, M.; Dehni, N.; Parc, R.; Tiret, E. Long-term results of intersphincteric resectio n for low rectal cancer. Ann. Surg. 2007, 246, 916–921; discussion 921–922.

13. Portier, G.; Ghouti, L.; Kirzin, S.; Guimbaud, R.; Rives, M.; Lazorthes, F. Oncological outcome of ultra-low coloanal ana stomosis with and without intersphincteric resection for low rectal adenocarcinoma. Br. J. Surg. 2007, 94, 341–345.

14. Akasu, T.; Takawa, M.; Yamamoto, S.; Fujita, S.; Moriya, Y. Incidence and patterns of recurrence after intersphincteric r esection for very low rectal adenocarcinoma. J. Am. Coll. Surg. 2007, 205, 642–647.

15. Zhang, Y.J.; Yin, L.; Huang, L.; Zhang, H.B.; Han, Y.; Lin, M.B. Long-term results of intersphincteric resection for low rec tal cancer. J. Investig. Surg. 2013, 26, 217–222.

16. Tokoro, T.; Okuno, K.; Hida, J.; Ueda, K.; Yoshifuji, T.; Daito, K.; Takemoto, M.; Sugiura, F. Analysis of the clinical factor s associated with anal function after intersphincteric resection for very low rectal cancer. World J. Surg. Oncol. 2013, 1 1, 24.

17. Akagi, Y.; Shirouzu, K.; Ogata, Y.; Kinugasa, T. Oncologic outcomes of intersphincteric resection without preoperative c hemoradiotherapy for very low rectal cancer. Surg. Oncol. 2013, 22, 144–149.

18. Mahalingam, S.; Seshadri, R.A.; Veeraiah, S. Long-Term Functional and Oncological Outcomes Following Intersphincte ric Resection for Low Rectal Cancers. Indian J. Surg. Oncol. 2017, 8, 457–461.

19. Matsunaga, R.; Kojima, M.; Nishizawa, Y.; Yokota, M.; Hasegawa, H.; Saito, N.; Ito, M.; Ochiai, A. The utility of longitudi nal slicing method for rectal specimen: Pathological analysis of circumferential resection margin of intersphincteric rese ction for low-lying rectal cancer. Pathol. Int. 2019, 69, 272–281.

20. Park, J.S.; Park, S.Y.; Kim, H.J.; Cho, S.H.; Kwak, S.G.; Choi, G.S. Long-term Oncologic Outcomes After Neoadjuvant Chemoradiation Followed by Intersphincteric Resection With Coloanal Anastomosis for Locally Advanced Low Rectal C ancer. Dis. Colon Rectum 2019, 62, 408–416.

21. Piozzi, G.N.; Park, H.; Lee, T.H.; Kim, J.S.; Choi, H.B.; Baek, S.J.; Kwak, J.M.; Kim, J.; Kim, S.H. Risk factors for local r ecurrence and long term survival after minimally invasive intersphincteric resection for very low rectal cancer: Multivaria te analysis in 161 patients. Eur. J. Surg. Oncol. 2021, 47, 2069–2077.

22. Vorobiev, G.I.; Odaryuk, T.S.; Tsarkov, P.V.; Talalakin, A.I.; Rybakov, E.G. Resection of the rectum and total excision of t he internal anal sphincter with smooth muscle plasty and colonic pouch for treatment of ultralow rectal carcinoma. Br. J. Surg. 2004, 91, 1506–1512.

23. Krand, O.; Yalti, T.; Tellioglu, G.; Kara, M.; Berber, I.; Titiz, M.I. Use of smooth muscle plasty after intersphincteric rectal resection to replace a partially resected internal anal sphincter: Long-term follow-up. Dis. Colon Rectum 2009, 52, 1895 –1901.

24. Han, J.G.; Wei, G.H.; Gao, Z.G.; Zheng, Y.; Wang, Z.J. Intersphincteric resection with direct coloanal anastomosis for ul tralow rectal cancer: The experience of People’s Republic of China. Dis. Colon Rectum 2009, 52, 950–957.

25. Weiser, M.R.; Quah, H.M.; Shia, J.; Guillem, J.G.; Paty, P.B.; Temple, L.K.; Goodman, K.A.; Minsky, B.D.; Wong, W.D. Sphincter preservation in low rectal cancer is facilitated by preoperative chemoradiation and intersphincteric dissection. Ann. Surg. 2009, 249, 236–242.

26. Kuo, L.J.; Hung, C.S.; Wu, C.H.; Wang, W.; Tam, K.W.; Liang, H.H.; Chang, Y.J.; Wei, P.L. Oncological and functional o utcomes of intersphincteric resection for low rectal cancer. J. Surg. Res. 2011, 170, e93–e98.

27. Gong, X.; Jin, Z.; Zheng, Q. Anorectal function after partial intersphincteric resection in ultra-low rectal cancer. Colorect al Dis. 2012, 14, e802–e806.

28. Saito, N.; Ito, M.; Kobayashi, A.; Nishizawa, Y.; Kojima, M.; Nishizawa, Y.; Sugito, M. Long-term outcomes after intersph incteric resection for low-lying rectal cancer. Ann. Surg. Oncol. 2014, 21, 3608–3615.

29. Abdel-Gawad, W.; Zaghloul, A.; Fakhr, I.; Sakr, M.; Shabana, A.; Lotayef, M.; Mansour, O. Evaluation of the frequency a nd pattern of local recurrence following intersphincteric resection for ultra-low rectal cancer. J. Egypt. Natl. Cancer Inst. 2014, 26, 87–92.

30. Koide, Y.; Maeda, K.; Katsuno, H.; Hanai, T.; Masumori, K.; Matsuoka, H.; Endo, T.; Cheong, Y.C.; Uyama, I. Exfoliated cancer cells during intersphincteric resection for very low rectal cancer. Surg. Today 2020, 50, 1652–1656.

31. Park, S.Y.; Choi, G.S.; Park, J.S.; Kim, H.J.; Choi, W.H.; Ryuk, J.P. Robotic-assisted transabdominal intersphincteric re section: A technique involving a completely abdominal approach and coloanal anastomosis. Surg. Laparosc. Endosc. P ercutaneous Tech. 2013, 23, e5–e10.

32. Kim, J.C.; Kim, C.W.; Lee, J.L.; Yoon, Y.S.; Park, I.J.; Kim, J.R.; Kim, J.; Park, S.H. Complete intersphincteric longitudinal muscle excision May Be key to reducing local recurrence during intersphincteric resection. Eur. J. Surg. Oncol. 2021, 47, 1629–1636.
33. Martin, S.T.; Heneghan, H.M.; Winter, D.C. Systematic review of outcomes after intersphincteric resection for low rectal cancer. Br. J. Surg. 2012, 99, 603–612.
34. Shirouzu, K.; Murakami, N.; Akagi, Y. Intersphincteric resection for very low rectal cancer: A review of the updated literature. Ann. Gastroenterol. Surg. 2017, 1, 24–32.
35. Yamada, K.; Saiki, Y.; Takano, S.; Iwamoto, K.; Tanaka, M.; Fukunaga, M.; Noguchi, T.; Nakamura, Y.; Hisano, S.; Fukami, K.; et al. Long-term results of intersphincteric resection for low rectal cancer in Japan. Surg. Today 2019, 49, 275–285.
36. Rullier, E.; Denost, Q.; Vendrely, V.; Rullier, A.; Laurent, C. Low rectal cancer: Classification and standardization of surgery. Dis. Colon Rectum 2013, 56, 560–567.
37. Shirouzu, K.; Ogata, Y.; Araki, Y.; Kishimoto, Y.; Sato, Y. A new ultimate anus-preserving operation for extremely low rectal cancer and for anal canal cancer. Tech. Coloproctol. 2003, 7, 203–206.
38. Shelygin, Y.A.; Vorobiev, G.I.; Pikunov, D.Y.; Markova, E.V.; Djhanaev, Y.A.; Fomenko, O.Y. Intersphincteric resection with partial removal of external anal sphincter for low rectal cancer. Acta Chir. Iugosl. 2008, 55, 45–53.
39. Kang, B.M.; Park, Y.K.; Park, S.J.; Lee, K.Y.; Kim, C.W.; Lee, S.H. Does circumferential tumor location affect the circumferential resection margin status in mid and low rectal cancer? Asian J. Surg. 2018, 41, 257–263.