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Rectal eversion: safe and effective way to achieve low transaction in minimally invasive Ileal pouch-anal anastomosis surgery, short- and long-term outcomes

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Abstract

Background Ileal pouch-anal anastomosis remains a gold standard in restoring continence in patient with ulcerative colitis. Achievinglow transection can be challenging and may require mucosectomy with a hand-sewn anastomosis. Rectal eversion (RE)technique provides a safe and effective alternative for both open and minimally invasive approaches. The purpose of thisstudy is to evaluate short- and long-term outcomes of patients who underwent RE when compared to those who underwentconventional *trans*-abdominal transection.

Materials and methods This is a retrospective review performed at tertiary care center. Patients undergoingproctectomy and pouch surgery by either standard approach or with RE from November 2004 to January 2017 wereevaluated. Demographics, post-operative complications, as well as 1- and 3-year functional outcomes were analyzed.

Results Total of176 underwent proctocolectomy with creation of a J pouch and 88 (50%) had the RE technique utilized. The RE group had ahigher rate of corticosteroid use at the time of surgery 59.1 versus 39.8% ($p = 0.0156$), but otherwise groups were statisticallysimilar. 20 cases (26.1%) of RE group and 54 (61%) of conventional group cases were accomplished in minimally invasivefashion. There was no difference in the rates of 30- and 90-day complications. Functional outcomes data were available forup to 78.4% of patient with *trans*-abdominal approach and 64.7% in RE group. At 1 and 3 years after surgery, there was nodifference in the number of bowel movements, fecal incontinence, or nocturnal bowel movements. The rates of returning toileostomy or pouch revision were the same.

Conclusion RE technique is safe and effective way to achieve a low transaction in J pouchsurgery. The technique provides similar functional outcomes at 1 and 3 years after surgery and can be particularly useful inminimally invasive approaches.

Keywords Ileal pouch-anal anastomosis · Rectal eversion · Low pelvic transection

Ileal pouch-anal anastomosis (IPAA) remains the gold standard in restoring continence in patient with ulcerative colitis [1, 2]. Achieving low transection is key to removing all the colorectal mucosa, avoiding long-term problems with cuffitis, reducing risk of colorectal cancer, and decreasing the need for anti inflammatory medication and re-intervention [1]. Historically, mucosectomy and hand-sewn anastomosis have been utilized to accomplish this goal; however, this technique is more labor intensive and can result in worse functional outcomes [2]. This goal can be further complicated by demands of minimally invasive approach, which provides less pain and faster recovery [3, 4], but creates a more challenging circumstance for lower division of the rectum at the pelvic floor [3].

Rectal eversion (RE) technique can allow a low transection with direct visualization of all the tissue that needs to be removed permitting stapled anastomoses [5–7]. The RE technique has been previously described as well as successfully applied for years in open proctectomy. It has not previously been evaluated in the context of laparoscopic

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proctectomy as part of IPAA. We have previously reported one method to combine laparoscopic proctectomy and RE [5].

The purpose of this study is to evaluate short- and long-term outcomes of patients who underwent RE when compared to the conventional *trans*-abdominal transection (AT).

Materials and methods

A retrospective review from a single institutional database was performed from November 2004 to January 2017. All patients undergoing restorative proctocolectomy with J pouch formation were included in the study. This review included patients undergoing the first stage of a 2-stage approach (total proctocolectomy and IPAA formation and ileostomy if performed) as well as the second stage of 3-stage approach (proctectomy with IPAA and ileostomy if performed). Patients were divided into RE and AT groups. Demographics, patients' comorbidities, and perioperative complications were analyzed. Functional outcomes were gathered from online medical records for 1 and 3-year mark from time of ileostomy takedown; the outcomes included rates of fecal incontinence, nocturnal incontinence, number of bowel movements, use of antidiarrheal medications, and rates of stoma formation and pouch loss.

RE in laparoscopic approach was accomplished by a pelvic dissection that was extended down to anorectal junction; that often times includes intra-levator dissection and was confirmed by both direct visualization as well as digital exam. If it was determined that stapled rectal transection at the pelvic floor could not be achieved with a *trans*-abdominal approach, the mesorectum was divided just below the sacral promontory and the rectum was divided with an endostapler. The anal sphincter was then dilated with EEA sizers and the staple line was grasped *trans*-anally by pushing the staple line into the jaws of Allis clamps or ring forceps under direct laparoscopic visualization and assistance. The rectum was then brought out through the anus in an "inside out" fashion. The surrounding gluteal tissue was retracted as needed to expose the dentate line and a Contour stapler was used (with or without scoring mucosa) at the dentate line. Vaginal examination when applicable as well as palpating around the remaining stump was performed to make sure no other tissue was incorporated into the staple line before firing. Abdominal colon and rectum were removed as needed through the ileostomy site. An EEA stapled anastomosis was later achieved in the usual fashion. Whether or not the RE technique was utilized as well as the method used to transect the rectum was at the discretion of the surgeons.

All analyses were conducted using IBM SPSS Statistics version 21.0.0 for Macintosh (IBM Corp., Armonk, NY). Comparisons between the RE and AT groups were made. Categorical variables were analyzed using the Chi-square or Fisher's exact test where appropriate. Continuous variables were tested for normality with the Shapiro–Wilk test and compared using two-tailed independent samples *t* test or Wilcoxon Rank-Sum (Mann–Whitney) test where appropriate. Throughout all analyses, statistical significance was determined by a criterion of p value ≤ 0.05.

Study was approved by institutional IRB.

Results

A total of 176 patients who underwent proctocolectomies with creation of an IPAA were analyzed. The rates of RE and AT were similar in this study with 88 patients (50%) in each arm. RE group had a significantly higher rate of corticosteroid use at the time of surgery 59.1 versus 39.8% ($p = 0.0156$). The rate of open surgery was also higher in the RE group (67.1% vs. 33%, $p < 0.001$) when compared to AT group. Otherwise, the groups were statistically similar including ASA class, BMI, and rates of biologics use (Table 1). Twenty cases (26.1%) of RE group and 54 (61%) of AT group cases were accomplished in minimally invasive fashion.

There was no difference in the rate of 30- and 90-day complications including similar rates of leak, intra-abdominal abscess, return to operating room, or readmission. Patients with RE had lower rates of blood transfusion (RE 4.6% vs. 17.1%; $p = 0.007$) (Table 2). On multivariate regression analysis, none of the variables predicted worse outcomes at 30 and 90 days including RE OR 1.05 (95% CI 0.48–2.26 p value: 0.89), steroids OR 1.35 (95% CI

Table 1 Perioperative characteristics

	Rectal eversion $N = 88$	Abdominal transection $N = 88$
	N (%)	*N* (%)
ASA Class		
1	2 (2.3)	3 (3.4)
2	69 (78.4)	61 (69.3)
3	15 (17)	24 (27.3)
Steroids	52 (59.1)	35 (39.8)*
BMI	24.2 ± 4.1	24.6 ± 5
Anti TNF-alfa	9 (10.2)	11 (12.5)
Laparoscopic	19 (21.6)	41 (46.6)*
Open	65 (67.1)	32 (33)*
MIS	22 (29)	54 (71)*

ASA american society of anesthesiology, *BMI* body mass index, *TNF* tumor necrosis factor, *MIS* minimally invasive surgery

*Statistically significant < 0.05

Table 2 Complications and functional outcomes of RE versus AT

	Rectal eversion $N=88$		Abdominal transection $N=88$		
	Data available, N	N (%)	Data available, N	N (%)	p Value
Leak	88	3 (3.4)	88	3 (3.4)	0.9
Intra-abdominal abscess	88	2 (2.3)	88	7 (8.0)	0.08
Urinary complications	88	14 (15.9)	88	21 (23.8)	0.5
Blood transfusion	88	4 (4.6)	88	15 (17.1)	0.007
Return to OR	88	3 (3.4)	88	7 (8)	0.08
Fecal incontinence 1 year	46	5 (10.9)	67	2 (3)	0.1
Fecal incontinence 3 years	31	1 (3.2)	34	0 (0)	1
> 8 Bowel movements/day at 1 year	35	15 (42.9)	61	20 (32.8)	0.3
> 8 Bowel movements/day at 3 years	25	9 (36)	29	8 (27.6)	0.6
Pouch failure	57	2 (3.5)	63	3 (4.8)	0.9

0.66–2.79 p value: 0.40), and open approach OR 0.61 (95% CI 0.15–2.45 p value: 0.483).

Functional outcomes data were available for up to 78.4% of patients with *trans*-abdominal approaches and 64.7% in the RE group. At 1 and 3 years after surgery, there was no difference in the number of bowel movements, fecal incontinence, nocturnal bowel movements, rates of pouchitis, or antidiarrheal use (Table 2). The need for antidiarrheal medications (psyllium, loperamide, diphenoxylate hydrochloride and atropine sulfate, and tincture of opium) was the same at the 1-year (66.7 vs. 71.0%) and 3-year (32.9% in both groups) marks for RE and AT. The rates of reverting to ileostomy or pouch revision were also the same.

Discussion

RE is a safe and effective technique in achieving low anastomoses in patients undergoing IPAA procedure. As surgical treatments evolve towards the higher utilization of minimally invasive surgery, the need to improve techniques that minimalize residual retained rectal mucosa has become even more important. The hybrid approach is sometimes used (laparoscopic abdominal resection followed by open transection through Pfannenstiel incision). In this study, we show that RE can be safely used in both minimally invasive and open approaches and has equivalent rates of immediate surgical complication. As such, RE can minimize rates of both conversion to open and the need for a hand-sewn approach. Using RE, the dentate line can be visualized in an easier fashion when compared to AT, especially in obese patients when surgeons often need to rely on a digital examination to be sure that the transection is appropriately low. To further ensure that all the rectal mucosa is removed, once eversion is done, the mucosa at the dentate line can be scored under direct vision using electrocautery before transection. This allows a stapled anastomosis which saves time, avoids a conversion or hybrid approach, and contributes to improved function. It is also important to note that this approach can be utilized in patients with a higher BMI.

Currently, transanal total mesorectal excision (TaTME) approach has also been used to achieving low anastomosis by dividing rectum at the dentate line under direct vision [8, 9]. Stapling as well as hand-sewn approach can be utilized with this technique [9]. However, it is a very labor-intensive technique with steep learning curve, often requiring two attending surgeons in addition to other resources and is not widely available [10]. In comparison, RE technique does not require additional equipment and can be easily performed with the help of the trainee.

This is a retrospective review and is further limited by smaller numbers available for the minimally invasive group. Functional data were collected from medical records (as assessed during regular clinic visits), but no validated instruments were used. Although the overall availability of data on functional outcomes was high, there were variations between questions asked. In our study, there was also a lower than expected rate of pouch failure and loss than previously reported in other studies. This difference could be attributed to and affected by the smaller sample size and reasonably short follow-up used for this study. We did not inquire beyond 3 years after pouch formation and loss. In our institution, 3 out of 5 surgeons whose operations were included in this study utilized RE technique which has the potential to introduce further bias. One of the surgeons active during the early part of the study performed primarily open surgery and heavily utilized the RE technique. This was later adapted by other surgeons performing mostly laparoscopic approaches. This would explain the higher prevalence of RE in the open arm and can thereby introduce bias.

Ultimately, the IPAA procedure is done to improve patients' quality of life by restoring continuity and avoiding a

permanent stoma. In our study, functional outcomes including rates of incontinence, number of bowel movements, and nocturnal bowel movements were the same in both groups. Similar to studies by Williamson and Miller et al. our study showed that functional outcomes were comparable providing further merit to this technique [11, 12].

It is important to point out that although this technique can be used whenever low transection and anastomosis is needed, including cases of inherited polyposis, it should not be used in cases of rectal cancer or when malignancy is suspected because the integrity of mesorectum is compromised.

Conclusion

RE technique is a safe and effective way to achieve a low transection in IPAA surgery. The technique provides similar functional outcomes at the one- and 3-year marks after surgery and can be particularly useful in minimally invasive approaches.

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Compliance with ethical standards

Disclosures Jose Cataneo, Peter Mowschenson, Thomas Cataldo, and Vitaliy Poylin have no conflicts of interest or financial ties to disclose.

References

1. Scoglio D, Ali UA, Fichera A (2014) Surgical treatment of ulcerative colitis: ileorectal vs ileal pouch-anal anastomosis. World J Gastroenterol 20(37):13211–13218. https://doi.org/10.3748/wjg.v20.i37.13211
2. Nobel T, Khaitov S, Greenstein AJ (2016) Controversies in J pouch surgery for ulcerative colitis: a focus on handsewn versus stapled anastomosis. Inflamm Bowel Dis 22(9):2302–2309. https://doi.org/10.1097/MIB.0000000000000876
3. Holder-Murray J, Marsicovetere P, Holubar SD (2015) Minimally invasive surgery for inflammatory bowel disease. Inflamm Bowel Dis 21(6):1443–1458. https://doi.org/10.1097/MIB.0000000000000316
4. Shrestha B (2016) Minimally invasive surgery for inflammatory bowel disease: current perspectives. World J Gastrointest Pharmacol Ther 7(2):214–216. https://doi.org/10.4292/wjgpt.v7.i2.214
5. Poylin V, Mowschenson P, Nagle D, Cataldo T (2017) Rectal eversion technique. Dis Colon Rectum 60(12):1329–1331. https://doi.org/10.1097/DCR.0000000000000932
6. Dignan RD, Kwa JA, Odom TA (1999) Stapler-facilitated rectal eversion. Dis Colon Rectum 42(11):1472–1474. https://doi.org/10.1007/BF02235050
7. Zhuo C, Liang L, Ying M et al (2015) Laparoscopic low anterior resection and eversion technique combined with a nondog ear anastomosis for mid- and distal rectal neoplasms. Medicine (Baltimore). 94(50):e2285. https://doi.org/10.1097/MD.0000000000002285
8. de Lacy FB, Keller DS, Martin-Perez B, Emile SH, Chand M, Spinelli A, Lacy AM (2019) The current state of the transanal approach to the ileal pouch-anal anastomosis. Surg Endosc 33(5):1368–1375
9. Zaghiyan K, Warusavitarne J, Spinelli A, Chandrasinghe P, Di Candido F, Fleshner P (2018) Technical variations and feasibility of transanal ileal pouch-anal anastomosis for ulcerative colitis and inflammatory bowel disease unclassified across continents. Tech Coloproctol 22(11):867–873
10. Mege D, Hain E, Lakkis Z, Maggiori L, Prost À la Denise J, Panis Y (2018) Is trans-anal total mesorectal excision really safe and better than laparoscopic total mesorectal excision with a perineal approach first in patients with low rectal cancer? A learning curve with case-matched study in 68 patients. Colorectal Dis 20(6):0143–0151
11. Williamson MER, Lewis WG, Miller AS, Sagar PM, Holdsworth PJ, Johnston D (1995) Clinical and physiological evaluation of anorectal eversion during restorative proctocolectomy. Br J Surg 82(10):1391–1394. https://doi.org/10.1002/bjs.1800821032
12. Miller AS, Lewis WG, Williamson MER, Sagar PM, Holdsworth PJ, Johnston D (1996) Does eversion of the anorectum during restorative proctocolectomy influence functional outcome? Dis Colon Rectum 39(5):489–493