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RESEARCH ARTICLE

Comparison of Anorectal Functional Outcome Following Low Anterior Resection Versus Intersphincteric Resection for Rectal Cancer

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ABSTRACT

Aim: Low anterior resection (LAR) and intersphincteric resection (ISR) are the standard surgical options for low and very low rectal cancers, respectively. Unlike LAR, dissection in between the internal and external sphincter in ISR may functionally compromise sphincter integrity post-surgery. The aim was to compare anal sphincter function using anorectal manometry (ARM) in patients undergoing LAR and ISR, prior to stoma closure.

Method: Retrospective review of 50 cases of rectal cancer operated between January 2017 to October 2019 and referred for ARM before stoma closure. Patients with anorectal dysfunction were referred for physiotherapy and reassessed.

Results: Of the 50 patients, 25 patients had undergone LAR and 25 patients had undergone ISR. No difference was seen between the groups with relation to mean Cleveland Clinic Florida Fecal Incontinence Score [(CCFFIS); 4.76±2.93 vs. 5.28±3.57], mean resting pressure (56.22±15.48 vs. 51.10±19.83 mmHg), mean squeeze pressure (128.68±47.15 vs. 126.09±41.90 mmHg) and mean squeeze duration (25.98±10.90 vs. 24.55±13.12 seconds). In the LAR and ISR groups 8/25 (32%) and 11/25 (44%) had inadequate sphincter function on manometry ($p>0.05$). Significantly lower squeeze pressure (145.36±43.30 vs. 114.37±40.70 mmHg) and higher CCFFIS score was seen in those patients who underwent ARM a year after surgery.

Conclusion: Both ISR and LAR had similar losses in anal sphincter function, with greater degree of dysfunction in patients having stoma for a prolonged period.

Keywords: Intersphincteric resection, low anterior resection, rectal cancer, anorectal manometry, pelvic floor muscle training

Introduction

The rectum is the most common site for colorectal cancer in India, accounting for around 42% of cases.[1] Low anterior resection (LAR) with total mesorectal excision (TME) is the standard treatment for patients with proximal rectal cancer, wherein tumors in the lower rectum above the level of the sphincters, extending below the peritoneal reflection, are resected with colorectal anastomosis. Intersphincteric resection (ISR) has been introduced as an alternative to abdomino-perineal resection for very low rectal cancer (tumor within 10-50 mm of the anorectal ring)[2] with the advantage of preserving the sphincter and thus avoiding a permanent colostomy. ISR has evolved from an open procedure to a laparoscopic procedure, followed by robotic ISR, with the advantage of reducing blood loss and morbidity. Presently ISR with TME and partial or complete excision of the internal anal sphincter, with coloanal anastomosis is the ultimate anal preserving surgery through both abdominal and anal approaches. However, dissection between the internal and external sphincter in ISR may functionally compromise sphincter integrity post-surgery, which is not the case with LAR. So, postoperative anorectal function is an important outcome following these surgeries.

Previous studies have compared the postoperative anorectal function using standardized patient questionnaires.[3] There are very few studies that have compared the functional outcome by manometry when assessing anorectal function following surgeries for rectal cancer. The aim of this study

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was to analyze the difference in anal sphincter function objectively by manometry in patients who had undergone LAR or ISR prior to stoma closure.

Materials and Methods

In this retrospective analysis, prospectively maintained data of patients who were operated because of rectal cancer and were referred to our department of Gastroenterology in a tertiary care center for anorectal manometry before stoma closure from September 2017 to October 2019 were analyzed. Patients had undergone either ISR (laparoscopic or robotic) or LAR according to the site of the tumor and the clinical choice of the operating surgeon. All patients had received neoadjuvant chemoradiation (with capecitabine as chemotherapy). Ileostomy was done in all patients for temporary fecal diversion to protect the anastomotic site from complications like anastomotic dehiscence. Patients were referred for ARM prior to stoma closure. All patients had undergone flexible sigmoidoscopy prior to the ARM procedure and those who were found to have stricture beyond which the scope could not be negotiated, underwent dilatation and were excluded from the study. A baseline Cleveland Clinic Florida Fecal Incontinence Score (CCFFIS) at referral for manometry was also recorded for all patients (Table 1) with a score ranging from 0 to 20.[4]

ARM was performed using a 20-channel water perfused anorectal catheter with length of 164 cm and a balloon at its tip. Manometry was performed with the patient being in the left lateral position. A digital rectal examination was performed before placing the catheter. Patients with rectal stricture on digital examination were excluded from the study and were referred for stricture dilatation and were considered for manometry after adequate dilatation. However these patients were not included in the present analysis. A catheter lubricated using lignocaine jelly was inserted such that the pressure sensors are located across the anal canal. After taking a baseline reading for two minutes, subjects were instructed to squeeze the anal canal as tightly as possible and for as long as possible, three times in succession with a resting period of 60 seconds in between two readings. The maximal endurance squeeze pressure and the maximal duration were recorded. Data were analyzed by MMS database software, version 9.5 h (Medical Measurement Systems B.V.). Although data regarding normal anorectal function (Figure 1) in a healthy Indian population is lacking, adequate sphincter function was defined by resting pressure ≥40 mmHg, maximal squeeze pressure ≥80 mmHg and squeeze duration ≥30 seconds.

All the patients who had anorectal dysfunction/inadequate sphincter function as defined by either resting pressure <40 mmHg or maximal squeeze pressure <80 mmHg (Figure 2) or maximum squeeze duration <30 seconds (Figure 3) or a combination of these, were referred for physiotherapy. Patients were taught pelvic floor muscle exercises, which included tightening and pulling up the pelvic floor muscles and anal sphincter muscles for as long as they could. Patients were asked to rest for four seconds and then repeat the contractions, gradually increasing up to 10 slow contractions at a time, holding them for 10 seconds each with a rest of four seconds in between. Patients were asked to practice three sets of these exercises 3-4 times each day for three months. They were then asked to return for repeat manometry prior to surgery with recalculation of CCFFIS

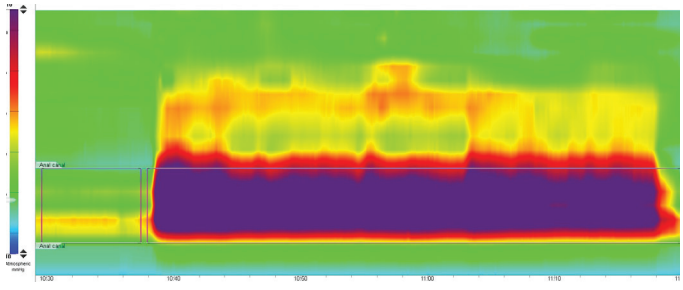

Figure 1. Normal anorectal manometry

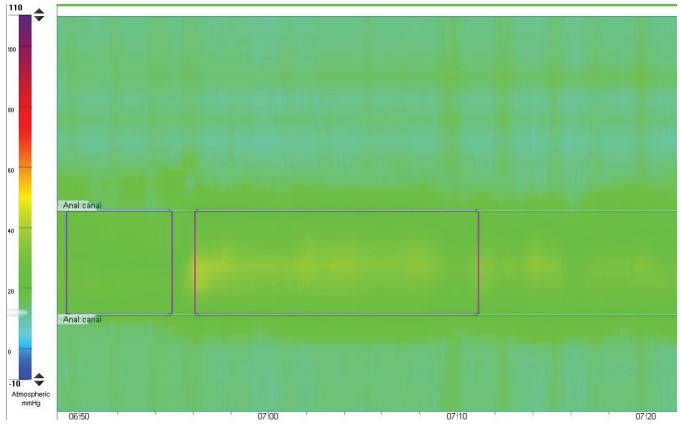

Figure 2. Inadequate endurance squeeze pressure of 35 mmHg

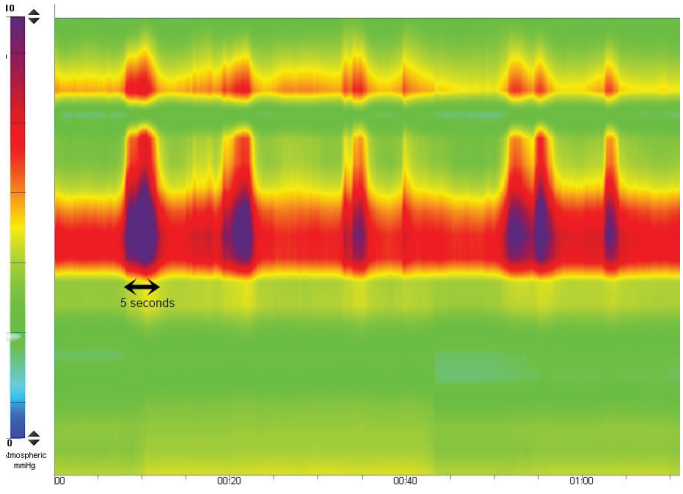

Figure 3. Poorly sustained squeeze pressure of 5 seconds

score. Stoma closure was deferred in patients with anorectal dysfunction.

Statistical Analysis

Continuous variables are presented as mean ± standard deviation and were analyzed with the chi-square test. Pearson chi-square test was used to compare the prevalence of anorectal dysfunction between the two groups. Paired data before and after physiotherapy were compared using a paired t-test. A p-value ≤0.05 was taken to be significant. All statistical analyses were performed using SPSS version 16.0 (SPSS Inc., Chicago, IL, USA).

Results

Out of 94 patients who underwent surgery during this period, manometry data for 26 patients were not available and 18 patients were excluded due to the presence of strictures. Of the patients with strictures, 11 (61%) were associated with ISR while seven (38.9%) were associated with LAR.

So, a total of 50 patients with a mean age 45.82±12.98 years, of whom 27 were males (54%), were included in the study. All patients had received perioperative CRT. Abnormality in at least one parameter of anorectal function was seen in 19 (38%) patients. Reduced squeeze duration was the most common dysfunction present in all patients (100%) while eight (16%) patients had combination of two or more abnormal parameters (Figure 4). Patients who had abnormal parameters on manometry had a higher CCFFIS (8.63±1.67) compared to patients with normal manometry (2.80±1.49) (p<0.001).

Of the 50 patients, 25 (50%) had undergone LAR (laparoscopic=15, robotic=10) while 25 (50%) had ISR (laparoscopic=20, robotic=5). There was no difference between the groups in terms of age, CCFFIS, mean resting pressure, maximal squeeze pressure and mean squeeze duration. In the two treatment groups 8/25 (32%) in the LAR and 11/25 (44%) in the ISR group had inadequate sphincter function as assessed by manometry [odds ratio (OR): 1.66, 95% confidence interval (CI): 0.527 to 5.28; p=0.560] (Table 2).

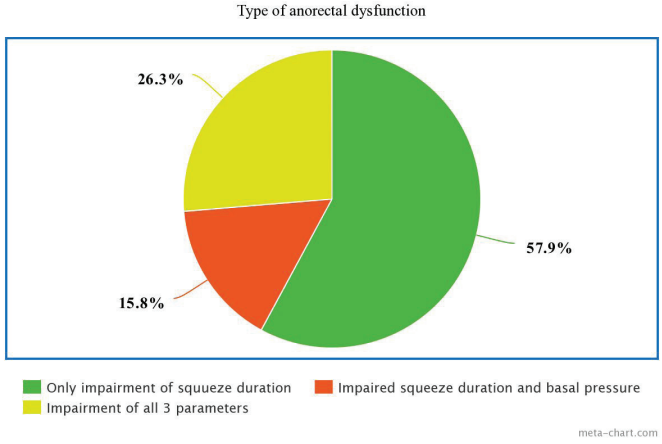

Figure 4. Pie-chart showing type of anorectal dysfunction

Patients underwent ARM after a median duration of 10 months (2-28 months) after the primary surgery. To assess whether duration of ileostomy affected the anal sphincter function, patients were divided into two groups: those patients who underwent ARM within a year of surgery and those after more than one year of surgery. Patients who underwent ARM within a year had lower CCFFIS score. Average squeeze pressure was lower in those patients who underwent ARM after a year of surgery (p=0.014) while there was no difference in basal pressure and squeeze duration. Of the 29 patients who underwent ARM within a year, only five patients had dysfunction while 14/21 (66.7%) who underwent ARM after 1 year had dysfunction (OR=9.6, 95% CI: 2.18 to 45.11; p=0.0008) (Table 3).

Table 1. Cleveland clinic florida fecal incontinence score

Type of incontinence	Frequency				
	Never	Rarely	Sometimes	Usually	Always
Solid	0	1	2	3	4
Liquid	0	1	2	3	4
Gas	0	1	2	3	4
Wears pad	0	1	2	3	4
Lifestyle alteration	0	1	2	3	4

Rarely: Less than 1 per month, Sometimes: Less than 1 per week and 1 or more per month, Usually: less than 1 per day and 1 or more per week, Always: 1 or more per day

Table 2. Comparison of anorectal function between LAR and ISR groups

	LAR (n=25)	ISR (n=25)	p value
Age (years)	48.4±15.25	43.24±9.89	0.163
CCFFIS (mean ± SD)	4.76±2.93	5.28±3.57	0.577
Basal pressure (mmHg)	56.22±15.48	51.10±19.83	0.315
Squeeze pressure (mmHg)	128.68±47.15	126.09±41.90	0.838
Duration of squeeze (seconds)	25.98±10.90	24.55±13.12	0.678
Impaired anorectal function (n)	8	11	0.560

LAR: Low anterior resection, ISR: Intersphincteric resection, CCFFIS: Cleveland Clinic Florida Fecal Incontinence Score, SD: Standard deviation

Out of the 19 patients who had dysfunction, only 10 patients came for follow-up and repeat manometry showed improvement in CCFFIS and all manometric parameters above the baseline value (Table 4) but complete resolution with respect to maximal squeeze pressure and maximal squeeze duration was seen in 6 of the 10 patients.

Table 3. Comparison of anorectal function with respect to interval between surgery and anorectal manometry

	Early (<12 months) (n=29)	Late (>12 months) (n=21)	p value
CCFFIS (mean ± SD)	3.85±3.26	5.86±3.02	**0.030**
Mean basal pressure (mmHg)	59.06±18.58	49.75±16.43	0.074
Mean squeeze pressure (mmHg)	145.36±43.30	114.37±40.70	**0.014**
Mean duration of squeeze (seconds)	28.63±10.80	22.83±12.35	0.084
Impaired anorectal function (n)	5	14	**0.0008**

CCFFIS: Cleveland Clinic Florida Fecal Incontinence Score, SD: Standard deviation

Table 4. Change in anorectal function after physiotherapy

	Before physiotherapy (n=10)	After physiotherapy (n=10)
CCFFIS	9.20±1.81	6.60±1.17
Mean basal pressure (mmHg)	40.85±16.00	49.25±15.95
Mean squeeze pressure (mmHg)	90.47±34.45	120.68±31.81
Mean duration of squeeze (seconds)	13.18±5.66	27.32±7.26

CCFFIS: Cleveland Clinic Florida Fecal Incontinence Score

Discussion

Anorectal dysfunction was seen in 38% of the patients undergoing surgery for rectal cancer. Reduced squeeze duration was the most common dysfunction. There was no difference in anorectal function between the patients undergoing LAR or ISR. Patients who underwent ARM after 12 months of surgery were more likely to have anorectal dysfunction. Around two thirds of the patients with dysfunction improved after physiotherapy.

The mean age in the presented cohort was 45.8 years, which is similar to the mean age of presentation of patients with colorectal cancer in other studies from India.[1,5] This is in contrast to Western data where 90% of new cases of colorectal cancer are above 50 years at diagnosis and 58% of all new cases are above 65 years of age.[6] This difference can be attributed to the younger aged population in India compared to Western countries, which have a larger elderly population or a biologically different type of disease.

The complex interaction of motor and sensory function between the rectum and anus maintains normal continence. The pathophysiology of sphincter dysfunction after surgery for rectal cancer is multifactorial and includes direct trauma to the sphincter during surgery[7], injury of pelvic nerves[8], chemo-radiotherapy[9] and disuse-atrophy of sphincter muscles.

Sailer et al.[10] studied the morphological changes in anal sphincter muscles during and after temporary diverting stoma by using endoscopic ultrasound (EUS). They observed that from the time of primary operation to stoma closure, the puborectalis and components of the external anal sphincter (EAS) underwent significant reduction in diameter, which normalized three months after stoma closure without any change in the internal anal sphincter (IAS).[10] These changes were ascribed to the involutional atrophy of the muscles during the resting period and this highlights the importance of initiating PFMT immediately postoperatively in preventing these changes.

In our study, we objectively compared anorectal functional parameters using manometry after a median duration of 10 months after surgery and found no difference between the two groups. Other methods for post-operative assessment of anorectal function include functional questionnaires, such as the Wexner score and GIFO score. Kawada et al.[3] compared anorectal function using questionnaire in patients who underwent laparoscopic ISR or LAR, before and at 6, 12, and 24 months after surgery. They observed that the mean Wexner score (CCFFIS) was significantly higher in the ISR group than the LAR group at 6 months postoperatively (11.9±5.6 vs 5.2±4.2). The return of anorectal function to that of the preoperative level took around 24 months in the ISR group while patients in the LAR group achieved the same by 12 months after stoma closure.[3]

Previous studies have reported that pre/peri-operative cardiac resynchronization therapy (CRT) was a risk factor for deterioration in continence function following surgery which was ascribed to neural degeneration.[11,12] In a study from Italy, manometric data from patients with rectal cancer were studied before and after CRT and it was reported that 23% of patients developed new-onset anorectal dysfunction with a significant reduction in resting anal sphincter pressure.[13] In our study, all the patients received CRT so that there is no confounding effect in our data although

we could not assess the effect of CRT in the induction of anorectal dysfunction as compared to surgery.

Pelvic floor muscle training (PFMT), which includes exercises for anal sphincters, is aimed at increasing the strength and improving endurance and coordination. In a RCT of patients treated for rectal cancer who were given biofeedback therapy (BFT) during the period of temporary stoma, Kye et al.[14] found that BFT was helpful in maintaining resting anal sphincter tone but had no effect on preventing anorectal dysfunction after stoma closure. In contrast, a similar study from China reported that BFT combined with PFMT significantly improved anorectal function.[15] In our study there was objective evidence of improvement in all parameters after PFMT, but complete improvement was seen in only 6 out of the 10 patients. Although knowledge regarding the ideal timing of starting PFMT is limited, various small studies have concluded that early initiation of PMFT will help in preventing fecal incontinence after surgery for rectal cancers.

Study Limitations

The limitations of our study are the lack of baseline pressure values prior to surgery, the retrospective nature of analysis and the small sample size. Due to the small sample size, the study is underpowered to detect a statistical significance. A larger sample size with additional BFT and a longer follow up period would have helped in confirming the findings of our study. There is the possibility of selection bias as this is a retrospective study. Although there are a few limitations, the study provided an objective assessment and comparison of sphincter function using manometry, which has not been previous performed or published.

Conclusion

To conclude, both ISR and LAR have a high rate of anal dysfunction in more than one-third of patients undergoing surgery in our cohort of patients. The rate of anal sphincter dysfunction in both surgeries is the same, based on manometry data, despite ISR being a surgery associated with sphincter manipulation. Anorectal manometry may be a useful tool for monitoring continence problems after surgery for rectal cancer so that adequate physiotherapy could be given to accelerate the recovery of the sphincter function.

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Ethics

Ethics Committee Approval: Received and approved by the IEC at King Edward Memorial Hospital, Mumbai.

Informed Consent: Consent waiver received as it was retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: S.G., H.D., S.K., M.M., Concept: S.S., Design: S.S., S.B., Data Collection or Processing: S.G., H.D., S.K., M.M., Analysis or Interpretation: S.G., S.S., Literature Search: S.G., H.D., S.S., Writing: S.G., S.S., S.B.

Conflict of Interest: No conflict of interest was declared by the authors.

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