

Long-Term Bowel Function after Transanal Minimally Invasive Surgery (TAMIS)

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ABSTRACT **Background:** Transanal minimally invasive surgery (TAMIS) is a single port access platform used for full thickness local excision of rectal lesions. It is an appealing alternative to a radical resection of rectum that often can cause a significant bowel dysfunction described as low anterior resection syndrome (LARS). LARS is evaluated using a validated score. Functional outcomes of patients undergoing TAMIS has not yet been evaluated using the LARS score.

Objectives: To evaluate long-term bowel function in patients who underwent TAMIS.

Methods: In this case series, all patients who underwent TAMIS in a single tertiary institute between 2011 and 2017 were retrospectively reviewed. We evaluated bowel function using the LARS score questionnaire through telephone interviews.

Results: The study consisted of 23 patients, average age of 67 ± 6.98 year; 72% were male. The median follow-up from the time of surgery was 5 years. Six patients (26.08%) had malignant type lesions. The average height of the lesion from the anal verge was 7.4 cm. The average size of the specimen was 4 cm. The total LARS score revealed that 17 patients (73.91%) had no definitive LAR syndrome following the surgery. Four patients (17.39%) fit the description of minor LARS and only two (8.69%) presented with major LARS.

Conclusions: TAMIS provides relatively good long-term functional outcomes in terms of bowel function. Further randomized studies with larger cohorts are still needed to better evaluate the outcomes.

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KEY WORDS: low anterior resection syndrome (LARS), rectal lesion, bowel function, transanal minimally invasive surgery (TAMIS)

on a patient's quality of life. Hence, the option of local excision of rectal lesions while avoiding radical resection is appealing. Due to high levels of recurrence, local excision of rectal tumors may only be suitable for a very selected group of patients [2].

There is enough evidence to advocate a local excision for selected patients with benign or early rectal cancer lesions that has not penetrated into the muscularis mucosa (T1N0) [3]. The obvious technical challenges in the traditional local transanal excisions including exposure difficulties and poor visualization of the rectal canal, has led to the development of the transanal endoscopic microsurgery (TEM) and transanal minimally invasive surgery (TAMIS) techniques [4]. The TAMIS technique, first introduced in 2010 [4], improves the standard transanal excision abilities by using a specialized insufflation system with single-site port and laparoscopic optics and instruments, allowing better endoluminal visualization and resection of more proximal rectal lesions.

TAMIS has gained increasing popularity and it is currently a good alternative to TEM as it allows better anal visualization with lower equipment costs and a lower learning curve [4,5].

Low anterior resection syndrome (LARS) is a combination of fecal incontinence or urgency, cluster bowel movements (BM), fecal fragmentation, increasing gas, and emptying difficulties following a radical rectal resection. This syndrome describes disordered bowel function leading to serious detriment in quality of life. LARS usually appears shortly after surgery, with a peak of severity after a few months, eventually reaching a steady state 2 years after surgery [6]. Aside from losing part or all of the rectum, there are additional factors that might play a role in acquiring this syndrome, such as disruption of rectal innervation, preoperative radiation, anal sphincter damage, and anastomosis malfunction. The rate of functional bowel disturbance after radical rectal cancer surgery may be as high as 90% [6]. It is reasonable to assume that local excision of rectal lesions will provide the patients with better functional outcomes compared to radical resections. However, since local excision usually requires a full thickness resection of the rectal wall in addition to the wide transanal port insertion, some functional disturbance can be expected following the local procedures, as was described by Herman et al. [7]. TAMIS techniques have been in use for almost a decade, but there are still only a few

reports on its effect on postoperative bowel function, especially in long-term follow-up [8].

The main goal of the current study was to evaluate the long-term postoperative bowel function in patients who underwent TAMIS for removal of rectal lesions.

PATIENTS AND METHODS

STUDY DESIGN

This retrospective study concentrated on a series of patients who underwent TAMIS between 2011 and 2017 in a single tertiary medical center in Israel. All procedures were performed at the same medical center by a dedicated team of colorectal surgeons. The technical details of the performed TAMIS procedures were described elsewhere [9]. The study was approved by the institutional review board.

We used our recently constructed departmental TAMIS database as the source for baseline patients and procedure data. Current bowel function of the patients was evaluated using the LARS score questionnaire by means of telephone encounters. The telephone interviews were conducted by skilled interviewers both in the Hebrew and Russian languages according to patient preferences.

STUDY POPULATION

The files of all patients (n=36) who underwent TAMIS between July 2011 and November 2017 were analyzed. The inclusion criteria were previous TAMIS performed by our institution, prior endoscopic evaluation of the rectal lesion and informed consent to participate in the study. Patients who

subsequently underwent proctectomy during the follow-up period were excluded. Eventually, 23 patients were eligible for the study [Figure 1].

THE LARS SCORE QUESTIONNAIRE.

The LARS score was developed to overcome the heterogeneity of the reported bowel dysfunction after sphincter sparing colorectal surgeries. It is a simple and brief assessment tool that allows to evaluate the five major items of LARS: incontinence for flatus, incontinence for liquid stool, cluster BMs, frequency and urgency as were validated in a large Danish trial in 2012 [10]. Each item receives its own score from 0 to 16 in direct correlation to its effect on the quality of life. The sum of the points in all five items is divided in to 3 categories: 0–20 points (No LARS), 21–29 (Minor LARS) and 30–42 (Major LARS). The score was found to have good correlation to the quality of life after the surgery.

STATISTICAL ANALYSIS

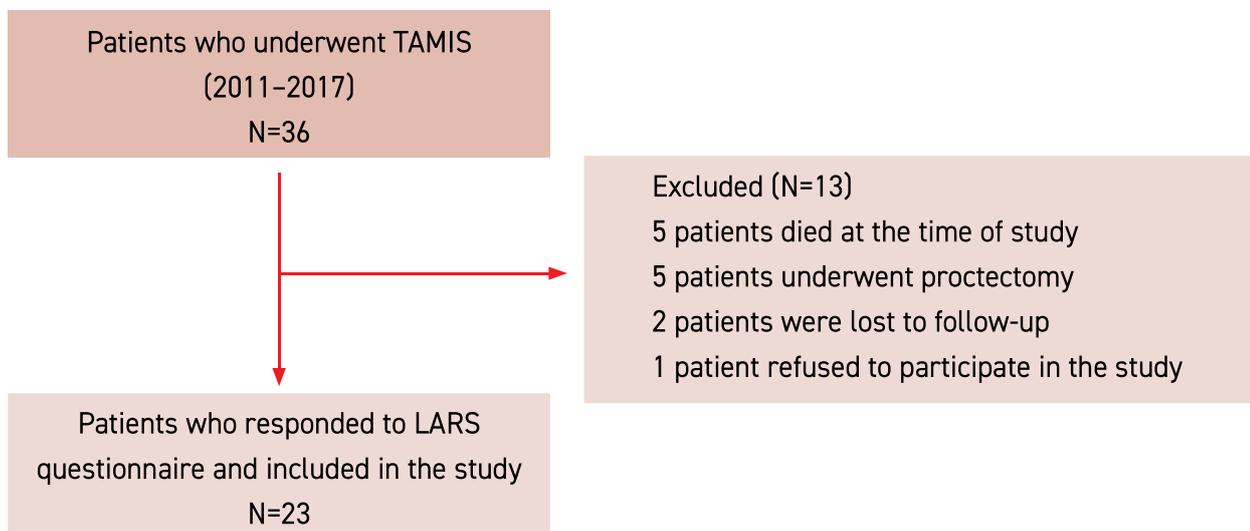
Statistical analyses were performed using IBM Statistical Package for the Social Sciences statistics software, version 23.1 (SPSS, IBM Corp, Armonk, NY, USA) and Microsoft Excel version, 2019 version (Redmond, Washington, US). Correlations were calculated using Pearson or Spearman coefficients according to their distribution.

RESULTS

The study included 23 patients with an average age of 67 ± 6.98 years (range 50–87) of whom 72% were males. The basic characteristics of the patients are presented in Table 1.

Figure 1. Study population

LARS = low anterior resection syndrome, TAMIS = transanal minimally invasive surgery



None of the patients underwent previous transanal resection or pelvic radiation.

The median follow-up time from the time of surgery until the time of the LARS questionnaire was 5 years. The indications for TAMIS were mostly benign lesions, only three (13%) of the patients had a known early rectal malignancy before the

procedure. The pathology after surgery showed malignant type lesions in three more patients (6/23 patients, 26.08%) [Table 2]. The average height of the lesion from the anal verge was 7.4 cm. The average size of the resection specimen was 4 cm. The average time of surgery was 92.5 ± 34.55 minutes (range 31–172 minutes). The average length of stay in the hospital after the procedure was 2.65 ± 1 days. There was no significant difference in the baseline characteristics, length of the surgery, extent of the resection, or the lesion location in the group of patients with malignant and non-malignant lesions. No correlation was found between the length of the surgery, location of the lesion, extent of the resection, and postoperative LARS scores.

The study cohort had no intraoperative complication. No mortality or major complications were reported. Three patients (13%) had minor postoperative complications, such as rectal bleeding and fever. All complications were resolved conservatively.

Detailed results of the LARS score questionnaire are described in Table 3. Most of the patients reported good control on flatus (69.57%) and stool (82.61%) after the surgery, stating they very seldomly encountered leak, if at all. Of the patients, 73% reported normal BM regimen of fewer than three times per day. None had more than seven BMs perday and only two reported some degree of constipation. Only 26% of the patients reported a need for another BM within one hour after the previous

Table 1. Baseline characteristics

Study sample patients, n=23	
Age, mean ± SD, years	67 ± 6.98
Male, N (%)	18 (72%)
Co-morbidities (%)	
Hypertension	14 (60.87)
Cardiovascular	5 (21.74)
Diabetes mellitus	6 (26.09)
Respiratory	3 (13.04)
Chronic renal failure	1 (4.35)
Body mass index, mean ± SD	27.45 ± 3.41
American Society of Anesthesiologists score (%)	
1	1 (4.35)
2	17 (73.91)
3	5 (21.74)

Table 2. Type of rectal lesion and TAMIS technique

Type of rectal lesion (%)	
Benign sessile polyp	9 (39.1)
Submucosal lesion	1 (4.35)
Scar s/p cancer in polyp	7 (30.43)
Benign pedunculated polyp	3 (13.04)
Cancer	3 (13.04)
Pathology results (%)	
Adenoma	4 (17.39)
Low-grade dysplasia	4 (17.39)
High-grade dysplasia	2 (8.69)
Carcinoma in situ	1 (4.35)
Early carcinoma (T1)	5 (21.74)
Neuroendocrine tumor	1 (4.35)
Granulation	6 (26.09)
Lesion height, mean, ± SD, cm	7.4 ± 1.61
Lesion Size, mean ± SD, mm	40.71 ± 16.04
Port type (%)	
SILS™	16 (69.57)
GelPath	7 (30.43)
Suturing type (%)	
Vloc	13 (56.53)
Vicril	7 (30.43)
No sutures	3 (13.04)

TAMIS = transanal minimally invasive surgery

Table 3. LARS score (n=23)

Frequency of gas leak, n (%)	4 (17.39)
≤ Once a week	3 (13.04)
≥ Once a week	16
Never	(69.57)
Frequency of stool leak, n (%)	4 (17.39)
≤ Once a week	0 (0)
≥ Once a week	19
Never	(82.61)
Frequency of bowel movements, n (%)	0 (0)
≥ 7 times per day	4 (17.39)
4–7 times per day	17
1–3 times per day	(73.91)
Less than once per day	2 (8.69)
Need for another bowel movement within one hour, n (%)	5 (21.73)
≤ Once a week	6 (26.09)
≥ Once a week	12
Never	(52.17)
Urge for bowel movement, n (%)	8 (34.78)
≤ Once a week	3 (13.04)
≥ Once a week	12
Never	(52.17)
Total LARS score, n (%)	17
≤ No LARS	(73.91)
≥ Minor LARS	4 (17.39)
Major LARS	2 (8.69)

LARS = low anterior resection syndrome

one and 35% reported periodic urge to move their bowels. None of the patients reported less than once a week frequency of BM.

The total LARS score revealed that 17 (73.91%) of the patients had no definitive LAR syndrome following the surgery, 4 (17.39%) fit the description of minor LARS, and only 2 (8.69%) were presented with major LARS. The two patients who showed signs of major LARS symptoms were also the oldest in the cohort: 79 and 87 years old. However, no significant correlation was found between age and LARS score in this cohort ($r = 0.295$, $n=23$, $P = 0.171$).

DISCUSSION

One of the major concerns of patients undergoing radical rectal resections is the quality of their bowel function after surgery. LARS represents a spectrum of symptoms of disordered bowel function occurring after rectal resection, causing a lower quality of life. It has been shown that the majority of the patients undergoing rectal resection will present with some level of LARS, with up to 62% reporting major LARS in a long-term follow-up assessment [1].

This situation makes local excision of rectal lesions very appealing since it is reasonable to assume that local excision will not result in such a devastating morbidity as the anterior rectal resections. However, local excision of rectal lesions usually results in a large full thickness defect along the anorectal wall. This defect can reach a diameter of 4–6 cm. Moreover, local excision by means of TAMIS is performed through a large transanal port that is fixed internally to the anorectal ring throughout the procedure.

LARS is a result of chronic permanent changes [6]. LARS symptoms usually appear right after surgery, turn to be more pronounced several months later, and reach a steady state more than 2 years later [10]. We chose to evaluate bowel function at a median of 5 years after the procedure. This way we were able to avoid the short-term irritability in the postoperative period and explore bowel function after reaching a steady state. Our data showed that only 2 patients (8.7%) had major LARS symptoms in a long-term follow-up after surgery. Sumrien et al. [11] were the first to describe the functional bowel disturbances after TAMIS in a small case series of 13 older patients who underwent the procedure as they were unfit for more radical surgery. Their findings show a low severity of anal incontinence in a short-term 3-month follow-up. Two other studies, which examined Fecal Incontinence Severity Index (FISI) after TAMIS, also showed that TAMIS has no detrimental effect on anorectal function in a short-term follow-up [12,13]. Furthermore, Schiphorst and colleagues [13] actually showed improvement of anorectal function in a short-term follow-up after TAMIS (based on FISI score). However, there is at least some evidence of poorer functional outcomes in the intermediate 3 years after LARS in almost a half of the patients from a series of 47 patients who developed decreased continence after the surgery [8].

To the best of our knowledge no previous studies have examined the long-term (> 3 years) effect of TAMIS on bowel function.

There are several intraoperative factors during TEM or TAMIS that may directly affect bowel function after surgery: the length of surgery [2], the size of the lesion [13], and its location [14]. Those factors in our cohort were similar to the previously published studies after TAMIS, including baseline characteristics, the lesion size, and its location from the anal verge [4,8,11,12,14]. We did have relatively longer average operative time of 92.5 minutes (compared to 60–70 minutes in previous reports) [11]. This longer surgical time can be partly attributed to the fact that TAMIS are still quite rare at our institution. Hence, the operative time might reflect our ongoing learning curve. The fact that the operative time was longer actually strengthens our findings of relatively low incidence of major LARS after this procedure.

Only 6 patients of 23 (26.08%) underwent surgery for oncological rectal lesions. All of those patients underwent full thickness local excision and had negative pathological margins. Although the small number of patients does not allow powered comparison between the malignant and non-malignant lesions groups, it is worth mentioning that the patients with the malignant lesions were not more affected by LARS. Neither of the oncological patients had developed major LARS and only 2/6 (33%) had minor symptoms.

LIMITATIONS

We acknowledge the major limitations of this work as a small retrospective case series study. Our data show that long-term LARS incidence was relatively low in 23 patients who underwent TAMIS. However, we cannot comment on the causative effect of the TAMIS surgery on the presence or lack of LARS as there may be multivariate reasons, which are not in the scope of this study. Due to the retrospective character of the study, the LARS score was performed only postoperatively with no baseline for comparison. In addition, our evaluation of the anorectal malfunction was based on a verbal subjective score only, with no manometric studies or sonographic assessments of the anal sphincter. Furthermore, most of the patients in this cohort underwent surgery due to benign lesions ($n=17/23$, 73.91%); hence, the conclusions regarding TAMIS performed for oncological resections should be further explored.

We believe that this study has important clinical value as the first report to describe long-term bowel dysfunction after TAMIS and the first one to implement LARS scores in those patients.

CONCLUSIONS

Our findings show that TAMIS is relatively safe in terms of bowel dysfunction. Further research is needed to establish stronger data about the extent of long-term bowel dysfunction after TAMIS generally and specifically after TAMIS for the treatment of early rectal malignancies.

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Capsule**Limiting fatality in COVID-19 patients**

Emerging evidence suggests that cytokine release syndrome (CRS), a systemic hyperinflammatory reaction, is a major cause of fatality in patients with severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2), which causes coronavirus disease 2019 (COVID-19). CRS is observed in some other severe coronavirus infections, as well as in some cancer patients after receiving engineered T cell therapy. On the basis of this past experience, an emerging treatment for COVID-19 under investigation in

the clinical setting is to antagonize key cytokine signaling pathways that drive CRS. In a perspective, **Moore** and **June** discussed the current understanding of CRS immunopathology and the developments in repurposing drugs with a track record in treating CRS for treating patients with severe COVID-19.

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Eitan Israeli

Capsule**Undetected cases**

The virus causing coronavirus disease 2019 (COVID-19) has now become pandemic. How has it managed to spread from China to the rest of the world within 3 to 4 months? **Li** et al. used multiple sources to infer the proportion of early infections that went undetected and their contribution to virus spread. The researchers combined data from Tencent, one of the world's largest social media and technology companies, with a networked dynamic metapopulation model and Bayesian inference to analyze early spread within China. They estimated that approximately 86% of cases were undocumented before travel restrictions were put in place. Before travel

restriction and personal isolation were implemented, the transmission rate of undocumented infections was a little more than half that of the known cases. However, because of their greater numbers, undocumented infections were the source for approximately 80% of the documented cases. Immediately after travel restrictions were imposed, approximately 65% of cases were documented. These findings help to explain the lightning-fast spread of this virus around the world.

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Eitan Israeli