Transanal minimally-invasive surgery (TAMIS): technique and results from an initial experience

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\textbf{abstract}

Transanal endoscopic microsurgery is a minimally-invasive approach for rectal lesions. Superior exposure and access to the entire rectum result in lesser risk of compromised margins and lower recurrence rates, when compared to conventional transanal excision. The aim of this study was to describe a single institution's initial experience with transanal minimally invasive surgery (TAMIS). This was a prospective review of our database. Eleven procedures from January 2012 to June 2013 were analyzed. Results: eleven operations were completed. Five men were evaluated. Mean age was 62.9 (40-86). Mean follow-up was 9.3 (2-17) months. Average tumor size was 3.8 (1.8-8) cm. Mean distance from anal verge was 6.3 (3-12) cm. Mean operating time was 53.73 (28-118) min. Postoperative complication rate was 9.1%. There were no readmissions. Mortality was null. Operative pathology disclosed the presence of adenoma in four patients, invasive adenocarcinoma in two, neuroendocrine carcinoma in three, and no residual lesion in one case. TAMIS is a minimally-invasive procedure with low postoperative morbidity at the initial experience. TAMIS is a curative procedure for benign lesions and for selected early cancers. It is useful after neoadjuvant therapy for strictly selected cancers, pending the results of multi-institutional trials.

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Microcirurgia endoscópica transanal é uma abordagem minimamente invasiva para lesões reetais. Apresenta menor risco de margem comprometida e menores taxas de recorrência em comparação com excisão transanal convencional. Objetivou-se descrever a experiência inicial, de uma única instituição, com cirurgia minimamente invasiva transanal (TAMIS). Avaliação prospectiva de nosso banco de dados. Onze procedimentos de janeiro de 2012 a junho de 2013, foram analisados. Resultados: onze operações foram concluídas. Havia cinco homens. A média de idade foi de 62,9 (40-86). O acompanhamento médio foi de 9,3 (2-17) meses. O tamanho médio do tumor foi de 3,8 (1,8-8 cm). Distância média de borda anal foi de 6,3 (3-12) cm. O tempo médio de operação foi de 53,73 (28-118) min. Taxa de complicação pós-operatória foi de 9,1%. Não houve readmissões. A mortalidade foi nula. Achados patológicos foram de adenoma em 4, adenocarcinoma invasivo em 2, carcinoma neuroendócrino em três, e nenhuma lesão residual em um caso. TAMIS é um procedimento minimamente invasivo, com baixa morbidade pós-operatória durante a experiência inicial. TAMIS é curativo para as lesões benignas e de cânceres selecionados. É útil após a terapia neoadjuvante para casos de câncer rigorosamente selecionados, enquanto os resultados de estudos multi-institucionais são aguardados.

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was positioned on the operating table in lithotomy position regardless of the location of lesion.

The SSL (single-site laparoscopic access system, Ethicon Endo-Surgery, Cincinnati, OH, USA) equipment was used (Fig. 1). After lubricating the kit and the anal canal, the port was installed and was established pneumorectum with a pressure of 12 mmHg. A 10 mm and 30° optical fiber cable and two 5 mm ports were employed to work with the laparoscopic instruments such as grasper, electrocautery and scissors (Fig. 2). A full-thickness excision was performed in all lesions with known or suspected submucosal invasion aiming to obtain 1 cm lateral and deep excision margins. Wound closure in all cases was performed by continuous primary suture using absorbable sutures, interrupted by laparoscopic clips.

All patients were hospitalized. All immediate and late complications were recorded. All patients included in the study underwent a rigorous follow-up and if they had invasive carcinoma, they were submitted to oncological follow-up, including anoscopy, rectoscopy, serum Carcinoembryonic Antigen (CEA) levels and imaging assessment.

### Results

Eleven consecutive patients were underwent surgery successfully using TAMIS in the lithotomy position using SSL. Five (45.5%) patients were women. The mean age was 62.9 (40-86) years (Table 1).

<table>
<thead>
<tr>
<th>Table 1 – Demographic data.</th>
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<td>Patients (n)</td>
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<tr>
<td>Male (%)</td>
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<tr>
<td>Female</td>
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<td>Mean age (range)</td>
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The distance from the lower limit of the lesion to the anal verge determined by preoperative rigid rectoscopy was 6.3 (3-12) cm.

There were no major technical difficulties associated with the procedures. The mean surgical time was 53.73 (28-118) minutes. The mean size of the lesions was 3.8 (1.8 to 8) cm (Table 2). A full-thickness resection was performed in 10 cases.

Of the 11 patients, four patients (36.4%) had adenoma, three patients (27.3%) had carcinoid tumors and two patients (18.2%) had pT1N0 adenocarcinomas. Suspected retrorectal tumor and melanoma were diagnosed each in one case (9.1%) (Table 2).

<table>
<thead>
<tr>
<th>Table 2 – Characteristics of patients and lesions in 11 surgical procedures using TAMIS.</th>
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<tbody>
<tr>
<td>Case</td>
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<td>-----------------------------</td>
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<td>83/m</td>
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<td>67/m</td>
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<tr>
<td>79/m</td>
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<td>81/f</td>
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<td>46/m</td>
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<tr>
<td>41/m</td>
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<td>65/f</td>
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f, female; m, male.
All tumors were resected with gross negative resection margins, confirmed by anatomopathological analysis.

Regarding the surgical wound closure, it was not performed in only one case (9.1%) of full-thickness resection as excessive tension was observed during the closing attempt, and thus healing by second intention was decided.

Early intraoperative morbidity occurred in only one case (9.1%). In this case, during full-thickness resection of the intraperitoneal lesion, perforation of the rectum with access to the abdominal cavity during surgery was identified and corrected by transanal suture. There was no subsequent adverse outcome in the treatment of this patient.

There were no postoperative complications in all cases. There was no postoperative bleeding or infectious complications. No patient required reoperation. There was no mortality associated with the technique.

The average duration of hospitalization was 1.09 days. Patients have not shown recurrent lesions after a mean follow-up of 9.2 months.

**Discussion**

In this study, we report the first 11 cases of TAMIS performed at our institution for the treatment of benign and malignant rectal lesions. The sample of TAMIS shown here represents, to our knowledge, the largest series of its kind in Brazil. It was possible to completely resect the rectal lesion in all cases and there was no significant morbidity associated with the approach, even when there was invasion of the peritoneal cavity, an intraoperative occurrence resolved without conversion to abdominal access.

Some authors consider the TEM/TEO surgical procedures as being associated with a significant degree of technical complexity. Fifteen years after the introduction of the technique, the number of procedures performed by Buess et al. did not exceed 500. Among the reasons involved for the limited use of the procedure within expert surgeons were the initial investment associated with equipment acquisition, the need for special training and pert surgeons were the initial investment associated with the limited use of the procedure within extra-peritoneal benign and selected malignant lesions. TAMIS emerged as an advanced alternative with better cost-effectiveness and as a result, possibly superior to the TEM/TEO platforms in the future, allowing more centers to perform minimally-invasive treatment of rectal tumors. It is estimated that in the United States, the cost of ports necessary to enable the TAMIS platform (between 500 and 650 dollars) is equivalent to the cost of materials used for CO₂ insufflation with the TEM platform.

Rapid preparation of the room before the procedure, a 360° and not 220° view within the rectal lumen and the use of conventional laparoscopic instruments represent another advantages when comparing TAMIS to TEM/TEO. The versatility of positioning the patient in the lithotomy position for virtually all cases of TAMIS is an additional advantage. Finally, an additional benefit of TAMIS is that, because the SSL port protector is flexible with a maximum diameter of 30 mm (compared with 40 mm of TEM/TEO), it is possible that the sphincter dilation during TAMIS is smaller than that performed during TEM/TEO, although its impact on sphincter function has not yet been studied.

One of the main technical difficulties related to TAMIS in some cases is pneumorectum instability, which can lead to intermittent rectal lumen collapse, hampering surgery. This event can be solved, to a greater or lesser degree, by an increase in intrarectal pressure to 20 mmHg, greater relaxation or by reposition of the port. Another difficulty occurs, similarly to that observed for TEM/TEO, to the release of smoke fromed by the activation of the electrocautery. The SSL system has only three ports that are used with the optical devices and surgical instruments and sometimes it is necessary to drain the formed smoke.

In the present study, the presence of positive margins in the resected specimen was not observed in 10 cases. In only one case, the pathological analysis showed that the removed tissue was only fibrosis. In none of the cases specimen fragmentation was identified, which can be attributed to the small mean lesion size (3.8 cm).

The increase of TAMIS, in the literature, with several disposable ports designed for single port surgery is still under evaluation. Several aspects need to be clarified. One of them refers to the viability of transanal endoscopic access in upper rectal procedures, as the TAMIS platform does not include a surgical rectoscope, which could theoretically provide stability to the surgical procedure at that site.

One of the cases shown in this series evolved with access to the peritoneal cavity during surgery, which characterizes its location more proximal to the rectum. The procedure in this case was appropriately finished using TAMIS. However, this is one more aspect that deserves further investigation. The performance of TAMIS as an alternative to TEM demonstrates that it is a safe procedure with low morbidity and no mortality. This is a perfectly viable alternative to the TEM/TEO platform for the resection of intra and extra-peritoneal benign and selected malignant lesions of the rectum.

**Conflicts of interest**

The authors declare no conflicts of interest.