

# Transanal Endoscopic Microsurgery: Where it Stands as of Today?

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## ABSTRACT

**Objective:** To review the present role of transanal endoscopic microsurgery (TEM) in the treatment of rectal neoplasms.

**Methods:** Literature search was conducted with restriction to English language and only published material was considered. Search was performed at Medline, Google, Cochrane library and SpringerLink. Search terms were: transanal endoscopic microsurgery, TEM, rectal cancer, rectal adenoma and carcinoid tumor.

**Results and conclusion:** The review of the present literature is confirming the increasing acceptance of TEM, as a primary modality, over conventional surgery in the management of early rectal cancers, especially pT1 lesions. As far as pT2 is considered, it has to be combined with either adjuvant chemoradiation or salvage surgery. For locally advanced pT3, lesions, it is not preferred unless neoadjuvant therapy is successful in downstaging the tumor or in patients who refuse or are unfit for major surgery. However, the cost of equipment and steep learning curve are restricting this therapy to few specialized centers around the world.

**Keywords:** Transanal endoscopic microsurgery (TEM), Rectal adenoma, Early rectal cancer, Locally advanced rectal cancer, Carcinoid tumor.

## INTRODUCTION

In 1980s, Buess in Germany described for the first time the alternative endoluminal surgery to low rectal neoplasms in order to circumvent the disadvantages associated with conventional local techniques.<sup>1</sup> TEM was the first attempt at minimally invasive surgery, through a natural orifice using laparoscopic instruments and a rigid operating proctoscope. This involved minimally invasive excision of large endoscopically irretrievable rectal polyps and T1 rectal cancers; some extended uses for more advanced disease.

The advantages of TEM, such as a better visibility, improvised optics, longer reach permit a more complete excision and precise closure. TEM is more precise than traditional transanal excision and more likely to get clean margins with less manipulation of the mass.<sup>1</sup>

Only lesions within 20 cm from the anal verge and, especially, below the peritoneal reflection are suitable for TEM. As the peritoneal reflection is approximately 12 cm against the anterior rectal wall, this is the anterior limit (Fig. 1). After assessment of the exact topography of the tumor and histological assessment, adenomas are planned for TEM excision.<sup>2</sup>

The aim of this review was to study the present place of TEM in the armamentarium of surgeons dealing with colorectal cancers. And compare it with existing techniques, such as low anterior resection and abdominoperineal resection.

## MATERIALS AND METHODS

Literature search was conducted with restriction to English language and only published material was considered. Search was performed at Medline, Google, Cochrane library and SpringerLink. Search terms were: Transanal endoscopic

microsurgery, TEM, early and locally advanced rectal cancer and primary modality therapy. Patient age, gender, tumor distance from the anal verge, lesion size, operative time, blood loss, complications recurrence and survival rates were studied.

## TECHNIQUE

The patient undergoes a full bowel preparation and general anesthesia. Patient is positioned on the table in such a way that the lesion is at 6'O clock at the time of dissection (Fig 1). Dilatation of the anus is required for the passage. Special design 40 × 200 mm proctoscope is inserted (Fig. 2). Carbon dioxide is preferred for gas insufflation. With the use of a binocular stereoscopic eyepiece for three-dimensional view or a forward oblique telescope, a magnified view is created for visualization of the lesion (Fig. 3). The proctoscope has three channels for instruments, including dissecting forceps, needle holder and suction cannula. A 40° optic enters through the fourth port and is connected to a video camera that transmits the image to a conventional monitor (Fig 4). Due to the narrow working space TEM requires expertise and special training. Moreover, distal rectal lesions are more challenging to resect due to difficulties in maintaining the gas seal and maneuverability of the instrumentation.

Lesions can be excised with partial or full-thickness of rectal wall. Following establishment of pneumorectum, a margin of at least 5 mm for adenomata and 10 mm for cancers is scored around the tumor with diathermy (Fig. 5). With various instruments (e.g. ultracision harmonic scalpel, needle diathermy, tissue handling forceps, needle holder, suction probe, injection needle, clip applicator) the lesion can be dissected by means of an *enbloc* full-thickness rectal wall excision until the perirectal

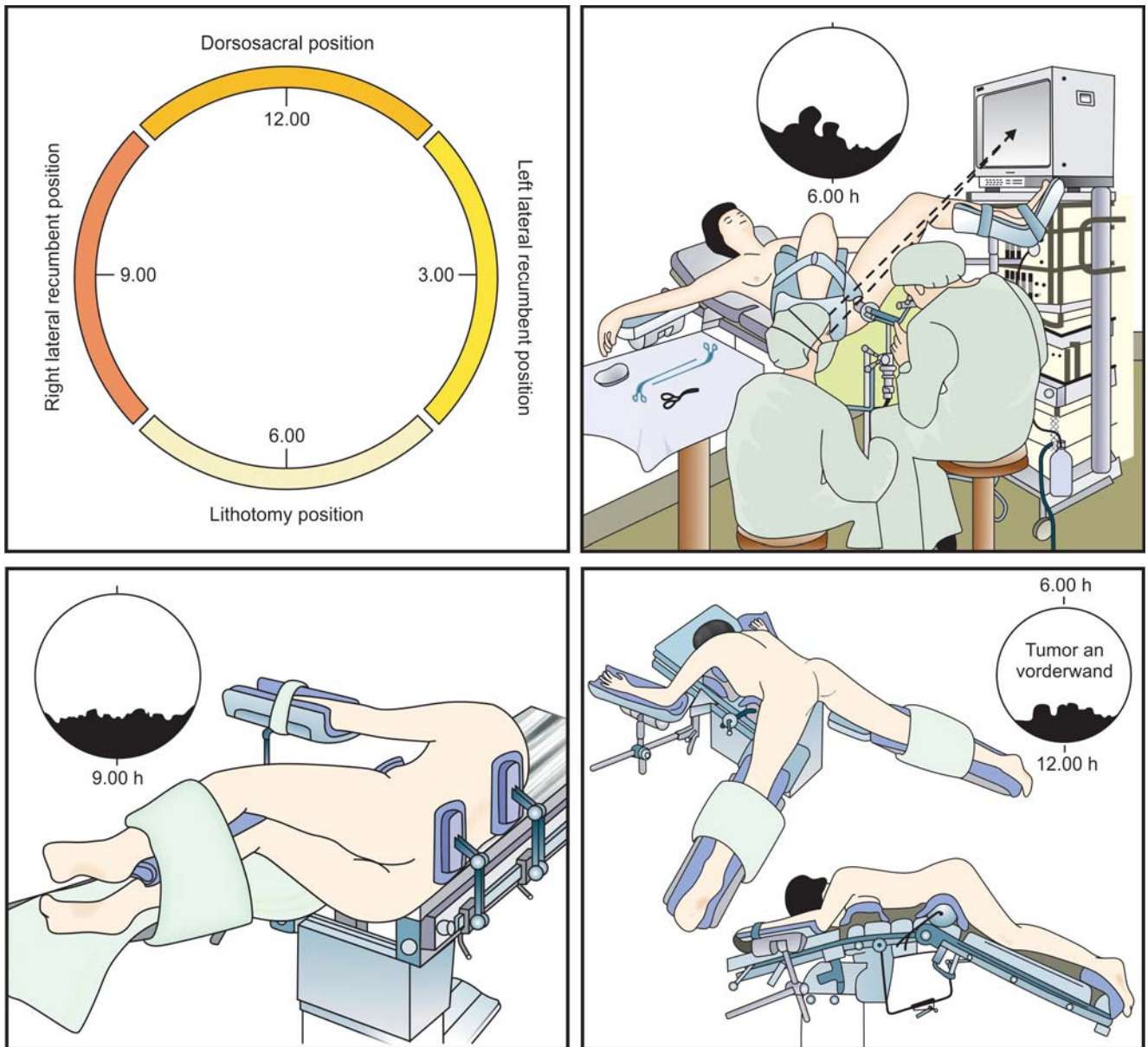


Fig. 1: Positioning of the patient for TEM

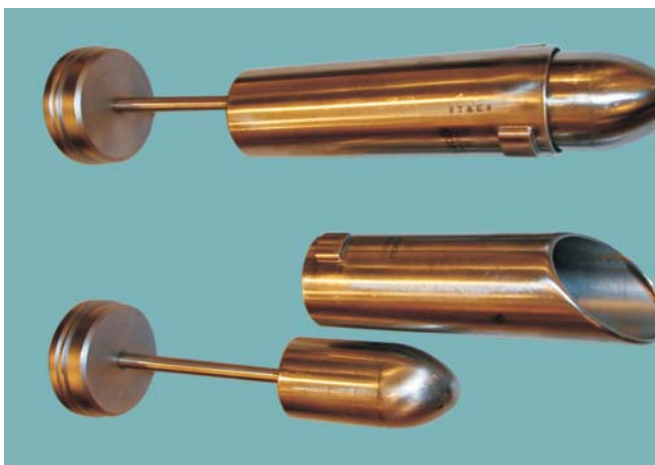


Fig. 2: Special proctoscope



Fig. 3. Binocular stereoscopic eyepiece for three-dimensional view

fat. A full-thickness excision of the tumor with negative margins is performed, including the adjacent perirectal fat. For anteriorly localized lesions, the plane of dissection was the vagina septum or the prostate capsule, whereas for posterior lesions it was the so-called "holy plane". The final specimen preferably has the shape of a "truncated pyramid"<sup>2</sup> (Fig. 6). The injection of saline solution in the submucosa in a mucosectomy fashion may be used to facilitate the removal of benign lesions. Wound closure can be achieved with clips or suture stitches. The surgical specimen is pinned out and oriented for pathological analysis of the margins (Fig. 7).

## DISCUSSION

Low lying rectal lesions whether benign or malignant have always been a subject of debate among the older conventional surgeons as well as the new breed of minimally invasive surgeons. The current gold standard treatment for any stage of the disease is conventional rectal resection, which is accompanied with significant morbidity and mortality. These relative drawbacks of conventional surgery have led to the development of local excision through transanal techniques.<sup>3-5</sup>

Conventional radical surgery (low anterior resection and abdominoperineal resection) proudly claims the success in good oncological clearance, which is virtually impossible by the newer local approaches (including the transanal resection and TEM). However, the complications associated like urinary and sexual dysfunction (30-40%), anastomotic leak (5-10%), requirement of colostomy, local recurrence rate (7-14%) and mortality (2-6%). The 5-year survival rate after APR is 60%; the failure and death after radical surgery for T1 and T2 are also high.<sup>6</sup> Local approaches like transanal resection and TEM were the alternatives to circumvent these disadvantages. The present goal of therapy of these cancers is optimal chance of cure and better quality of life.

In terms of local recurrence and survival rates, the long-term results for patients with early-stage rectal cancer treated using TEM procedure are comparable with those after radical surgery quoted till now in literature.<sup>6,7</sup> Resection of the rectum, a major surgery procedure associated with significant morbidity (7-68%) and mortality (0-6.5%), is avoided.<sup>8</sup> Though for lesions T2 and above it is undoubtedly superior, for T1 and T2 is a radical procedure accompanied by its morbidity and mortality. Patient acceptance of colostomy is a major cause of concern.

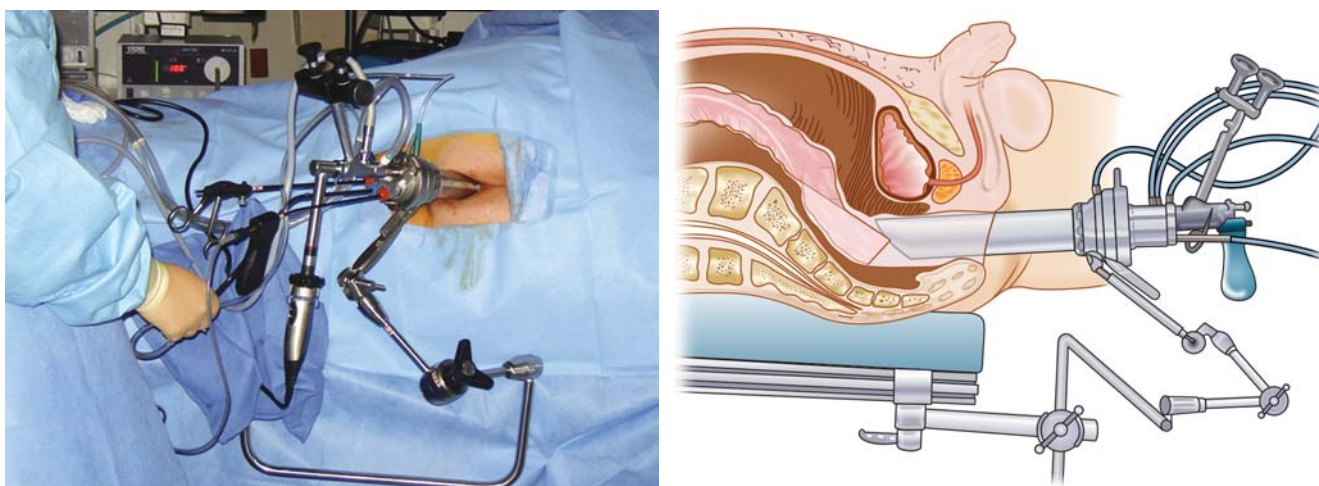


Fig 4. Instrument assembly for TEM

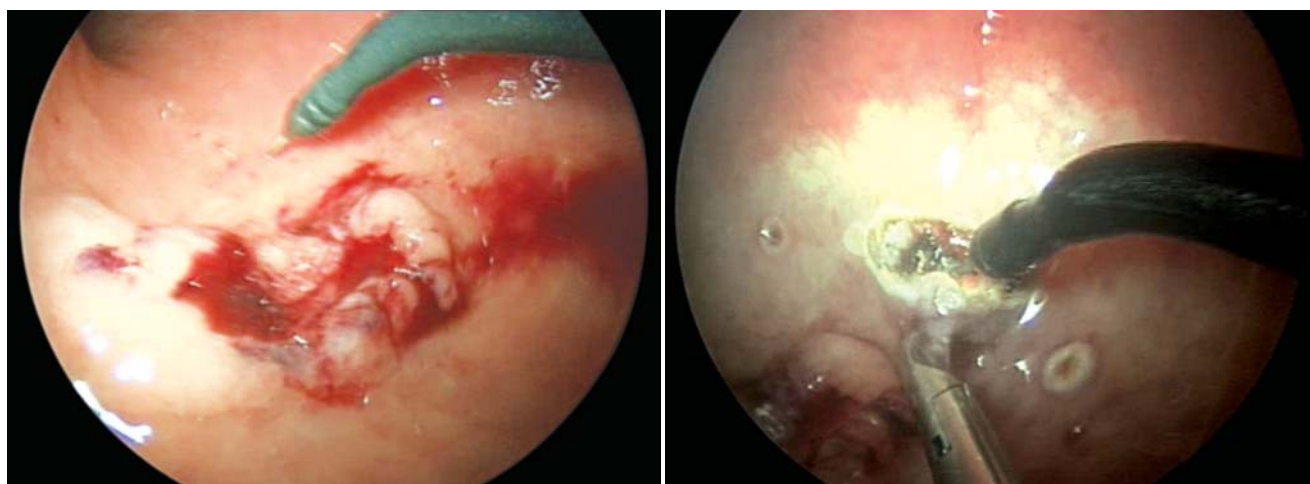


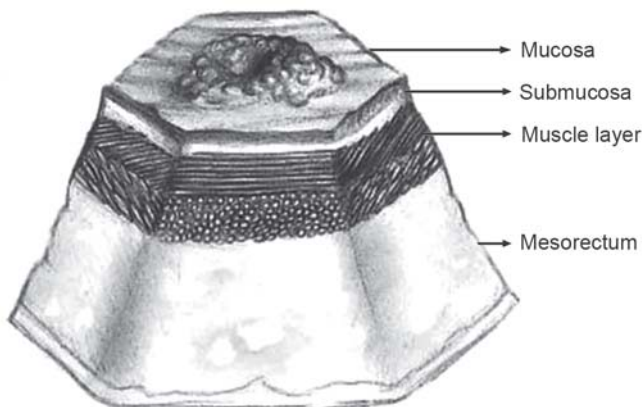
Fig. 5: Margin scoring for tumor with diathermy

TEM as a curative option, are for early rectal cancers which are histologically pT1, i.e. small (< 3 cm), well-to-moderately differentiated adenocarcinomas, with no lymphovascular space invasion and minimal (sm1) invasion of the submucosa (Table 1).<sup>2</sup>

Hence, it is crucial to confirm the T stage before embarking on TEM. The two preferred imaging approaches are endorectal ultrasound (ERUS) (accuracy 82-93% in distinguishing T1 from T2) and when it comes to detection of lymph node metastasis MRI with accuracy of 72 to 92% (65 to 81% for ERUS) is preferred. Hence in totality, for both T and N staging, both ERUS and MRI are used.<sup>6,7</sup>

**Table 1:** T1 tumors and risk factors for lymph node metastases<sup>2</sup>

	Low-risk	High-risk
Degree of differentiation	Well/moderate	Poor
Histological	Grades 1 and 2	3
Histological subtype	-	Mucinous adenocarcinoma
Lymphovascular space invasion	-	+
Kikuchi level	sm1	sm2 and sm3
Tumor diameter	< 3 cm	≥ 3 cm



**Fig. 6:** Truncated specimen after resection



**Fig. 7:** Pinned out specimen for pathological analysis

### TEM for Benign Lesions

It is now widely accepted that TEM is an excellent option in managing rectal adenoma and polyps which are not amenable to treatment by colonoscopic approach. Low recurrence rate, low conversion rate, low complication rate and lower cost are the favoring aspects.

TEM is now confirmed in many studies to be safe and effective for rectal adenomas, in comparison to conventional transanal approach.<sup>8,9</sup>

### TEM for Malignant Lesions

Low anterior resection or abdominoperineal resection encompasses removal of the mesorectum with or without preoperative combined modality therapy (CMT). Though recurrence and survival rates are improved, long operative time and postoperative complications, such as bleeding, anastomotic dehiscence, need for colostomy, sexual or urinary dysfunctions, pneumonia and thromboembolic events are prohibitive.<sup>10</sup> TEM surpassed TME (total mesorectal excision) in all these aspects. But most notably, TEM does not address the mesorectal lymphnodes. Hence, proper patient selection is mandatory to optimize results.

#### TEM for pT1—Is TEM Alone Sufficient ?

Early rectal cancer refers to T1 or T2N0M0. Till now TEM has been usually indicated for patients with low-risk T1 adenocarcinomas. A low-risk T1 lesion is the one with favorable prognostic factors, such as small size (less than four centimeters), absence of invasion of the sm2 or sm3 levels of the submucosa, well-differentiated histology, absence of vascular, lymphatic or perineural invasion.<sup>10</sup> When these criteria are fulfilled survival and local recurrence rates achieved by TEM are similar to those of radical treatment but with limited morbidity and mortality.

Heintz et al<sup>11</sup> compared the results of TEM and radical surgery in 103 patients with T1 rectal carcinomas. TEM had significantly lower morbidity and mortality rates (3.4% vs 18% and 0% vs 3.8% respectively). Regarding 5-year survival rate, no difference was observed between the procedures in those patients with low-risk T1 lesions. Borschitz et al<sup>12</sup> observed that R0 resection in cases with low-risk pT1 carcinomas by TEM can be oncologic adequate with similar results when compared to primary radical surgery for pT1N0M0 rectal lesions.

Other studies have also demonstrated good results with low recurrence and high survival for selected pT1N0 rectal adenocarcinomas treated by TEM alone. In the advent that pathological examination reveals a pT1 lesion with unfavorable features or a more advanced lesion the authors recommend complementary treatment with radical surgery and/or CMT.<sup>13-16</sup>

### What is the Role of TEM in pT2?

Local excision alone for T2 rectal cancer is inadequate with a high risk for recurrence in spite of complete (R0) resection. Neoadjuvant or adjuvant therapy are combined with TEM in this scenario,<sup>17</sup> as noted earlier, due to the greater risk of lymph node involvement in T2 as compared to T1. The study done by Lee et al<sup>18</sup> and Lezoche et al<sup>19</sup> has proven increased risk of local recurrence but it is interesting to note that there was no difference noted in 5-year survival rate in the patients with T2N0 treated by TEM alone. Preoperative combined modality therapy (CMT) than TEM is preferred by many authors. When compared with CMT + TME, local recurrence, distant metastases and survival are same.<sup>17-19</sup>

### Can TEM be done after Chemoradiotherapy for Locally Advanced Rectal Cancers?

In spite of the technological advancement (EUS, CT, MRI, PET-CT) even today it is difficult to confirm the downstaging of locally advanced rectal cancer after neoadjuvant therapy. However for patients who respond to neoadjuvant therapy, TEM is technically feasible as noted in study done by Lezoche et al.<sup>19</sup> Here, the role of TEM is both as therapeutic and diagnostic tool that allows histologic confirmation of downstaging. TEM allows pathologic evaluation of the rectal area involved with low morbidity. Only when there is complete clinical response and negative biopsy TEM is recommended. In case of any doubt radical resection remains the therapy of choice.

### Can TEM be used in Advanced Malignancy?

Palliative role of TEM is in those patients who present with advanced disease or those who are unfit for major surgery. The absence of painful abdominal incision and short length of hospital stay and faster recovery is favorable in many such patients.

### When to Resect Carcinoid Tumor by TEM?

TEM is safe for the local excision of rectal carcinoid tumors. The depth of invasion followed by the size of the tumor plays a vital role in the response to local treatment. With a diameter < 1 cm and 1 to 2 cm with free margins, 5-year survival is reported at 100% after local excision. If rectal wall is involved then prognosis is poor with 5-year survival of 73%. TEM is not recommended for lesions more than 2 cm diameter and total mesorectal excision preferred.<sup>20,21</sup>

Recurrence is nil as seen in many studies when tumor is less than 1 cm. Another role of TEM is in complete removal of residual tumors, after endoscopic polypectomy.<sup>22</sup>

### What is New?

In order to improve the diagnosis of early rectal cancers confocal chromolaser endomicroscopy (cCLEM) has been utilized by

Borschitz et al (2009). cCLEM utilizes optical transversal sections at 103 magnification and at this magnification mucosal microarchitecture and differentiation of normal mucosa from adenomas and carcinomas become clear. This has been recommended in cases with rectal tumors having conflicting or unclear findings. An improvised topography showing suspicious areas even in a case of suspected adenoma helps in precise resection of tumor with negative margins. Hence, repeat surgeries are avoided by selective use of cCLEM.<sup>23</sup>

Waleg P et al<sup>24</sup> (2010) have added endoscopic posterior mesorectal resection (EPMR) to TEM. This makes it possible to remove the important lymph nodes draining the lower-third of the rectum in the minimally invasive way, which can help with adequate tumor staging. The increased local recurrence noted with TEM alone can be prevented in this way. They also studied the influence of combined TEM and EPMR treatment on the anorectal functions of this group of patients. EPMR and TEM is reported to be a safe and feasible technique, which does not have influence on basic anorectal functions. However, further studies are required to assess the oncological efficacy of this technique.

## COMPLICATIONS

Though a sophisticated approach, a specialized instrument and relatively less working space TEM in experienced hands has complication rate of approximately 10%. The duration of surgery quoted in many studies is around 70 to 80 minutes.<sup>25,26</sup> Common complications listed by many authors are fever, urinary retention, rectal bleeding and pain. Abdominal perforation, transitory fecal incontinence and suture dehiscence with pelvic abscess are rare. The overall complication rate after radical surgery was 48%.<sup>27</sup>

Mortality noted in few studies is due to advanced malignancy in the late postoperative when TEM was done as palliative procedure. Complication rates are same whether TEM is done for benign or malignant cause.<sup>28</sup> The hospital stay is short and reoperation rates are lower. Fecal incontinence is temporary and returns to normal over period of time.<sup>29</sup> In fact, quality of life and even continence are improved after tumor removal.<sup>30</sup>

### Why is TEM not Available in all Centers?

The considerable cost of the equipment, the specialized training required, steep learning curve and high cost of surgery are some of the reasons. Absence of screening programs to pick up the lesion early, the late presentation of many patients and restricted availability in specialized centers only are other notable causes.

TEM using two-dimensional visualization and standard endoscopic instruments has been proposed by Nieuwenhuis et al (2009) instead of using three-dimensional equipment (Wolf) (Fig. 8) so they have used two-dimensional (Storz) equipment

(Fig 9). The use of two-dimensional optic capacities has been shown to be more economical and has better ergonomics, though the visibility is superior with three-dimensional equipment. Use of standard laparoscopic equipment reduces the costs even more because of fewer costs for the equipment than for the 3D system (€15,000 vs €44,000). The total expense of the procedure using this equipment is €6,000, though the cost of procedure using the conventional one has not been mentioned.<sup>31</sup> Hopefully with technological advancement, the cost of equipment and the procedure becomes affordable.

## CONCLUSION

TEM is a boon to patients of rectal cancer, especially for those who are diagnosed early. The low morbidity and practically nil mortality are the key factors. Now it is universally accepted treatment of choice for large rectal adenomas, low-risk pT1, and selected small neuroendocrine tumors localized in the rectum. The 5-year survival rate and frequency of recurrence is similar to that in abdominal surgery. Complications are minimal and mortality is practically nil. In more advanced stages of rectal adenocarcinoma, neoadjuvant/adjuvant therapy when combined with TEM has better outcome and a promising future



Fig. 8: Wolf rectoscope including a binocular stereoscope



Fig. 9: Storz rectoscope

perspective. Therefore, TEM is an added armamentarium for surgeons in managing rectal neoplasms.

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