Endoscopic Surgery in Rectal Cancer- A Review

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ABSTRACT

Colorectal cancer is one of the leading causes of cancer related deaths worldwide. Total mesorectal excision (TME) remains the gold standard treatment for any stage of rectal cancer, especially in more advanced disease, as it effectively treats the mesorectal lymph nodes and reduces recurrence [1]. Minimally invasive abdominal approach has been established to be oncologically safe, feasible and associated with all the advantages of minimal access surgery, however it has not had a measurable impact on the incidence of post operative complications, sexual and urinary dysfunction, or quality of life. TME performed either via open, laparoscopic or robotic approach is accompanied by significant morbidity and mortality [2]. In addition, widespread adoption of laparoscopic techniques in colorectal surgery has been limited by the technical complexity and steep learning curve. In an effort to harness the advantages of a minimally invasive approach to benefit patients with colorectal pathology, trans anal natural orifice transluminal endoscopic surgery (NOTES) has been explored, with promising preliminary results, particularly when used for rectal cancer and other benign lesions. NOTES in Rectal lesions can be carried out using Transanal Endoscopic Microsurgery (TEMS) and Transanal Minimal Invasive Surgery (TAMIS), which can be together termed as Transanal endoscopic surgery. TEMS and TAMIS utilises specialised platforms that have been devised specifically for the respective procedures. In this review we will be discussing in detail about these two procedures. Also we will discuss about Transanal total mesorectal excision (TaTME) which is a recent concept performed using TEMS, TAMIS or in some cases using traditional Transanal approach as well. JMS 2018; 21 (1):3-10

Key Words: Rectum, Endoscopy, Endoscopic sx in ca Rectum

INTRODUCTION

Colorectal cancer is one of the leading causes of cancer related deaths worldwide. Total mesorectal excision (TME) remains the gold standard treatment for any stage of rectal cancer, especially in more advanced disease, as it effectively treats the mesorectal lymph nodes and reduces recurrence [1]. Minimally invasive abdominal approach has been established to be oncologically safe, feasible and associated with all the advantages of minimal access surgery, however it has not had a measurable impact on the incidence of post operative complications, sexual and urinary dysfunction, or quality of life. TME performed either via open, laparoscopic or robotic approach is accompanied by significant morbidity and mortality [2]. In addition, widespread adoption of laparoscopic techniques in colorectal surgery has been limited by the technical complexity and steep learning curve. In an effort to harness the advantages of a minimally invasive approach to benefit patients with colorectal pathology, trans anal natural orifice transluminal endoscopic surgery (NOTES) has been explored, with promising preliminary results, particularly when used for rectal cancer and other benign lesions. NOTES in Rectal lesions can be carried out using Transanal Endoscopic Microsurgery (TEMS) and Transanal Minimal Invasive Surgery (TAMIS), which can be together termed as Transanal endoscopic surgery. TEMS and TAMIS utilises specialised platforms that have been devised specifically for the respective procedures. In this review we will be discussing in detail about these two procedures. Also we will discuss about Transanal total mesorectal excision (TaTME) which is a recent concept performed using TEMS, TAMIS or in some cases using traditional Transanal approach as well.

Trans anal Endoscopic Microsurgery(TEMS)

TEMS is a transanal surgical procedure first reported from Germany in early 1980s by Gerhard Buess. [3] This technique was initially devised to deal with lesions which were located...
high up in the rectum limiting their removal by conventional transanal excision. E Lezoche in 1996 for the first time used TEMS for excision of an early rectal cancer\(^4\).

In TEMS a binocular magnified operating system comprising of an operating proctoscope, insufflation and magnified stereoscopic vision is used to perform local excision through natural orifice (Fig 1). As a result of good illumination, three dimensional amplification and a magnified view, the surgeons have a better vision and can resect better with lot of precision including a full thickness excision. It has evolved into a valuable, state of the art technology compared to any other technique in terms of positive patient outcome.

**Fig 1: Transanal Endoscopic Microsurgery (TEMS) Port**

In addition to extending the surgeon's reach high up to the distal sigmoid colon, the four ports of access allow for concomitant use of an illuminated camera, forceps, cautery, suction as well as the freedom to apply common laparoscopic techniques such as suturing and different energy sources.

The greatest advantage of the TEMs is that it allows resecting lesions upto 20 cms from anal verge. However, the limitations may be in the form of learning curve, surgeon skill, initial cost and experience.

TEM bears some advantages over standard trans anal excision of neoplasms in terms of

- Better visualization
- Clearance of tumor margins with more precision
- Inflicting less traumas
- Less tumor fragmentation and dissemination
- Resection of the potentially infiltrated mesorectum

- Access to more proximal lesions upto 20 cms.

**Indications for TEMS:**

- Excision of benign polyps
- Removal of early rectal cancers
- Palliation of advanced rectal cancers
- Treatment of anastomotic strictures
- Repair of proximal complex rectal fistulae
- Resection of carcinoid tumours
- Resection of retro-rectal tumors

**Equipment:**

TEM equipment can be divided into 2 major components:

1. Operating instruments and
2. The endo surgical unit

The operating instruments include:

a) Operating rectoscopes
b) Stereoscope and
c) Long-handled instruments for dissection, excision, and suturing.

The endo surgical unit provides carbon dioxide (CO2) insufflation, suction, irrigation, and continuous monitoring of intra rectal pressure. The operating rectoscope is approximately 4 cm in diameter and either 12 cm or 20 cm in length with a beveled or straight faced end. The surgeon's end has an airtight face plate with 4 ports sealed by capped rubber sleeves through which the optical stereoscope, suction, and 2 long shafted operating instruments are inserted. The surgeon visualizes the field through the binocular stereoscopic eyepiece, which provides a precise 3-D view of the operative area with up to 6-fold magnification of the operative field. The stereoscopic eyepiece itself includes dual lenses, an insufflation channel, and lens irrigator operated by foot pedal. An accessory monocular scope is connected to a video screen to allow the surgical team to view the procedure. All operating instruments are 5 mm in diameter and include graspers, scissors, a high-frequency knife, needle driver and clip applier. Most instruments angle downward at the tip. Graspers are made both with a right or left curve. The rectoscope and its attachments are secured to the operating room table using a multi jointed clamp, the Martin's Arm.
The endosurgical unit provides the light source, irrigation, and suction, and is equipped with a pressure controlled insufflator that measures pressure constantly via a separate channel. Simultaneously, an integrated roller pump provides constant suction at the same rate as the gas insufflation to allow for stable gas pressure in order to maintain visualization of the distended rectum without insufflation of the more proximal colon.

Operative Technique

Patient is subjected to a mechanical bowel preparation or rectal enemas depending on the patient's regular bowel habits and surgeons choice. Intravenous prophylactic antibiotics are used selectively. TEM procedures are usually performed under general anesthesia and a Foley catheter is used to decompress the bladder. Preoperative localization of the tumor is performed with rigid sigmoidoscopy in the clinic setting to determine the quadrant location of the lesion and to plan for operative positioning of the patient to allow the lesion of interest to sit at the 6-o’clock position. Patients with an anterior-based lesion are positioned in the prone jackknife position, while those with a posterior lesion are positioned in lithotomy. Laterally located lesions are best approached with patients in the appropriate lateral decubitus position. The operation starts with gentle dilation of the anus with two fingers and insertion of the rectoscope, inspection of the rectum under manual air insufflation and positioning of the rectoscope for optimal visualization of the lesion. The rectoscope is then attached to the operating table using the Martin's arm. During the resection, frequent repositioning of the scope is often necessary to keep the operative field in optimal view. Optics and operative instruments are introduced and the endosurgical unit is activated providing insufflation, suction, irrigation and pressure monitoring. Using cautery, the surgeon first makes the desired margin of clearance. This margin should be 5 mm from the macroscopic tumor edge for benign lesions and 10 mm in cases of invasive carcinoma. For adenomas located within the intraperitoneal portion of the rectum, a careful mucosectomy is performed to prevent entry into the peritoneum with the ensuing loss of rectal distention. For extraperitoneally located adenomas and for all invasive carcinomas, full thickness resection is standard. Circumferential adenomas in the lower and middle rectum can be resected as complete full thickness segments followed by an end-to-end anastomosis. Invasive carcinoma in the posterior or lateral position may be resected with some perirectal fat, which can often yield 1 or 2 adjacent lymph nodes, that can be examined for metastatic spread. The resection bed for lesions below the peritoneal reflection may be left open or closed using a running suture with 3-0 polydioxanone suture (PDS) on a small-half (SH) needle. Knot tying using TEM equipment is very difficult and is instead achieved using silver clips, which are secured onto the suture. Closure of all intraperitoneal defects can be performed in 2 layers with separate closure of the peritoneum if entered or else the defect can be left open for secondary wound repair, especially in cases of partial-thickness excision [5].

Glove Port Transanal endoscopic microsurgery (TEM):

TEMS is an appealing procedure, however the associated cost and complex learning curve limits its utilization by colorectal surgeons. The glove TEM port is a safe, inexpensive and readily available access tool that may obviate the use of specialized equipment for transanal resection of rectal lesions [6].

In this technique, a wound retractor (Alexis) is applied through a disposable circular anal retractor. It is well fixed with skin stitches, or a disposable retractor with PPH device. A surgical glove is then put, air tight, on the wound port. All laparoscopic standard instruments can be used without any bond or limitation in manoeuvrability since they are free to work through the wound retractor. The pneumo-rectum is maintained at almost 12 mmHg. The operation then proceeds exactly like the traditional TEM, with the mucosal marking all around the lesion. The tumor is then resected deep to the level of mesorectal tissue dissecting the rectal wall along the marking and ensuring wide safety margins. The smaller length of the anal retractor, compared to the traditional TEM, allows easily excising the distal margin of the specimen even at only 1.5/2 cm from the dentate line. The excisional area is then closed with an absorbable continue suture [7].

Glove TEM is a promising surgical technique, safe, effective, and easy to install and perform. It is made from commonly used and relatively inexpensive surgical
equipment and offers the possibility to use all the conventional laparoscopic instruments with an amazing manoeuvrability thus avoiding long and complex learning curves for a laparoscopic surgeon.

The overall complication rate for TEM for benign and for malignant lesions has been reported to range from 6% to 31%.\(^{[8,10,11,12,13,14,15]}\) Perioperative complications include hemorrhage and peritoneal entry, which may require conversion to laparotomy. The intraperitoneal perforation rate varies from 0% to 9%.\(^{[8,10,12,16,17]}\) However, perforation into the peritoneal cavity does not always necessitate conversion to open laparotomy. Early and late complications in TEM patients were similar or lower than for patients undergoing open resection in several randomized trials comparing TEM with radical excision.\(^{[16,19,20]}\)

Winde and colleagues randomized 50 patients with T1 rectal cancer to TEM (n = 24) and anterior resection (AR) (n = 26). Patients were not statistically different in age or tumor location. However, early morbidity was 21% in the TEM group compared with 35% in AR group. TEM patients also had significantly shorter average operating times (103 min vs 149 min, p < 0.05), lower blood loss (p < 0.001), shorter length of stay (5.7 days [standard deviation (SD)] 1.8 days vs 15.4 days [SD 1.5 days], p < 0.0001) and a lower postoperative analgesia requirement.\(^{[19]}\)

Transanal Minimally Invasive Surgery (TAMIS)

The concept of TAMIS was given from USA in 2010 by Sam Atallah and team.\(^{[21]}\) TAMIS is witnessing convincing growth as an alternative to the more expensive and complex system for TEM. One of the most important factors that has lead to more acceptability of TAMIS procedure amongst majority of surgeons is the familiarity with the minimal invasive procedure and instruments used in conventional laparoscopy. TAMIS utilises common laparoscopic instruments like graspers, cautery hook, suction irrigation catheters, etc. A 5 mm, 30° or 45° camera is used in the procedure. Only specific item to be used in TAMIS is the platform for gaining access into the rectal lumen. SILS™ port was the first such platform used to gain access. This is a multiple access, advanced surgical device actually designed to perform laparoscopic surgery through a single incision, but over the years has gained popularity as an access port for rectal procedures in TAMIS. Its design and malleability allows the surgeon to use multiple instruments through adjustable canulas with a lot of maneuverability. The other device used is Gelpoint™ Path Trasanal Access Platform. Its gel base provides utmost versatility and accessibility for surgeons to perform TAMIS. It consists of gelseal cap, access channel and self retaining sleeves with obturators. Anesthesia is provided with either spinal or general anesthesia and the patient is placed in the dorsal lithotomy position. At our centre we prefer giving general anesthesia.

An access port in the form of Gelport (Fig 2) or SILS port (Fig 3) is first lubricated and introduced into the anal canal and pneumorectum is established with a standard laparoscopic CO2 insufflator upto a pressure of 10-15 mm of Hg. Laparoscopic camera lens and instruments are introduced through the access port to assist the operator in performing a full thickness resection of the neoplasm with 1 cm margins (Fig 4). The remaining rectal defect is either closed or left open (below peritoneal reflection, Fig 5). Postoperatively, patients are expected to have an overnight hospital stay and quick recovery with early resumption of normal diet and activities.

![Fig 2: Gel port for transanal access](image)

![Fig 3: SILS port](image)

![Fig 4: Full thickness Excision with 1 cm margin](image)
indwelling catheterisation. Resection margin was positive in 3 (12.5%) cases (2 adenocarcinomas and 1 villous adenoma). Average hospital stay was 2.7 (2-9) days. Follow up period ranged from 2 to 28 months. Local recurrence occurred in 2 (8.33%) villous adenoma patients (after 11 and 13 months), in whom redo TAMIS was done.

Martin Perez et al performed a systemic review and reported that complications following the TAMIS procedure were infrequent with an overall rate of 7.4%. The conversion rate in 390 cases performed for both benign and malignant lesions was 2.3%. Inadvertent peritoneal entry during the procedure was reported in 1% of cases and in some cases, the closure of the rectum was successful transanally. In malignant polyps, the rate of positive margins was 4.4% and the rate of tumor fragmentation was 4.1% [24].

The advantages of TAMIS are:

- Less expensive
- Setup time is significantly lower
- Can use conventional laparoscopic instruments
- Access platforms are pliable and allow well fitted positioning at the anal canal, possibly leading to less impairment of sphincter function than the 40mm rigid scope used for TEM.
- It can be easily learned by surgeons not used to TEMS technique due to its potential instrumental simplicity and similarity with conventional laparoscopic surgery.

TAMIS has been used successfully for excision of benign rectal lesions. For carefully selected patients, TAMIS for LE of rectal neoplasia is a valid option with low morbidity that maintains the advantage of organ preservation [25].

Besides benign lesions, TAMIS can be used for resection of early as well as advanced rectal cancers. TAMIS seems to be a safe & feasible option for treating patients with locally advanced rectal cancer who show good response to preoperative CRT [26].

At our centre, from 2014 to 2016, TAMIS was performed for 16 benign and 8 adenocarcinomas (24 patients), which were located at an average distance of 6.2 (4-10) cm from anal verge. The mean operating time was 72 (46-110) minutes. There were no intra operative complications, however, 1 (8.33%) patient suffered post operative bleeding, which was managed conservatively. 2 (8.33%) patients developed acute urinary retention who required indwelling catheterisation. Resection margin was positive in 3 (12.5%) cases (2 adenocarcinomas and 1 villous adenoma). Average hospital stay was 2.7 (2-9) days. Follow up period ranged from 2 to 28 months. Local recurrence occurred in 2 (8.33%) villous adenoma patients (after 11 and 13 months), in whom redo TAMIS was done.

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**Trans anal TME (TaTME)**

Low anterior resection (LAR) with TME is considered to be the ideal procedure at present to achieve low recurrence rate for rectal cancer surgery. However performing LAR with TME by either open or laparoscopic technique is technically challenging operation due to reduced working space in the pelvis, especially in male patients with narrow pelvis and obese individuals and because of inadequate retraction capabilities and poor visibility. These challenges have lead to increased interest towards robotic rectal surgery. However, even with robotic surgery, there still remain several technical difficulties in the minimally invasive approach to rectal cancer. The division of the distal rectum remains to be one of the most technically difficult steps due to the limited space in the pelvis, even after utilising modern stapling devices. To perform TME for rectal cancer, whether by open laparotomy, laparoscopy or robotic surgery, access to peritoneal cavity is gained through incision in the abdomen. To overcome these challenges, a new approach to the surgical excision of rectal cancer is trans-anal total mesorectal excision (TaTME), in which the rectum is mobilized through Transanal route using endoscopic instruments (Fig 6). TaTME can be performed using different platforms like TEMS or TAMIS, depending on the availability and experience of the surgeon. The surgical procedure for the TaTME is same as that for Abdominal TME, except that the dissection starts from below.
Since the first TaTME resection assisted by laparoscopy was reported in 2010,[25] TaTME performed on patients with rectal cancer has shown promising results with regard to pathologic quality and short and mid term outcomes.[26,27,28]

A meta analysis carried out by Bin Ma et al included seven studies consisting of 573 patients (TaTME group=270, LaTME group= 303). Concerning oncological outcomes, no differences were observed in harvested lymph nodes, distal resection margin between the two groups. However, the TaTME group showed a higher rate of achievement of complete grading of mesorectal quality, a longer circumferential resection margin and less involvement of Transanal TME for rectal cancer has many potential advantages compared to the transabdominal TME:

a) The dissection through the avascular embryologic tissue plane surrounding the rectum is assisted by pressure generated by CO2 pneumorectum. This pneumatic pressure dissection does not occur when using a transabdominal approach to rectal surgery (Fig 7).

b) A safe distal resection margin can be selected under direct vision through the lumen by the surgeon which is not possible in open, laparoscopic or robotic surgery.

c) The low coloanal anastomosis can be performed using a double circular stapler technique or hand sewn technique, thereby avoiding the multiple staple line and staple cross over lines which are associated with an increased rate of anastomotic leak.

d) The retraction of the rectum is technically less difficult from the transanal approach as rectal retraction is a "forward pushing motion" for transanal rectal surgery compared to a "pulling up and out of the pelvis motion" required for transabdominal rectal surgery.

Charlotte L, et al performed an international, multicentre, superiority, randomized trial (COLORIII Trial) to compare TaTME and conventional laparoscopic TME as the surgical technique, thereby avoiding the multiple staple line cross over lines which are associated with an increased rate of anastomotic leak. Although the incidence of anastomotic leakage, ileus and urinary morbidity showed no difference between the groups, a significantly lower rate of overall postoperative complications was observed in the TaTME group.[29]

CONCLUSION

Transanal surgery may turn out to be the future of rectal surgery both for benign as well as malignant lesion. Local
excision using platforms like TEMS and TAMIS for benign and early malignant lesion are technically feasible, oncologically safe with the advantage of low morbidity to the patient. The concept of Total Mesorectal Excision (TME) through transanal route (TaTME) is an emerging field which seems to have the potential to replace the conventional abdominal surgery.

REFERENCES


