



Argument for taTME

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There is little doubt that the advent of total mesorectal excision revolutionised the treatment of rectal cancer. Before the standardisation of this technique, the outcomes for rectal cancer surgery were disparate. Thanks to the work by Heald *et al.* in propagating the surgical technique necessary to perform an accurate mesorectal excision (1) the results have significantly improved. The key factors of adequate distal resection margin (DRM), circumferential resection margin (CRM), mesorectal resection grade and lymph node yield are achieved in the vast majority of cases (2). Ensuring this ongoing quality with the introduction of new techniques is essential to providing good long terms results in the treatment of rectal cancer.

As surgical technique has evolved over the past decades the propensity is to tackle more challenging cases. From an oncological perspective this includes lower tumours with sphincter preserving surgery as well as more locally advanced tumours (3). Whilst neoadjuvant therapy can help to downstage disease and gain better local control (4) it also adds an increasing level of difficulty given the tissues reaction to radiotherapy. Ultimately a tumour that appears difficult to resect prior to neoadjuvant therapy will remain difficult to resect. The colorectal surgeon therefore needs a variety of approaches to succeed in these difficult cases.

Perhaps the most significant current issue that has challenged the surgeon's ability to perform an adequate TME is obesity. It is well known that obesity rates worldwide have increased dramatically over the past few decades (5). This has led to an increased level of technical difficulty during the pelvic dissection for rectal cancer.

The analogy of a cork in a bottle is often used to describe the anatomy of a fatty rectum within a narrow pelvis. The bony constraints of a male pelvis make the use of any instrument that does not articulate increasingly difficult (6).

This effect is magnified the further distal the tumour is located. A specific advantage of the trans anal approach is the ability to facilitate the mobilization of the rectum in obese patients. Anatomically, the mesorectum is thinner in its distal extent and the plane can be entered more easily and then followed to meet the dissection from above. Less traction on the specimen is required for anatomical exposure. There are numerous ways in which taTME aides the surgeon's ability to perform a complete mesorectal excision and these are outlined below.

Image magnification

Modern laparoscopes with the availability of 3D vision systems, allow a far superior view for the operating surgeon, and importantly the assistant. The scenario of an assistant straining on a retractor, where they cannot discern the operative field, is avoided. Another advantage alongside the improved vision is the ability to accurately teach TME dissection. The identification and description of operative cues discerned while dissecting anatomical planes can be easily taught with the taTME platform. Review of recorded footage also facilitates critical appraisal of technique and evaluation. When an unanticipated operative issue has occurred, the footage can be reviewed to elucidate and alterations in approach that may avoid similar problems in future cases.

Pneumodissection

The improved identification of dissection planes is facilitated by the insufflation of gas under pressure. This helps to open up the areolar planes surrounding the mesorectum. It is imperative that the correct plane is

entered so that the pneumodissection does not propagate an undesired plane. During the evolution of the taTME technique teaching cues have been developed to help guide surgeons into recognising the correct plane. Identification of a triangle, created by traction on the rectum, indicates a dissection point at the apex of this triangle. The transgression of a new plane is indicated when an 'O' is created (7). Whilst this does not necessarily mean that the incorrect plane has been entered it should highlight the surgeon's need to re-evaluate their dissection.

The higher pressure insufflation may also be used transiently when venous bleeding is encountered until definitive control is achieved. Modern gas insufflation systems are also highly effective at removing diathermy plume whilst maintaining a constant pressure level. This consistent pressure control helps to minimise the bellowing effect that was seen in early attempts at taTME. Newer instruments, specifically designed for taTME, are also available which have smoke evacuation inbuilt to aide visualization.

Improved ergonomics

Having the capacity for two team synchronous surgery not only provides the potential for time saving in a prolonged laparoscopic procedure, it also allows for a facilitated level of cooperation during pelvic dissection. Aspects of the dissection that are more difficult from above can be tackled via the trans anal route and vice versa. Manipulation of the specimen or surrounding structures can also be performed from proximal or distal approaches. Providing co-ordinated traction helps to display the correct planes and improves diathermy dissection. Transillumination of tissues between operative fields can also guide the plane of dissection.

The use of an extended length laparoscope, in the trans-anal approach allows the assistant to manage the view whilst minimizing collisions with the operating surgeon. Articulating laparoscopes have also been used to improve the field of vision, particularly if the trans anal dissection is continued more proximally.

A variety of instruments have been used in the trans anal approach. These include those designed for use in trans anal endoscopic microsurgery (TEM) as well as articulating instruments originally designed for use in single incision laparoscopic surgery (SILS). Some of these instruments have discontinued production while new products are on the horizon. Robotic taTME dissection has also been described, bringing with it all of the advantage of an increased range of

movement within the confined operating space.

Tumour identification and specimen

Dictating the level of dissection by the trans anal route provides a more accurate means of determining the distal resection margin from the tumour as it is able to be directly visualised. Abbott *et al.* highlighted this aspect with a positive distal resection margin of zero % in the early Australian and New Zealand experience of 112 patients (8). The trans-anal approach can facilitate a low, hand sewn or stapled, coloanal anastomosis. In very distal tumours, it may be necessary to commence the rectotomy prior to insertion of the trans-anal platform and complete a restorative procedure that may be beyond the double stapled abdominal approach. The pursestring suture is clearly key in this aspect of the procedure to prevent the spillage of tumour cells and stool, and to stop any insufflation of the proximal colon. A further figure-of-eight reinforcing suture is recommended in the protocol of the Color III TaTME trial.

Excellent quality of the TME specimen was shown in two large randomised studies of open *vs.* laparoscopic approaches to rectal cancer (9,10). A complete, or nearly complete TME was obtained in 97% and 92.1% of laparoscopic specimens.

Natural orifice specimen extraction

Minimally invasive surgery should be exactly that, and where appropriate delivering the resected specimen by the trans anal route reduces the number and size of abdominal incisions. It should be emphasised that not all specimens are suitable for trans anal extraction and bulky tumours are better delivered through an appropriately sized abdominal incision to avoid disruption of the specimen (11).

Anastomosis

Several methods of anastomosis have been described with taTME (12). The use of a double pursestring to facilitate end to end stapled anastomosis in taTME avoids cross stapling of the rectum. This technique is by no means new to taTME however the ability to accurately place the rectal pursestring is a clear advantage. This is of particular relevance when laparoscopically there may have been multiple firings of the stapler to complete rectal transection. The redundant lateral 'dog ears' of a stapled rectum are also avoided.

Structured training programs

TaTME represents an unfamiliar approach to familiar anatomy and to translate the early adopters' experience a number of structured training programs have been developed and reported in the literature (8,13-15). In addition, the European Society of Coloproctology (ESCP) has been developing a new consensus statement with the aim to produce guidelines regarding safe implementation and application of TaTME. Active collaboration with other colorectal societies has been sought.

Summary

The adoption of the taTME approach combines the surgical standard of total mesorectal excision with modern minimally invasive techniques to provide numerous advantages for the surgeon. As with other emerging techniques, there have been concerns regarding complications and patient outcomes for taTME. A structured approach to teaching of the procedure aims to address these concerns and ensure consistent results. The registry for taTME procedures provides important data for the assessment of outcomes and can be used to identify common factors in those cases with suboptimal results.

Emerging robotic technologies provide further scope for adaptation of the taTME technique with improved articulation and ergonomics for the operating surgeon. Current practice generally reserves the use of taTME for those cases that are predicted to be of a more challenging nature. It may be that as more surgeons become proficient in the technique this approach will change to a more widespread uptake. The TaTME technique is an additional important approach for the "toolbox" of the colorectal surgeon.

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