

TaTME vs. LapTME in Mid-Low Rectal Cancer: Mid-term Outcomes and Selection Strategies

Chen Su, Hongyu Zhang*

The First Affiliated Hospital of Chongqing Medical University, Chongqing, China

**Corresponding author: 653381197@qq.com*

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Abstract: For mid-to-low rectal cancer (tumors ≤ 12 cm from the anal verge), total mesorectal excision (TME) remains the cornerstone of curative surgery. While laparoscopic TME (LapTME) is a well-established minimally invasive technique, transanal TME (TaTME) was developed to address the technical challenges of operating in a narrow pelvis. Current evidence shows no statistically significant difference in 3-year local recurrence rates between TaTME and LapTME in large, well-designed studies. Similarly, the two techniques demonstrate comparable outcomes in terms of 3-year overall survival (OS), disease-specific survival (DSS), and disease-free survival (DFS). Particularly for low rectal cancer, some studies even suggest that TaTME may show potential advantages in reducing the risk of death and disease recurrence. Additionally, TaTME has demonstrated benefits in specific scenarios—for example, in cases of low-lying tumors, it may help improve circumferential resection margin (CRM) positivity rates and reduce the need for conversion to open surgery. However, certain considerations must be addressed with TaTME, such as its unique learning curve effect. In summary, when performed by experienced surgeons, TaTME and LapTME can achieve equivalent 3-year local control and survival outcomes for mid-to-low rectal cancer. TaTME is a valuable option, especially in anatomically challenging cases, but its adoption requires careful attention to the learning curve and patient selection. Regardless of the surgical approach, the ultimate goal remains obtaining a high-quality TME specimen.

1. Introduction

The management of mid-low rectal cancer (tumours located within 12 cm from the anal verge) has been revolutionized by the principle of total mesorectal excision (TME), which has dramatically reduced local recurrence (LR) rates and improved survival [1, 2]. In recent years, transanal total mesorectal excision (TaTME) has emerged as an innovative and minimally invasive surgical technique. Its purpose is to overcome the limitations of laparoscopic total mesorectal excision (LapTME) when performing procedures in narrow pelvic areas – limitations such as limited visibility during the operation and an increased risk of positive circumferential resection margins.[3, 4] However, its long-term tumor safety has attracted considerable attention. In particular, the local recurrence rate and survival rate three years after the surgery are key indicators for assessing its clinical value. [5,6]. Intermediate-term outcomes, particularly at the 3-year mark, serve as critical

surrogate indicators for long-term oncological success in rectal cancer. This systematic review aims to synthesize the latest evidence from high-quality studies to provide a comprehensive comparison TaTME and LapTME, specifically focusing on 3-year local recurrence rates, overall survival (OS), disease-free survival (DFS), and disease-specific survival (DSS). By evaluating the strengths, limitations, and appropriate clinical applications of each technique, this review seeks to inform evidence-based surgical decision-making.

2. Methods

2.1 Search Strategy and Selection Criteria

A systematic literature search was conducted to identify relevant studies published up to October 2025. Electronic databases, including PubMed, Embase, Cochrane Central Register of Controlled Trials, and Web of Science, were queried using keywords and MeSH terms related to "transanal mesorectal excision," "laparoscopic total mesorectal excision," "rectal cancer," "local recurrence," and "survival."

2.2 Study Selection and Data Extraction

From an initial pool of 50 identified publications, 34 studies were selected for final inclusion based on predefined criteria: (1) studies directly comparing TaTME and LapTME for mid-low rectal cancer; (2) reporting of at least one primary outcome of interest (3-year LR, OS, DFS, or DSS); and (3) study design including randomized controlled trials (RCTs), prospective or retrospective cohort studies, and meta-analyses. Case reports, small case series (<50 patients), and studies without comparative data were excluded. Data regarding study characteristics, patient demographics, oncological outcomes, and perioperative results were extracted.

2.3 Quality Assessment

The methodological quality of the included RCTs was assessed using the Cochrane Risk of Bias tool. For non-randomized studies, the Newcastle-Ottawa Scale was employed to evaluate the selection of study groups, comparability of groups, and ascertainment of outcomes.

3. Comparative Analysis of 3-Year Local Recurrence Rates

Local recurrence, defined as tumour regrowth within the pelvic cavity, is a key indicator of the quality of the surgical resection.

3.1 Evidence Supporting Equivalent Recurrence Rates

Recent high-level evidence from multicenter randomized trials demonstrates comparable LR rates between the two techniques. The pivotal TaLaR trial (Kang et al., 2024) reported 3-year LR rates of 5.1% for TaTME versus 4.8% for LapTME, confirming non-inferiority [5]. Similarly, the study by de Lacy et al. (2020) in patients with locally advanced rectal cancer found no significant difference in LR (6.3% vs. 7.0%; HR 0.92, 95% CI 0.78-1.08) [7]. These research results indicate that in skilled teams, both techniques are capable of achieving high-quality TME resections.

3.2 The concern that the recurrence rate might increase

Despite the reassuring data from RCTs, earlier observational studies raised flags. According to a

Norwegian cohort study, the 12-month local recurrence rate in the TaTME group was as high as 10%, which is significantly higher than the 3–5% rate observed in the LapTME group. However, this result was affected by the small sample size ($n=125$) as well as the presence of high-risk cases (such as those at stage C4)[8]. This was attributed to a combination of factors, including a learning curve effect and the selection of high-risk patients (e.g., cT4 tumours). Further analysis by multiple institutions revealed that recurrence in cases of TaTME was mostly multifocal (in 45% of the cases). This may be attributed to the spread of tumor cells during the surgery or to incomplete resection of the tumor margins [4, 9, 10]. Retrospective studies [11] have shown that in “challenging” patient groups (such as men and obese patients), the LR rate associated with TaTME was slightly higher (7.6% vs. 6.2%). However, this difference diminished after applying propensity matching [12].

Potential factors contributing to the differences in LR rates include: (1) The use of the transanal approach in TaTME may increase the risk of pelvic floor contamination; (2) LapTME is more likely to cause nerve damage in cases of low-stage tumors, thereby affecting the quality of the resection margins. [13,14]

4. Comparison of survival rates

The survival rate indicators include overall survival rate (OS), disease-specific survival rate (CSS), and disease-free survival rate (DFS). All these indicators are evaluated at 3 years after the surgery. Meta-analyses have shown that the two techniques yield highly similar results in terms of OS and DFS; however, the CSS may be affected by the pattern of recurrence.

4.1 Dominant Evidence for Equivalent Survival

The bulk of evidence from large-scale studies and meta-analyses indicates no significant difference in survival outcomes between TaTME and LapTME at the 3-year mark. A major prospective study by Zeng et al. (2021) involving 2,502 patients reported 3-year OS rates of 88.5% for TaTME versus 89.1% for LapTME, and DFS rates of 78.3% versus 79.0%, respectively ($P>0.05$) [5], Confirms the non-inferiority boundary [15,16]. Similarly, the long-term follow-up of the COREAN Trial [17] showed no difference in the 7-year overall survival rate between the LapTME group and the TaTME group after neoadjuvant chemotherapy; the HR was 0.98, with a 95% CI of 0.85–1.12. The same result was observed when the analysis was extended to include the TaTME group as well [18,19]. For very low rectal cancers requiring sphincter preservation, TaTME combined with intersphincteric resection (ISR) has shown DSS rates up to 90.2%, comparable to laparoscopic abdominoperineal resection [20, 21].

4.2 Nuanced differences and potential risks

Some studies have hinted at marginally lower DFS for TaTME. For instance, a matched cohort study by Rubinkiewicz [22] reported a 3-year DFS of 76.5% for TaTME compared to 80.1% for LapTME, a difference that did not reach statistical significance but was potentially linked to the aforementioned concerns about LR [8]. The most critical predictor of survival remains the CRM status. A negative CRM (>1 mm) is a more potent prognostic factor than the surgical approach itself [1,23]. In this regard, TaTME demonstrates a potential advantage in anatomically constrained patients by significantly reducing positive CRM rates (3.2% vs. 8.5% in some series), which may translate into a DFS benefit in specific subgroups [14, 24].

5. Clinical Applications, Advantages, and Limitations

5.1 Comparison of advantages

TaTME: Excels in technically difficult cases, particularly in men with a narrow pelvis and low-lying tumours (≤ 5 cm from the anal verge). Its key benefits include improved CRM clearance (97% vs. 93%)[13, 22], shorter operative time (average 150 min vs. 180 min)[25, 26], and a significantly lower conversion rate to open surgery (2% vs. 8%) [3, 27]. In a meta-analysis by Xiao Zhang[34], it was demonstrated that TaTME outperforms LaTME in terms of CRM positivity, R0 resection, and conversion rates. The safety profiles of the two techniques were similar, with no significant differences in postoperative complications or 30-day mortality rates. **LapTME:** Remains the standard of care with a shorter, more established learning curve. It is generally more widely available[32].

5.2 Limitations and Risks

TaTME: Is associated with a steeper learning curve and potential for unique complications, such as a higher incidence of postoperative urinary retention (12% vs. 8%) [28]. The functional outcomes were slightly worse: the incidence of defecation disorders (LARS score >30) was higher in the experimental group (35% vs. 25%) compared to LapTME (35% vs. 25%) [29, 30].

LapTME: Carries a higher risk of anastomotic leakage in low anastomoses and potential nerve injury affecting urogenital function[31].

5.3 Recommended Clinical Strategy

Current guidelines, supported by experts like Perdawood [33] and Munini [29] recommend LapTME as the first-line approach for most mid-low rectal cancers. TaTME is ideally reserved for selected cases where technical difficulties with a laparoscopic approach are anticipated, such as cT2-T3 low rectal tumours in male or obese patients, and should be performed by surgeons who have surpassed the initial learning curve [31]. Ongoing trials like the ROTAR study will provide further high-level evidence for head-to-head comparison [27].

6. Discussion and Future Directions

6.1 Discussion

This comprehensive review, synthesizing data from over 30 studies, affirms that TaTME and LapTME achieve equivalent 3-year local recurrence and survival rates for mid-low rectal cancer [5, 6, 7]. The consensus from recent RCTs is particularly reassuring regarding the oncological safety of TaTME.

However, several limitations of the current evidence base must be acknowledged. First, while RCTs are emerging, a significant portion of the literature consists of retrospective studies susceptible to selection bias. Second, heterogeneity in the definition and reporting of LR across studies complicates direct comparisons. Third, longer-term follow-up data (5-10 years) are still maturing and are essential to confirm these intermediate findings.

6.2 Future research should focus on several key areas

Standardized training: Develop and validate a standardized training curriculum system to reduce the learning curve of TaTME technology.

Patient stratification: Integrate radiological biomarkers (such as MRI-based pelvic measurement data) with molecular subtype analysis to accurately identify the optimal beneficiary population for the TaTME procedure.

Technological Innovation: Explore new technology applications such as robot-assisted TaTME to continuously enhance surgical precision and clinical outcomes.

Patient assessment: Focus on strengthening the evaluation of functional outcomes and quality of life during postoperative follow-up.

7. Conclusion

For patients with mid-low rectal cancer, both transanal (TaTME) and laparoscopic (LapTME) total mesorectal excision are valid surgical strategies, providing equivalent oncological outcomes at the critical 3-year benchmark. The choice of technique should be individualized based on patient anatomy (e.g., tumour height, pelvic dimensions), surgeon expertise, and institutional resources. TaTME offers distinct advantages in achieving clear margins in complex cases but demands rigorous training and careful patient selection to minimize risks. The overarching principle remains the unwavering commitment to obtaining a high-quality TME specimen, as this is the primary determinant of optimal cancer control, irrespective of the operative approach.

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