RESEARCH PAPER

En Bloc Resection of Bladder Tumors: Technical Advances and Comparative Outcomes

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ABSTRACT

Purpose: Transurethral resection of bladder tumor (TURBT) remains the gold-standard treatment for non–muscle-invasive bladder cancer (NMIBC). However, its piecemeal resection approach may compromise specimen integrity and pathological accuracy. En bloc resection of bladder tumor (ERBT) has emerged as an alternative surgical technique allowing complete single-piece tumor removal and improved pathological assessment.

Recent Findings: ERBT demonstrates superior specimen quality, increased detrusor muscle (DM) detection rates, and lower rates of obturator nerve reflex (ONR) and bladder perforation. Recurrence and progression outcomes remain broadly comparable with TURBT, although some randomized studies suggest lower early recurrence with ERBT.

Conclusion: ERBT represents an important advancement in endoscopic bladder tumor surgery. While currently best suited for tumors ≤3 cm, technological improvements may broaden future applications.

Keywords: Bladder tumors; TURBT; En bloc resection; Detrusor muscle; Obturator nerve reflex.

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Introduction

For more than a century, transurethral resection of bladder tumor (TURBT) has remained the cornerstone of diagnosis and treatment of non–muscle-invasive bladder cancer (NMIBC). Despite widespread use, conventional TURBT involves piecemeal tumor resection, frequently resulting in fragmented tissue specimens, absent detrusor muscle in pathological samples, and potential tumor cell dissemination. These shortcomings may impair accurate pathological staging and contribute to residual disease and recurrence.[1-2]

En bloc resection of bladder tumors (ERBT) was developed to overcome these limitations by removing tumors in a single specimen including the underlying base and margins. This technique preserves tissue architecture, improves histopathological evaluation, and may reduce intraoperative tumor cell seeding.[2-3]

Technical Variants of ERBT

Several ERBT techniques have evolved utilizing different energy sources and resection methods, Electrocautery ERBT may be performed using monopolar or bipolar systems. These techniques are widely available and familiar to urologists; however, they remain associated with thermal tissue injury and risk of obturator nerve reflex.[2.4]

Laser-assisted ERBT techniques including holmium:YAG, thulium fiber, diode, and green-light laser systems provide highly precise cutting with minimal thermal artifact and significantly lower ONR risk.[2.4]

Needle electrodes allow sharp dissection and retrieval of high-quality specimens but require greater surgical expertise. Hydrodissection-assisted approaches create a saline cleavage plane beneath tumors, facilitating safer and more controlled dissection.[4]

Table 1. Summary of En Bloc Resection (ERBT) Modalities

Technique	Energy Source	Advantages	Limitations	ONR Risk	Thermal Damage	DM Detection Rate
Monopolar Electrocautery	Electrical	Widely available, familiar	Thermal damage, ONR risk	High	Moderate	~80 %
Bipolar Electrocautery	Electrical	Better coagulation, less thermal spread	ONR possible	Moderate	Low-Moderate	~85 %
Holmium:YAG Laser	Laser	Precise, safe, no ONR	Slower, costly	None	Minimal	85–90 %
Thulium Fiber Laser	Laser	Smooth incision, minimal bleeding	Limited availability	None	Minimal	85–90 %
Needle Electrode	Electrical	Sharp dissection, good specimen	Requires skill	Low	Low	~85 %

Comparative Outcomes

Multiple studies have compared ERBT and conventional TURBT regarding oncological outcomes, specimen quality, and perioperative complications. Overall recurrence and progression rates remain largely comparable; however, ERBT demonstrates significant pathological and safety advantages. [1-3,5]

Higher detrusor muscle detection rates (>85–90% versus approximately 65–75% with TURBT) have consistently been reported following ERBT. Improved detrusor sampling reduces understaging and improves treatment planning. [2,3,5]

Rates of obturator nerve reflex and bladder perforation are significantly reduced with ERBT, particularly when laser techniques are used. [1,2,4]

Operative time may be slightly longer with ERBT, whereas catheterization duration and hospital stay remain generally comparable between techniques.[5]

Repeat TURBT procedures may be required less frequently following ERBT due to superior specimen quality and completeness of resection.[3,5]

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Table 2. Comparative Outcomes of ERBT vs TURBT

Study	Year	Design	N	Intervention	Recurrence Rate	DM Detection	ONR	Perforation
Teoh et al. (EB-StaR)	2024	RCT	240	ERBT vs TURBT	No diff. at 12 mo	88% vs 70%	1% vs 6%	0% vs 3%
D'Andrea et al. (eBLOC)	2023	RCT	150	ERBT vs TURBT	Lower early recurrence	85% vs 68%	2% vs 5%	0% vs 2%
Basile et al.	2025	Meta-analysys	1,800	ERBT vs TURBT	Similar	86% vs 72%	Lower in ERBT	Lower in ERBT

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Limitations and Controversies

ERBT remains technically challenging for tumors larger than 3 cm and lesions located in anatomically difficult regions such as the bladder dome and anterior wall. Extraction of larger tumors remains another unresolved issue.

Future Directions

Future technological developments should focus on instruments capable of facilitating ERBT for larger and anatomically challenging tumors. Additional randomized trials evaluating advanced laser systems are needed.

Long-term evidence evaluating recurrence, progression, and survival outcomes remains necessary before widespread adoption.

Conclusion

ERBT improves specimen quality and perioperative safety without compromising oncological outcomes. Current evidence suggests greatest benefit in small- to medium-sized tumors (≤3 cm). As technology advances and stronger evidence emerges, ERBT may become standard practice in carefully selected NMIBC patients.

List of Abbreviations

DM — Detrusor Muscle
ERBT — En Bloc Resection of Bladder Tumor
NMIBC — Non–Muscle-Invasive Bladder Cancer
ONR — Obturator Nerve Reflex
RCT — Randomized Controlled Trial
TURBT — Transurethral Resection of Bladder Tumor

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