A Review of Bipolar En Bloc Resection in Non-Muscle-Invasive Bladder Cancer Management

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ABSTRACT

Introduction

In the management of non-muscle-invasive bladder cancer (NMIBC), bipolar en bloc resection of bladder tumors (ERBT) has emerged as a promising alternative to transurethral resection (TURBT).

Materials and Methods

There has been an increase in comparative studies, randomized clinical trials, multi-institutional analyses, as well as guideline recommendations in the last decade, and the evidence in this review summarizes the evidence from these studies.

Results

The histopathological quality of ERBT is generally superior across most series, with detrusor muscle present in 90–100% of specimens as opposed to 58–80% for TURBT. Reduced obturator reflexes, fewer perforations, and shorter catheterizations are some of the perioperative advantages. During the mid-term oncologic follow-up period, early recurrence rates are consistently reduced (30-60% relative risk reduction at 6-12 months), while progression rates remain similar.

Conclusions

Using data from the Phase 3 randomized trial eBLOC, European Association of Urology (EAU) guidelines, and numerous reviews, this review evaluates ERBT's impact on perioperative and oncologic outcomes, identifies clinical practice implications, and outlines future research needs by integrating high-quality data from these sources.

Keywords:bipolar en bloc resection of bladder tumors (ERBT), non-muscle-invasive bladder cancer (NMIBC), TURBT

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Introduction

Non–muscle-invasive bladder cancer accounts for 70–75% of newly diagnosed bladder tumors worldwide and remains characterized by high recurrence and frequent need for repeat intervention [3,11]. Conventional TURBT has been the cornerstone of initial management for decades, yet it is limited by specimen fragmentation, cautery artefact, and absence of detrusor muscle in up to one-third of cases [10,12]. These limitations hinder accurate staging, especially for T1 tumors, and contribute to guideline-mandated re-TURBT in many situations.

En bloc resection (ERBT) [Figure 1], initially developed using laser platforms and subsequently adapted to bipolar plasma energy, aims to remove the entire tumor—including the stalk and detrusor—in a single, intact specimen. This approach is hypothesized to improve pathological interpretation, reduce tumor cell dissemination, and enhance perioperative safety [1,4,7].

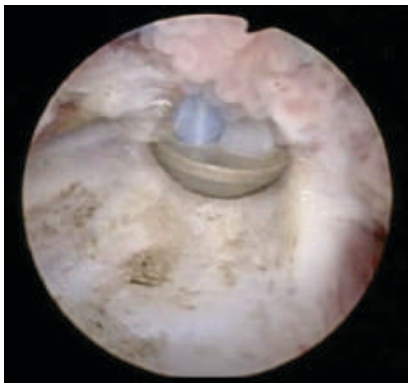


Figure 1. Bipolar ERBT Instrumentation and Dissection Technique

The recent expansion of high-level evidence—including randomized trials such as eBLOC and multiple institutional comparisons—has renewed interest in bipolar ERBT as a modern alternative to standard TURBT [6,13]. The aim of this review is to synthesise data from user-provided references and additional peer-reviewed literature to provide a comprehensive assessment of the effectiveness of ERBT on perioperative outcomes and oncologic impact.

Methods

As a result of a narrative review methodology being applied, multiple trials and studies were integrated with different endpoints being able to be assessed, as shown in Table

Table 1. Review methodology and endpoints evaluated

Review methodology
Prospective comparative trials
Randomized controlled trials (Gallioli 2023; eBLOC 2023)
Systematic reviews and meta-analyses
Institutional cohort studies
European guidelines (EAU 2024–2025)
Endpoints evaluated
Histopathological quality (detrusor presence, intact specimens) Intraoperative safety (obturator reflex, perforation)
Perioperative metrics (catheterization, length of stay, operative time)
Medium-term oncologic outcomes (6–24-month recurrence and progression)
Technical Considerations and Study Characteristics

Multiple technological adaptations of ERBT exist, including holmium laser, thulium laser, hybrid laser-bipolar systems, and fully bipolar electrosurgical platforms [4,7,8]. It can be said that bipolar ERBT is the most widely adopted technique because it uses standard resectoscope infrastructure while enabling controlled and precise dissection at the same time. Guidelines including EAU 2024–2025 recognize ERBT as an evidence-supported option in selected NMIBC cases, particularly for solitary tumors ≤3 cm [Figure 2] [3,11]. In Table 2, you can see some of the most important characteristics of major studies that have been conducted.

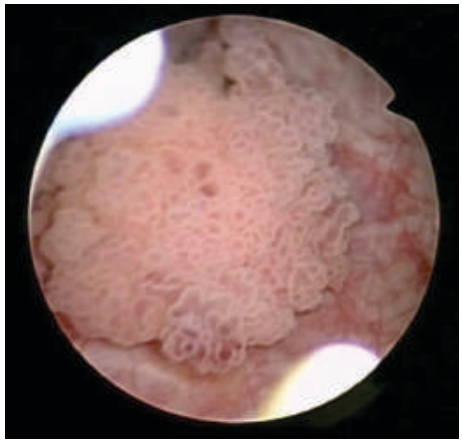


Figure 2. Solitary Non–Muscle-Invasive Bladder Tumor ≤3 cmd

Table 2. Key characteristics of major studies:

Study	Characteristics
Geavlete 2020	Feasibility and safety of bipolar ERBT, with high specimen integrity and minimal thermal artefact [1]
Bălan 2018	Prospective comparison of bipolar ERBT vs monopolar TURBT in 90 patients; perioperative outcomes and recurrence [2]
Teoh 2023	Comprehensive global review documenting ERBT evolution and consistent improvements in specimen quality [4]
Fankhauser 2021, Fritsche 2022, and Kramer 2017	Detailed systematic evaluations of ERBT techniques, safety, and early outcomes [5,7,8]
eBLOC Trial (2023)	Largest randomized controlled multicenter study to date comparing ERBT vs TURBT [6]
Gallioli 2023	RCT: Demonstrated reduced residual disease and enhanced resection quality [13]

As a rule of thumb, the two main directions to follow when it comes to histopathological outcomes are detrusor muscle presence along with fragmentation and margins. Regarding the first direction, it is important to assess the presence of detrusor muscle as it is a critical indicator of the quality of the bladder biopsy. Proper evaluation of fragmentation and margins can provide insights into the extent of tumor invasion and help guide treatment decisions. ERBT's most reproducible advantage is superior specimen quality:

·**ERBT**: 90–100% detrusor presence [Figure 3] (Geavlete 2020; Bălan 2018; Teoh 2023; Fankhauser 2021; Fritsche 2022) [1,2,4,5,7]

·**TURBT**: 58–80% detrusor presence (Bălan 2018; Brausi/EORTC 2015; Teoh 2020) [2,9,10]

The EAU guidelines emphasize detrusor presence as a critical quality indicator, directly influencing the need for early re-TURBT [3,11].

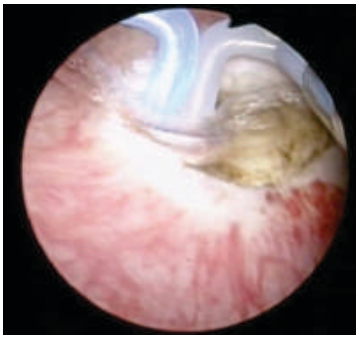


Figure 3. ERBTWith Detrusor Presence

With regard to fragmentation and margins, it is clear that intact monobloc specimensas shown in [Figure 4], obtained via ERBT provide clear margin assessment, accurate staging (particularly T1), as well as a reduced amount of cautery artifact compared to monopolar TURBT [4,5,7]. This allows for more precise evaluation of tumor characteristics and enhances the ability to determine appropriate treatment strategies. Additionally, the reduced thermal damage associated with ERBT may improve the accuracy of molecular testing and histopathological analysis, further supporting its clinical utility.

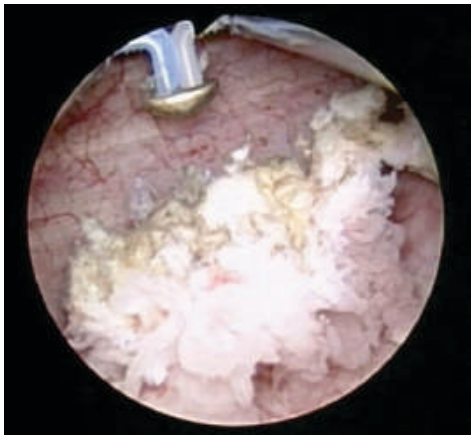


Figure 4. Monobloc Specimen Obtained via Endoscopic En Bloc Resection

To ensure the safety and recovery of the patient, a few steps need to be taken in order to make sure that the patient is taken care of. Firstly, intraoperative safety is one of the most important factors. According to the majority of comparative studies, the obturator reflex is significantly reduced in ERBT due to the controlled use of bipolar energy and the avoidance of deep lateral wall cuts [1,6,8]. ERBT is known to have a lower rate of bladder perforation than TURBT, especially with lesions that affect the lateral wall of the bladder [2,4]. Another step is catheterization and hospital stay. Based on consistent trends, an ERBT requires 1–2 days of catheterization, while a TURBT requires 2–4 days of catheterization. In several studies, the length of stay was reduced by one day [1,2,5]. The operating time should be taken into consideration, as it can be slightly longer in the early stages of adoption, but comparable or shorter once proficiency has been achieved in the implementation [4,7,13].

Oncologic outcomes are primarily evaluated in terms of recurrence, residual tumor after TURBT, and progression. Recurrence rates indicate the likelihood of the tumor returning, residual tumor at Re-TURBT reflects incomplete initial removal, and progression assesses whether the cancer has advanced to a more aggressive stage. Together, these factors provide critical insights into the effectiveness of interventions.

As far as the recurrence is concerned, this is an area that needs to be carefully evaluated.It is essential to assess recurrence rates in patients over time to determine the effectiveness of treatment and identify any potential risk factors. This evaluation helps in refining therapeutic approaches and improving long-term patient outcomes. There has been a consistent reduction in early recurrence among cohorts that have undergone ERBT: 30–60% relative risk reductions at 6–12 months (Teoh 2020; Teoh 2023; Fritsche 2022; eBLOC 2023; Gallioli 2023) [4,6,7,9,13]. There are several possible mechanisms responsible for this, including: reduced tumor cell dispersion, better margin control, and improved staging that ensures appropriate adjuvant therapy can be provided.

There is a marked difference between ERBT and TURBT cohorts when it comes to the residual tumor at Re-TURBT: remaining disease: 0-10% where as TURBT has residual tumors of 20-40% (Bălan 2018; Gallioli 2023; eBLOC 2023) [2,6,13].
At the medium term follow-up, the progress of the proposed interventions seems to have not differed significantly from the baselines.As a result of accurate staging, risk can be decreased over a long period of time, but data on this remains immature [3,7,11].

The impact on Re-TURBT requires intact tumor removal and reliable detrusor sampling. This model explains a 5–10% RE-TURBT rate (ERBT) and a 20–40% re-TURBT rate (TURBT) [2,10,11,12]. There are both clinical and economic benefits associated with this approach.

Discussion

Currently, there is an overwhelming amount of evidence that bipolar ERBT is a superior alternative to conventional TURBT for selected patients with NMIBC. In general, the technique produces the following results:

- Better pathological assessment
- Fewer perioperative complications
- Lower early recurrence
- Reduced need for re-TURBT

These advantages are reinforced by high-quality RCTs and guideline-level endorsements.
However, limitations persist:

- Most studies restrict tumors to ≤3 cm
- Operator experience varies
- Long-term progression data remain limited
- Lack of uniform adoption prevents standardized training

The future directions of ERBT training are expected to include multicenter RCTs with 5-year follow-ups and standardized curricula for ERBT training.

Conclusions

Compared with conventional TURBT, bipolar ERBT provides significant advantages in terms of specimen quality, perioperative safety, and early oncologic outcomes compared to conventional TURBT. As a result of robust evidence generated by multicenter studies, randomized trials, and the contemporary EAU guidelines, ERBT is gaining momentum as an evidence-based, superior treatment option for the management of selected cases of NMIBC. In the future, long-term data will help determine whether or not it can be considered a new standard of care.

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