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INTEGRATED STUDY MASTER'S THESIS

En-Bloc Resection of Bladder Tumor. Literature Review and Case Report

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Master thesis: En-bloc resection of Bladder Tumor. Literature Review and Case Report

1. Summary

The standard for the treatment of non-muscle invasive bladder cancer (NMIBC) has long been the transurethral resection of bladder tumors (TURBT). This method is practical and feasible. However, there are also some concerns regarding this resection method. Conventional TURBT does not respect standard oncological surgery principles, meaning it does not avoid unnecessary handling of the tumor and causes fragmentation of the tumor, which can lead to tumor cell seeding and, in turn, increases the likelihood of recurrence or metastases. To address this problem, surgeons have developed a procedure for the *en bloc* resection of bladder tumors (ERBT). This method can avoid unnecessary tumor fragmentation and has been reported to provide improved quality specimens, thus aiding in the staging and subsequent treatment of the NMIBC.

Following a search of the PubMed database, reviews, RCTs, trials, and meta-analyses were chosen to provide insight into the current application of ERBT, including its surgical safety, feasibility, the quality of the specimens it provides for histopathological staging, and recurrence and progression rates. Different energy sources used in ERBT were compared with each other and with conventional TURBT (cTURBT).

The findings reveal a significant superiority of ERBT regarding resection quality, thus also improving the staging of NMIBC. ERBT is a safe and feasible procedure with lower complication rates, improved subsequent treatment, and better quality of life. The rate of recurrence and progression was similar or superior in ERBT versus conventional TURBT. However, there is a lack of studies focusing on the long-term follow-up of their patients, warranting additional research on this specific aspect.

2. Keywords

Bladder Cancer, NMIBC, En bloc, ERBT, Transurethral resection, TURBT

3. Introduction

Bladder cancer (BC) is the 10th most commonly diagnosed cancer worldwide. Most of the cases are NMIBC, for which the standard treatment is a transurethral resection of the bladder tumor (TURBT) (1). This method does not respect common principles applied in oncological surgery. The resection using electrocautery energy does not remove the tumor in an *en bloc* fashion, can increase the likelihood of an incomplete resection, and, most importantly, impacts the quality of the resected specimen needed for accurate staging of the disease. Accurate staging is essential since it determines the required subsequent treatment. A good quality specimen can also omit the need for a second resection, which impacts the quality of life of the patients and is a financial burden (2,3).

An *en bloc* resection method for the treatment of bladder tumors (ERBT) is needed to combat these issues. Extensive research regarding this procedure has been conducted over the last decades. This paper's literature review and case report focus on evaluating the perioperative safety, feasibility, quality of resection, and recurrence-free survival (RFS) and progression rates following ERBT in comparison with conventional TURBT (cTURBT) and give a comprehensive overview of the most recent studies done on ERBT.

4. Methods

The literature search for this review was conducted using the PubMed/Medline database. The search included open-access, English language, RCTs, reviews, meta-analyses, multi- and single-center studies, and cohort studies published within the last five years, focusing on the comparison between ERBT and cTURBT regarding oncological and perioperative outcomes.

5. Bladder Cancer

5.1. Definition

NMIBCs are defined as Ta tumors, which are confined to the mucosa, and T1 tumors, which invade the lamina propria. Tis tumors are high-grade (HG) intra-epithelial tumors that are confined to the mucosa and are classified as carcinoma in situ (CIS). The treatment for the abovementioned tumors includes TURBT, which is why they are defined as NMIBCs. (1)

5.2. **Table 1:** *Classification of Bladder Cancer*

2017 TNM classification of urinary bladder cancer		
T – primary tumor		
TX	Primary tumor cannot be assessed	
T0	No evidence of primary tumor	
Ta	Non-invasive papillary carcinoma	
Tis	Carcinoma in situ: ‘flat tumor’	
T1	Tumor invades subepithelial connective tissue	
T2	Tumor invades muscle	
	T2a	Tumor invades superficial muscle (inner half)
	T2b	Tumor invades deep muscle (outer half)

Table 1: Classification of Bladder Cancer (continued)

T3	**Tumor invades perivesical tissue**	
	T3a	Microscopically
	T3b	Macroscopically (extravesical mass)
T4	Tumor invades any of the following: prostate stroma, seminal vesicles, uterus, vagina, pelvic wall, abdominal wall	
	T4a	Tumor invades prostate stroma, seminal vesicles, uterus or vagina
	T4b	Tumor invades pelvic wall or abdominal wall
N – regional lymph nodes		
NX	Regional lymph nodes cannot be assessed	
N0	No regional lymph node metastasis	
N1	Metastasis in a single lymph node in the true pelvis (hypogastric, obturator, external iliac, or presacral)	
N2	Metastasis in multiple regional lymph nodes in the true pelvis (hypogastric, obturator, external iliac, or presacral)	
N3	Metastasis in common iliac lymph node(s)	
M – distant metastasis		
M0	No distant metastasis	
M1a	Non-regional lymph nodes	
M1b	Other distant metastasis	

Note. From: "EAU Guidelines on Non-muscle-invasive Bladder Cancer (TaT1 and CIS)", 2025, Gontero P, Birtle A, Compérat E, Dominguez Escrig JL, Liedberg F, Mariappan P, et al., European Association of Urology, p. 9, Copyright by Gontero, Birtle, Compérat, Dominguez Escrig, Liedberg, Mariappan et al. (1)

5.3. Epidemiology

Bladder cancer (BC) is the 10th most commonly diagnosed cancer among men and women worldwide. It is more commonly found in men and makes up the seventh most common cancer among them. Worldwide, the age-standardized incidence rate (100,000 persons/year) is 9.5 and 2.4 in men and women, respectively. Within the European Union, the incidence rate is even higher, with 20 and 4.6 in men and women, respectively. (1)

The age-standardized mortality rate (100,000 persons/year) worldwide is 3.3 for men and 0.86 for women. The mortality rate varies significantly between countries due to different risk factors, healthcare practices, and accessibility. (1)

Most patients (75%) suffering from BC present to the urological consultant with a lesion(s) of stage Ta, CIS (confined to the mucosa), or T1 (confined to the submucosa). Young patients below the age of 40 are even more commonly diagnosed with Ta, CIS, or T1 disease. Fortunately, the long-term survival of these patients is much higher, thus also increasing the prevalence of these lesions. (1)

5.4. Etiology

Making up around 50% of BC cases, Tobacco is the most significant risk factor in the development of BC. The risk of developing BC increases with the smoking intensity and duration, with second-hand smoke also being associated with an increased risk. The aromatic amines and polycyclic aromatic hydrocarbons found in cigarette smoke are excreted renally and thus increase the risk of developing BC. (1)

Occupational exposure to the abovementioned aromatic amines, polycyclic aromatic hydrocarbons, and chlorinated hydrocarbons make up the second most important risk factor (10%) in the development of BC. This exposure occurs mainly in industrial settings where paints, metal, and petroleum products are processed. The exposure risk has been reduced in developed industrial settings. Recently, increased occupational exposure to diesel exhaust has also been defined as a risk factor. (1)

Some less important risk factors include genetic factors (which seem to have little impact on the development of BC), diet, environmental exposure (e.g., exposure to arsenic in drinking water), schistosomiasis, and exposure to pelvic ionizing radiation. (1)

5.5. Diagnosis

Patient history plays a central role in diagnosing BC. The main symptom of BC is hematuria, while gross hematuria is associated with a higher stage at the time of diagnosis. CIS may be suspected in patients presenting with lower urinary tract symptoms, mainly irritation on voiding.

While a physical examination is mandatory, it cannot reveal NMIBC. (1)

Different imaging modalities can be used to diagnose BC. Computed tomography (CT) urography is very useful in detecting papillary tumors in the urinary tract and may show filling defects and/or hydronephrosis. (1)

If CT is unavailable, intravenous urography (IVU) can be used as an alternative; however, CT urography is preferred because it can deliver more information about the detection of NMIBC.

Furthermore, ultrasonography (US) can be used in addition to physical examination; nevertheless, it cannot reliably differentiate between all possible causes of hematuria. (1)

The application of urinary cytology has a high sensitivity in the diagnosis of HG and G3 tumors (84%); however, in the diagnosis of LG/G1 tumors, the sensitivity is significantly lower (16%). Furthermore, the sensitivity of urinary cytology in the diagnosis of CIS varies greatly, ranging from 28-100%. It is essential to mention that a negative cytology does not exclude a diagnosis of urothelial carcinomas; thus, further tests are required. (1)

One of the most critical investigations in the case of a suspected carcinoma of the urothelium is a cystoscopy. The diagnosis of papillary BC is mainly based on this examination of the bladder and the following histological evaluation of the biopsied tissue. This procedure, which is often needed for an accurate diagnosis, is combined with a TURBT if any lesions are observed during the cystoscopy. (1)

5.6. Treatment

As mentioned before, the diagnosis and resection often go hand in hand in the case of bladder cancers. This is why some operative steps are necessary for successfully providing an accurate diagnosis and completely resecting the tumor. (1)

These include identifying the factors needed for an accurate assignment of disease risks, including the number of tumors observed, their size, their architecture, their location, whether there are any concerns for the presence of CIS, and whether the tumor is primary or recurrent. The clinical stage of the tumor can be assessed with a bimanual examination under anesthesia. Furthermore, during the cystoscopy, the size of the largest tumor can be measured using a cutting loop, which is approximately 1 cm wide, and the architecture of the tumor should be differentiated between sessile, nodular, papillary, mixed papillary or solid, and flat. Additionally, it is crucial to assess the adequacy of the resection, which includes, for example, a visually complete resection and a visualization of muscle at the base of the resection. It should also be noted if a tumor can be visualized in the distal ureter and if there are any complications, for instance, bladder perforation, during or following the TURBT. This documentation is of utter importance since it is used, in combination with the predicted tumor grade and stage, to assign patients to a post-TURBT single instillation of chemotherapy in the case of low-grade, non-invasive tumors or for patients with a muscle-invasive disease to be provided with definitive treatment. (1)

There are different surgical and technical aspects to be considered during the tumor resection. The specific technique used during TURBT is based on the observed size and location of the tumor, as well as the surgeon’s experience. (1)

In piecemeal resections, the tumor is excised in fractions. The exophytic part of the tumor, the underlying bladder wall, and the edges of the resection are resected separately. This method uses a loop with diathermy or mono- or bipolar current and provides good information about the extent of the tumor. (1)

En bloc resection, using mono- or bipolar current, Thulium-YAG, or KTP-Green light lasers, can be applied in some exophytic tumors. This method provides very high-quality specimens, with detrusor muscle present in 96-100% of cases. The accuracy of T1 staging and the possibility of sub-staging increases, while there is simultaneously a decrease in the risk for perioperative complications like bladder wall perforation. This method will be discussed in more detail below. (1)

It is of utmost importance to properly assess the resection quality since an absence of the detrusor muscle in the specimen is associated with an increased risk of residual disease, early recurrence, and the possibility of an upstaging of the tumor at a second-look TURBT. Consequently, the presence of detrusor muscle in the resection specimen is required (except for Ta LG/G1 tumors) and used as a criterion of resection quality. (1)

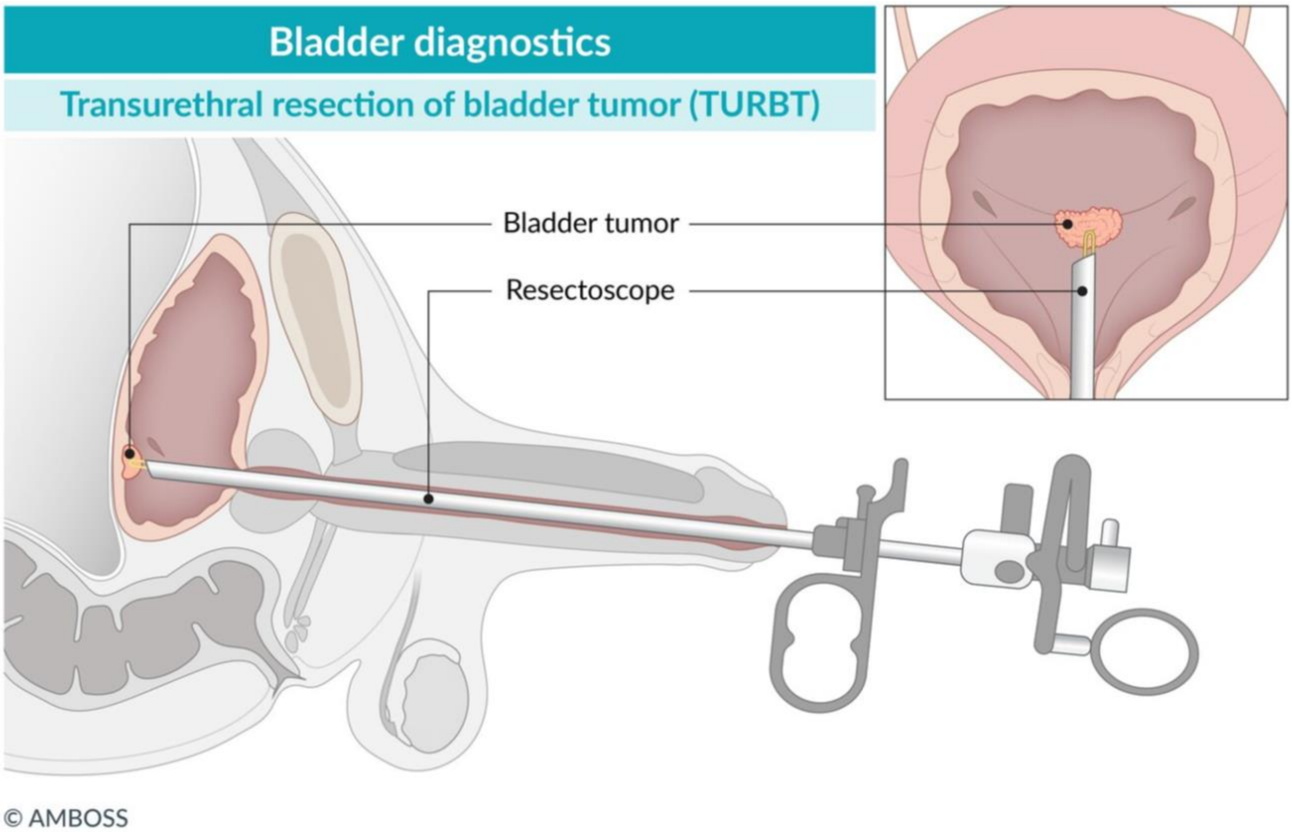


Figure 1: *Bladder diagnostics – TURBT*

Note. From: “Bladder diagnostics”, 2025, Amboss, copyright by Amboss. (4)

Table 2: *TURBT Checklist*

In the operating room (OR)	
Check the operating room setup	Instruments (sheath, resectoscope, loops, roller if needed, monopolar/bipolar), camera, video, strainer, specimen container, catheter if needed
Decide irrigation fluid	Saline, glycine, water
Disease characteristics	History of bladder cancer, tumor characteristics at cystoscopy if any, imaging results if any, first or second look, visual optimization planned (PDD/NBI), risk classification
Cystoscopy/TURB	
Cystoscopy	Urethra/prostate (men)
	Urethral orifices
	Diverticula
	Tumor location, number, size, appearance (papillary/sessile), CIS (yes/no)
	White light/PDD/NBI/IMAGE1 S™
	Urine for cytology/bladder wash
TURBT	Resection technique (standard/en bloc/cold cup/roller ball cautery)
	Depth of resection
	Complete/incomplete resection
	Prostatic urethra biopsy if performed
	Any additional procedure, i.e. retrograde contrast study
	Estimated blood loss
	Intra-operative complications, if any
	Intravesical chemotherapy if given or planned in recovery setting

Note. From: "EAU Guidelines on Non-muscle-invasive Bladder Cancer (TaT1 and CIS)", 2025, Gontero P, Birtle A, Compérat E, Dominguez Escrig JL, Liedberg F, Mariappan P, et al., European Association of Urology, p. 19, Copyright by Gontero, Birtle, Compérat, Dominguez Escrig, Liedberg, Mariappan et al. (1)

It has been reported that more experienced surgeons may have superior TURBT results. However, they can also be associated with a risk of complications, recurrence, and survival since resident doctors utilize the checklists more often, which is associated with a higher rate of detrusor muscle in the resection specimen. (1)

Apart from a specific treatment tailored to the grade and stage of the bladder tumor, general disease management is an essential factor. This especially includes the counselling of smoking cessation.

An alternative to TURBT and office-based fulguration is active surveillance. This method can be helpful in LG (G1) Ta tumors since they are more likely to recur as low-grade and non-invasive, and the risk of progression to a higher grade or stage is uncommon. However, it is essential to understand that active surveillance can only be applied in selected patients, and its success is predicted by prognostic variables associated with Ta LG tumors. (1)

Office-based fulguration and laser vaporization are also possible. These methods significantly reduce the therapeutic burden in patients with a history of small Ta LG/G1. (1)

As previously mentioned, bladder tumors commonly recur and may progress to MIBC, thus, an adjuvant therapy should be considered in all patients. (1)

One of these options is post-operative irrigation, which can be contemplated if intravesical chemotherapy is not applicable. (1)

Another option is intravesical chemotherapy, which can be applied as an immediate single instillation (SI) and acts by destroying circular tumor cells following the TURBT. It has an ablative effect on the residual tumor cells at the resection site and smaller tumors that may have been overlooked. Some of the positive effects of SI chemotherapy include a significant reduction in the recurrence rate compared to the application of TURBT alone. Unfortunately, only patients with primary tumors or recurrent tumors of intermediate risk with a previous recurrence rate of less than one recurrence per year and those with a 2006 EORTC recurrence score (5) of less than five benefited from SI chemotherapy. For the SI chemotherapy to be most effective, the prevention of the tumor cell implantation must be initiated within the first few hours after the TURBT. Preferably, the patient should receive the SI within two hours after the TURBT in the operating room or the recovery room. (1)

Furthermore, additional adjuvant intravesical chemotherapy instillations can be applied. The administration depends on the prognosis of the individual patient. For low-risk patients, SI chemotherapy reduces the risk of recurrence significantly and can be considered standard and complete treatment, whereas other patients may be incompletely treated with SI chemotherapy since they have a high risk of recurrence and/or progression. (1)

Adjusting the pH, the duration of the instillation, and the drug concentration can help improve the efficacy of intravesical chemotherapy. Additionally, there are some device-assisted intravesical chemotherapy methods, including Hyperthermic intravesical Chemotherapy, Microwave-induced

Hyperthermia Effect (RITE), Conductive Chemohyperthermia, and Electromotive Drug Administration, which can make the instillation more efficient. (1)

Another alternative is Intravesical Bacillus Calmette-Guérin (BCG) immunotherapy. The application of BCG after TURBT has been shown to be superior compared with TURBT alone, as well as TURBT plus chemotherapy, in the prevention of recurrence of NMIBC. The effect of recurrence prevention is long-lasting, and BCG delays and may even lower the tumor progression risk if a BCG maintenance schedule (for more detail, see the table below) is applied. There has been no observed superiority of one specific strain of BCG, even though 10 strains can be used. Unfortunately, BCG immunotherapy has more side effects than intravesical chemotherapy. Serious side effects, however, have been observed in less than five percent of patients and can be treated effectively in most cases. Respecting the contraindications for BCG immunotherapy is of utmost importance, as major complications may appear following systemic drug absorption. Not included in the contraindications are the presence of leukocyturia, asymptomatic bacteriuria, or nonvisible hematuria. Generally, antibiotic prophylaxis is not needed; BCG should be used cautiously in immunocompromised patients. (1)

5.6.1. **Table 3:** *The Management of Side Effects following BCG Immunotherapy*

Local side effects	
Cystitis	Phenazopyridine, propantheline bromide, NSAIDs
	Improvement of symptoms within a few days: continuation of treatment
	Persisting or worsening symptoms: a. Postpone instillations b. Urine culture c. Empirical antibiotic therapy
	Persisting symptoms under antibiotic therapy: a. Positive culture: adjust antibiotic therapy according to sensitivity b. Negative culture: quinolones, analgesic anti-inflammatory instillations once daily for five days (repeat cycle if necessary)
	Persisting symptoms: anti-tuberculosis medication + corticosteroids
	If there is no response to the treatment and/or contracted bladder: radical cystectomy

Table 3: *The Management of Side Effects following BCG Immunotherapy* (continued)

Hematuria	**Urine culture to exclude hemorrhagic cystitis if other symptoms are present**
	Persisting hematuria: perform cystoscopy to evaluate the presence of a bladder tumor
Symptomatic granulomatous prostatitis	Symptoms rarely present: urine culture
	Quinolones
	If quinolones are not effective: isoniazid (300 mg/day) and rifampicin (600 mg/day) for three months
	Cessation of intravesical therapy
Epididymo-orchitis	Urine culture, administer quinolones
	Cessation of intravesical therapy
	Orchidectomy if there is an abscess or no response to the treatment
Systemic side effects	
General malaise, fever	Generally resolves within 48 hours, with or without antipyretics
Arthralgia and/or arthritis	Rare complication, considered autoimmune reaction
	Arthralgia: NSAIDs
	Reactive arthritis: NSIADs
	No or partial response: corticosteroids, high-dose quinolones or antituberculosis medication
Persistent high-grade fever (>38.5ºC for >48 h)	Permanent discontinuation of BCG instillations
	Immediate evaluation: urine culture, blood tests, chest X-ray
	Treatment: more than two antimicrobial agents while diagnostic evaluation is being conducted
	Consultation with an infectious diseases specialist
BCG sepsis	Prevention: initiate BCG at least two weeks post-TURBT (if there are no signs and symptoms of hematuria)
	Cessation of BCG
	Severe infection: high-dose quinolones or isoniazid, rifampicin, and ethambutol 1.2 g daily for six months Early, high-dose corticosteroids as long as the symptoms persist Consider an empirical non-specific antibiotic to cover Gram-negative bacteria and/or Enterococcus

Table 3: *The Management of Side Effects following BCG Immunotherapy* (continued)

Allergic reactions	**Antihistamines and anti-inflammatory agents**
	Consider high-dose quinolones or isoniazid and rifampicin for persisting symptoms
	Delay therapy until reactions resolve

Note. From: "EAU Guidelines on Non-muscle-invasive Bladder Cancer (TaT1 and CIS)", 2025, Gontero P, Birtle A, Compérat E, Dominguez Escrig JL, Liedberg F, Mariappan P, et al., European Association of Urology, p. 29-30, Copyright by Gontero, Birtle, Compérat, Dominguez Escrig, Liedberg, Mariappan et al. (1)

5.6.2. Table 4: *BCG Schedule*

Induction phase	Six-weekly instillations
Maintenance phase	Three-weekly instillations at 3, 6, 12, 18, 24, 20, 36 months, respectively
Three-year maintenance is more effective than one year to prevent recurrence in patients with high-risk tumors, but not in patients with intermediate-risk tumors	

Note. From: "EAU Guidelines on Non-muscle-invasive Bladder Cancer (TaT1 and CIS)", 2025, Gontero P, Birtle A, Compérat E, Dominguez Escrig JL, Liedberg F, Mariappan P, et al., European Association of Urology (1).

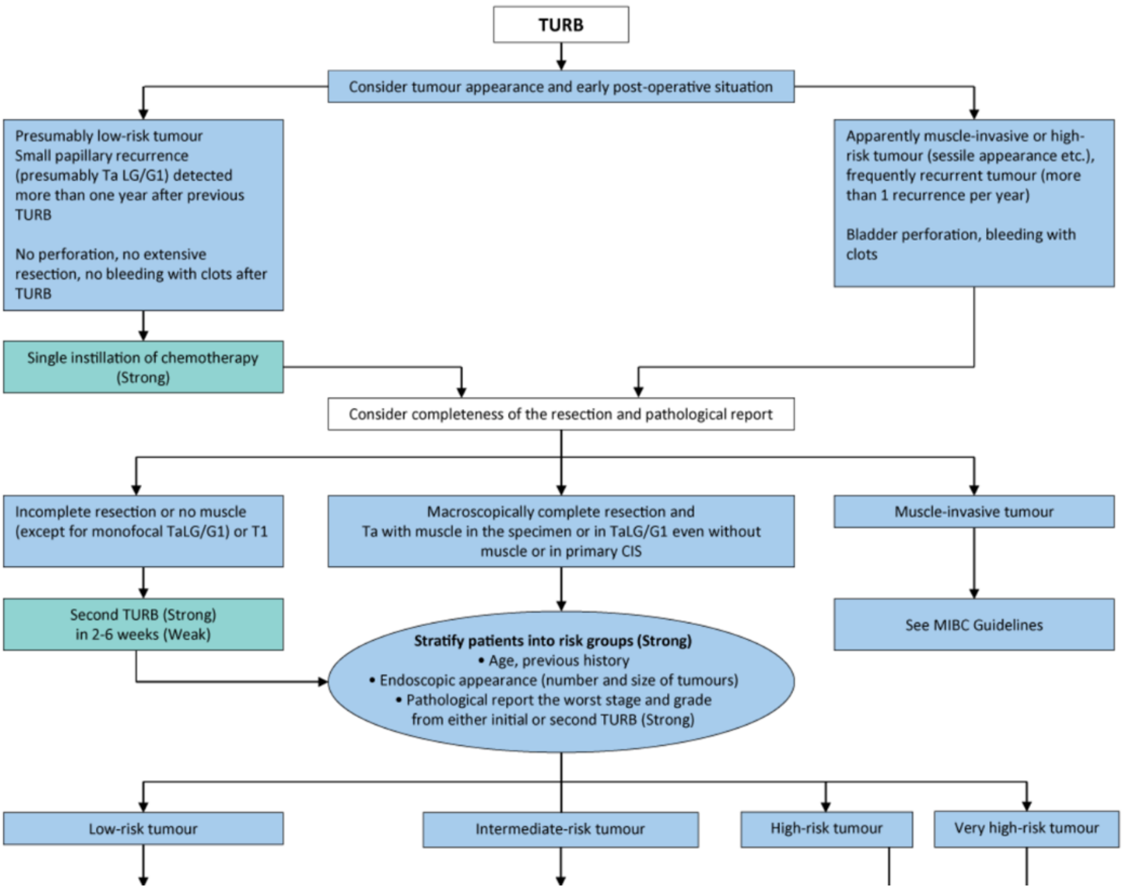
Additionally, there are different kinds of combination therapies. One of them combines the instillation of intravesical BCG with chemotherapy. This method has been shown to be more effective in reducing the disease recurrence risk; however, it also increases toxicity compared to BCG monotherapy. (1) Other combination therapy methods include sequential chemotherapy instillations and the usage of interferon. (1)

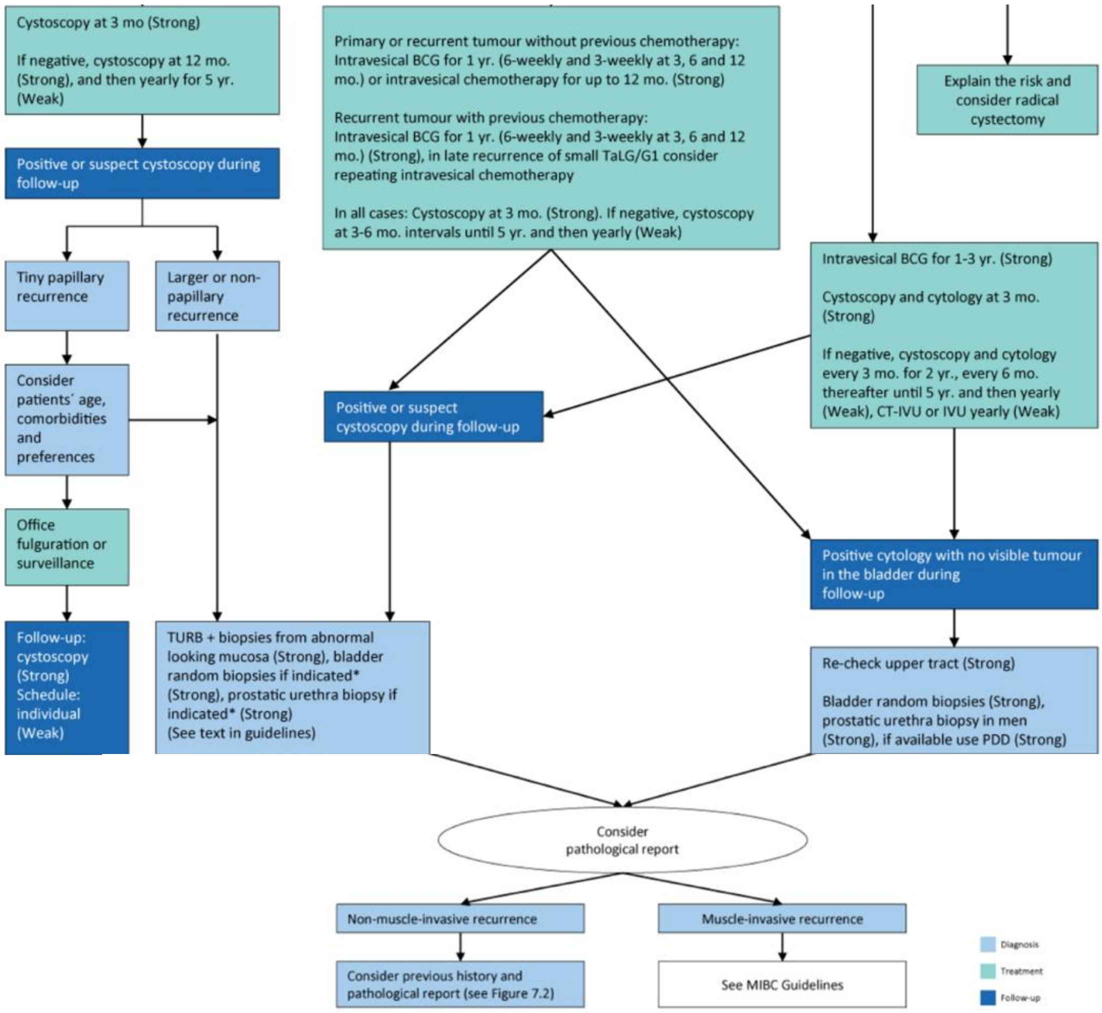
Treating CIS requires some special attention since the detection of concurrent CIS during TURBT increases the risk of recurrence and progression of TaT1 tumors, and thus, further treatment is mandatory. An endoscopic procedure alone does not cure CIS, which is why further treatment using intravesical BCG instillations or a radical cystectomy (RC) are necessary. The tumor-specific survival rates after immediate RC for CIS are excellent; the patients may, however, be over-treated. (1)

Radical cystectomy can also be used to treat NMIBC. There are several reasons to consider RC in some patients with NMIBC. These can include TURBT's low staging accuracy in T1 tumors, with 27-51% of patients being upstaged to a muscle-invasive disease at the RC. Additionally, some patients

may progress to a muscle-invasive disease, causing them to have a worse prognosis compared with patients who present with muscle-invasive disease at the time of the diagnosis. (1)
It is vital to apply a shared decision-making process where the patient is informed about the potential benefits and risks of RC, as well as the morbidity and impact on the quality of life following a RC. It is reasonable to offer patients with a NMIBC and a very high risk of progression an immediate RC. Moreover, patients who do not respond to BCG therapy are recommended to receive an early RC as well. Generally, the five-year disease-free survival (DFS) rate in patients who received a RC before a progression to MIBC surpasses 80%. (1)

As with any treatment of different tumors, a multidisciplinary approach is also essential in treating NMIBC. It has been shown that treatment plans may be changed in up to 44% of patients if they are approached by a multidisciplinary team (MDT), including a reassessment of radiology and pathology. (1)





5.6.3. Figure 2: *Treatment Algorithm for Bladder Cancers*

Note. From: "EAU Guidelines on Non-muscle-invasive Bladder Cancer (TaT1 and CIS)", 2025, Gontero P, Birtle A, Compérat E, Dominguez Escrig JL, Liedberg F, Mariappan P, et al., European Association of Urology, p. 34, Copyright by Gontero, Birtle, Compérat, Dominguez Escrig, Liedberg, Mariappan et al. (1)

5.7. Second Resection

It has been observed that there is a significant risk of a residual tumor after the initial TURBT of a TaT1 lesion, which may worsen the oncological outcomes, underlining the importance of an efficient initial TURBT. Performing a second TURBT mainly focuses on clearing any residual cancer cells that were missed during the initial TURBT, re-resecting the initial resection site for accurate staging, and obtaining any additional clinical information. (1)

A second resection can increase the recurrence-free survival (RFS), improve the outcomes following BCG treatment, and offer prognostic information. (1)

Generally, it is recommended to perform a second resection after two to six weeks in select cases, which can include an incomplete initial resection or doubts about the completeness of the resection. Preferably, a second TURBT should be performed 14-42 days after the initial TURBT since it provides a longer RFS and progression-free survival (PFS) when comparing it with a second TURBT after 43-90 days. (1)

5.8. Recurrence and Progression

In the case of TaT1 tumors, it is important to take the prognosis of the patient into account in order to provide a successful treatment plan. This is why different prognostic models have been presented. (1) There are scoring models using the WHO 1973 classification system. For example, the European Organization for Research and Treatment of Cancer (EORTC) scoring model (5) can predict short- and long-term risks regarding the recurrence and progression of the bladder cancer in individual patients. This scoring system was published in 2006 and considers the clinical and pathological factors that are most significant in patients mainly treated by intravesical chemotherapy. These factors include the number of tumors found during cystoscopy, the tumor diameter, prior recurrence rate, T category, any concurrent CIS, and the WHO 1973 tumor grade. The utilization of this scoring model can help calculate the patients' individual recurrence and progression likelihoods at one and five years. (1)

Another model was developed for patients with a TaG1/G2 (WHO 1973) diagnosis, who are treated with chemotherapy. These patients can be divided into three risk groups for the recurrence of the tumor. This model considers the history of recurrences, the history of intravesical treatment, tumor grade (WHO 1973), the number of tumors found, and any adjuvant chemotherapy. (1)
The EAU NMIBC 2021 scoring model (6) can be used to determine the risk of tumor progression but not recurrence. It combines the WHO 1973 and the WHO 2004/2016 classification systems. (1)

Other prognostic factors should also be considered. For T1 HG/G3 tumors, these include female sex, CIS in the prostatic urethra in men treated with an induction course of BCG, and age, tumor size, and concurrent CIS in BCG-treated patients. Furthermore, special attention should be given to patients in whom a T1 HG/G3 tumor was found in the bladder diverticulum due to the absence of a muscle layer in the diverticular wall. (1)
The finding of a residual T1 disease at the time of a second TURBT is an unfavorable factor in the prognosis.(1)

Finally, in patients diagnosed with T1G1 tumors who were treated with TURBT, the recurrence of tumors after 3 months was the most critical factor in predicting the progression of the disease. (1)

The prediction of progression and recurrence of primary CIS in bladder cancer needs some special consideration. Around 54% of patients with a diagnosis of CIS progress to a muscle-invasive disease if there is no treatment. Even though there are no reliable prognostic factors, some studies have reported a worse prognosis if there is a concurrent CIS and T1 tumor compared to a primary CIS, extended CIS, and CIS in the prostatic urethra. (1)

An important prognostic factor for a subsequent progression and death caused by BC is the intravesical treatment with BCG or chemotherapy, with studies showing a disease progression to a muscle-invasive disease in 10-20% of patients that responded well to either BCG or chemotherapy, compared with a 66% progression rate in the case of patients that did not respond to either of the mentioned therapies. (1)

To enable better treatment recommendations, a stratification of patients into risk groups has also been recommended by the European Association of Urology (EAU) guidelines panel. This stratification is based on the patient's likelihood of progression to a muscle-invasive disease and uses the WHO 1973 and/or WHO 2004/2016 classification systems. Between these established risk groups, the five-year likelihood of a progression can vary between under 1% and over 40%. (1)

5.9. Follow-up

After the initial TURBT, the first cystoscopy should be performed after three months since it is an important prognostic and recurrence indicator. Following the first cystoscopy after TURBT, the frequency and duration of further follow-up cystoscopies, as well as other imaging modalities, depends on the patient's individual risk of recurrence and is summarized in Table 5. (1)

Table 5

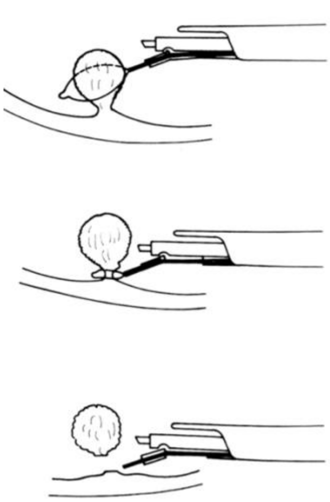
Follow-up schedule

Risk group	**Cytology**	**Cystoscopy**	**Imaging**	**Duration of follow-up**
Low	No	At 3 and 12 months Then annually	Not systematic	5 years

Table 5: *Follow-up schedule* (continued)

Intermediate (not incl. HG/G3 subgroup)	**No**	**At 3 months** **Then every 6 months for 2 years** **Then annually**	**Not systematic**	**10 years**
High and very high (incl. HG/G3 subgroup)	Yes	Every 3 months for 2 years Then every 6 months for up to 5 years Then annually	CT annually up to 5 years Then CT every 2 years up to 10 years	Life long

Note. From: "EAU Guidelines on Non-muscle-invasive Bladder Cancer (TaT1 and CIS)", 2025, Gontero P, Birtle A, Compérat E, Dominguez Escrig JL, Liedberg F, Mariappan P, et al., European Association of Urology, p. 41, Copyright by Gontero, Birtle, Compérat, Dominguez Escrig, Liedberg, Mariappan et al. (1)



Note. From: "En bloc resection of bladder tumour: the rebirth of past through reminiscence", 2023, Teoh JYC, D'Andrea D, Gallioli A, Yanagisawa T, MacLennan S, Nicoletti R, et al., World J Urol., p. 2600, Copyright: Teoh, D'Andrea, Gallioli, Yanagisawa, MacLennan, Nicoletti. (7)

Figure 3
Polypectomy snare used in ERBT

Figure 4
High-frequency wave ERBT

Note. From:
"En bloc resection of bladder tumour: the rebirth of past through reminiscence", 2023, Teoh JYC, D'Andrea D, Gallioli A, Yanagisawa T, MacLennan S, Nicoletti R, et al., World J Urol., p. 2600, Copyright: Teoh, D'Andrea, Gallioli, Yanagisawa, MacLennan, Nicoletti. (7)

6. History of the En Bloc Resection of Non-muscle Invasive Bladder Tumors

Initially, the *en bloc* resection using a polypectomy snare was developed for the resection of rectal polyps. It was later adapted for *en bloc* resection of bladder tumors (ERBT) of bladder tumors with a size of three or fewer centimeters. (7)

1980 •Kitamura et al.: ERBT using a polypectomy snare applied through a resectoscope (Figure 3)

1997 •Kawada et al.: ERBT with tailor-made arched electrode (Figure 4)

2000 •Ukai et al.: ERBT in systematic manner with basic steps which ramains the foundation of ERBT until to today

2001 •Saito: ERBT using holmium laser and knifde electrode
•First substaging (T1) for resected specimens

2005 •Introduction of thulium laser (incision is more precise and has a better hemostatic effect when compared with holmium laser)

2010 •Zhong et al.: utilization of thulium laser in ERBT

2011 •Nagele et al.: ERBT using Waterjet hydrodissection (firt used in gastroenterology for endoscopic submucosal dissection)

2015 •Mario and Hermann et al.: EBRUC (en bloc resection urothelial carcinoma) project demonstrating safety and feasibility of ERBT regardless of enegry source

2018 •Rapoport and Enikeev et al.: resection of the exophytic part of the tumor, followed by an en bloc resection of the tumor base, shaping the basis of the modified ERBT

2020 •Hurle et al.: report of results of ERBT in patients with high-risk NMIBC, concluding that no patients experienced bladder perforation and recurrence rate at three months was 3.85%
•Teoh et al.: development of the international consensus statement on ERBT

2023 •Teoh et al.: first randomized controlled trial (RCT) shwoing considerable benefit in the one-year recurrence rate after ERBT

Figure 5: *History of ERBT*

Note: Adapted from: "En bloc resection of bladder tumour: the rebirth of past through reminiscence", 2023, Teoh JYC, D'Andrea D, Gallioli A, Yanagisawa T, MacLennan S, Nicoletti R, et al., World J Urol., Copyright by Teoh, D'Andrea, Gallioli, Yanagisawa, MacLennan, Nicoletti, et al. (7)

7. Definition and Significance of En Bloc Resection of Bladder Tumors (ERBT)

The conventional resection of bladder tumors with a transurethral resection (TURBT) has been the standard of treatment for many years. Unfortunately, this method contradicts the resection principles generally used in oncological surgery. If the tumor to be resected has a larger diameter than the wire loop, the tumor cannot be resected in one piece and is thus resected in a 'piecemeal' fashion. This causes a fragmentation of the tumor tissue, which should generally be avoided since it can increase the risk of tumor seeding. This, in turn, may cause local recurrence or even the formation of metastases in distant organs. (2,3,8–10)

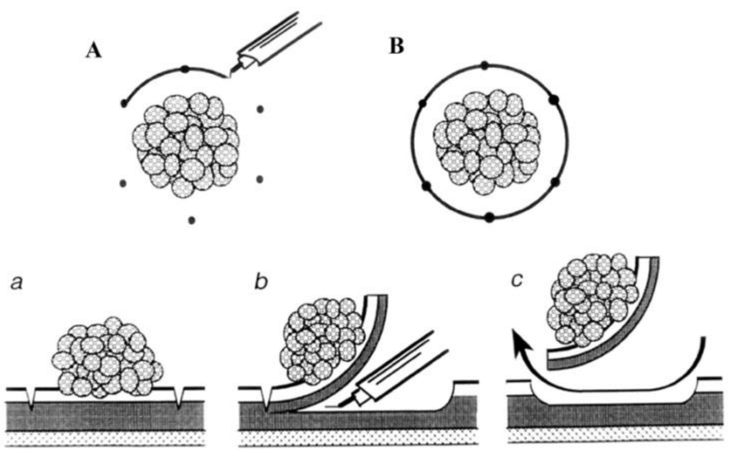
Furthermore, the specimens obtained after cTURBT may be harder to properly examine since they often have artifacts caused by electrocautery. An appropriate examination of the resection margins is of utmost importance, as it is the only possibility to assess for invasive urothelial carcinoma (T1 substaging) or lymphovascular invasion. This causes an underestimation of the risk for the progression of the tumor and leads to upstaging at second-look TURBT. (2,3,8–10)

To overcome the described concerns, ERBT has been applied. When an *en bloc* resection is used, tumors larger in diameter than the wire loop used can be resected in one piece, thus adhering to oncological resection principles. Multiple studies have shown that the rate of detrusor muscle (DM) in the resected specimens is also higher and better assessable in ERBT compared to cTURBT. The rate of DM in the resected specimens is used as a measurement of the resection quality. There are also fewer electrocautery artifacts in ERBT, likely due to the safety margin applied around the tumor before resection. (2,3,7–9,11–14)

8. Surgical and Technical Aspects of Tumor Resection

Figure 6
En Bloc resection from above and sideview

Note. From:
"En bloc resection of bladder tumour: the rebirth of past through reminiscence", 2023,
Teoh JYC, D'Andrea D, Gallioli A, Yanagisawa T, MacLennan S, Nicoletti R, et al., World J Urol., p. 2601, Copyright: Teoh, D'Andrea, Gallioli, Yanagisawa, MacLennan, Nicoletti. (7)



The most critical aspect in the resection of bladder tumors, as with other tumors as well, is to ensure the complete resection of the tumor. This is also the case in larger NMIBC which may be impossible to remove in one piece. When resecting MIBC, on the other hand, it is most important to provide accurate local staging, and removing the tumor in one or more pieces makes no difference regarding the subsequent management of the disease. (7)

It is possible that ERBT can attain a maximal transurethral resection, and it can aid in the optimization of the ensuing treatment, including, for example, a radical cystectomy or trimodal therapy. (7)

In the case of larger NMIBC where resection in one piece (Figure 7, A) is not achievable, the principles of *en bloc* resection can still be very helpful, applying a modified ERBT. One of these approaches includes an excision of the exophytic part of the tumor in a piecemeal fashion and subsequent *en bloc* resection of the base (Figure 7, B). (7)

Another approach describes the excision of the main bulk of the exophytic part of the tumor, which is then removed by morcellation, after which the tumor base is resected in an *en bloc* manner. (7)

For even larger tumors, where the tumor base cannot be resected *en bloc*, removal of the tumor base in multiple pieces may be considered (Figure 7, C). (7)

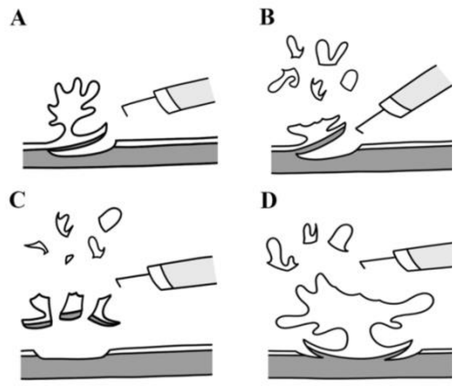


Figure 7
En bloc resection

Note. From: "En bloc resection of bladder tumour: the rebirth of past through reminiscence", 2023, Teoh JYC, D'Andrea D, Gallioli A, Yanagisawa T, MacLennan S, Nicoletti R, et al., World J Urol., p. 2603, Copyright: Teoh, D'Andrea, Gallioli, Yanagisawa, MacLennan, Nicoletti. (7)

If the removal of the tumor is so technically challenging that conventional TURBT is the only option, the *en bloc* resection principles may still be followed. In this case, the resection margins should be defined, and an incision should be made downwards to the normal detrusor muscle layer in a circumferential manner. Working from lateral to medial and from normal to abnormal towards the central part of the tumor, the tumor should lastly be resected in a piecemeal manner (Figure 7, D). (7)

9. Key International Studies on ERBT

9.1. Multicenter RCT in 7 European Hospitals (2019-2022)

In 2024, Struck et al. published an international multicenter RCT in which seven hospitals across Europe participated. The primary interest of this study was the recurrence rate and the rate of DM present in the samples when ERBT and cTURBT were compared. Secondary outcomes that were investigated in this study were the progression rate, perioperative safety of the procedure, residual tumor rate at 2-6 weeks, methods used for the extraction of the tumor, 24-month RFS rate, feasibility, and staging, which included the assessment of the resection margins and T1 sub-staging possibility.

Patients included in this study had to have no previous diagnosis of NMIBC and a tumor size exceeding 3.4 mm. The study did not exclude patients based on the number, location, or size of the lesion(s). For the resections, surgeons were allowed to apply any visualization method and energy

source based on their preference. Patients included in this study were randomly assigned to ERBT or cTURBT in a 1:1 manner. Patients presenting with solid tumors and single CIS were excluded. (8)
Finally, 97 patients were included in the analysis, most of them presenting with tumors located on the lateral wall of the bladder. Out of the patients receiving ERBT, 83.6% of lesions were suitable for *en bloc* extraction, while the remaining 16.4% had to undergo fragmentation intravesically. The largest tumor that was managed to be retrieved *en bloc* measured 4 cm. The intra- and postoperative complications did not differ significantly between the groups. However, the ERBT group experienced significantly more bladder perforations. 12.7% of patients undergoing ERBT had a perforation compared with none in the cTURBT group. This raised safety concerns, eventually leading to the premature termination of the study. (8)
Regarding the resection quality, the authors did not find any superiority in the DM sampling rate between the two groups. The complete resection (R0), though, was statistically significantly achieved more often in the ERBT group. Similarly, nonassessable resection margins were statistically significantly more frequently observed in the cTURBT group. No significant difference was seen regarding positive margins (R1). (8)

The likelihood of the patients needing a second resection (according to EAU guidelines) was statistically significantly lower in the ERBT group. Additionally, substaging was also statistically significantly better in the ERBT group, with 100% of T1 tumors in the ERBT group versus 35% of T1 tumors in the cTURBT group. This can lead to improved additional treatment and less upstaging at the follow-ups. Nonetheless, the authors did not report a statistically significant difference regarding the 6-month RFS. (8)

To summarize the information provided above, the study by Struck et al. proved ERBT to be similar to cTURBT in terms of safety, however, they observed an increased risk of perforation when ERBT was applied. A conclusion was drawn that a thorough preoperative tumor assessment is essential for the success of this resection method. (8)
The quality of specimens resected was better in the ERBT, leading to fewer patients requiring a second resection, which in turn improves the quality of life and has a positive impact on financial aspects as well. (8)

9.2. Hong Kong Phase 3 Trial (2017-2020)

In 2024, Teoh et al. published ‘Transurethral *En Bloc* Resection versus standard resection of bladder tumor: a randomized, multicenter, phase 3 trial’. Adults with tumor(s) of three or fewer centimeters in diameter were enrolled from April 2017 to December 2020. These patients also received a follow-up of one year following their initial surgery. The primary outcome of this study was the one-year recurrence rate. The secondary outcomes that were also comprised were DM rate in specimens, operative time, hospital stay, any complications occurring within 30 days, residual or upstaging of the disease upon second-look TURBT, one-year progression rate, obturator nerve reflex occurring during the procedure and the rate of postoperative instillations of mitomycin C. (11)

The difference in the one-year recurrence rates was not statistically significant, with 29% of patients having developed a recurrence in the ERBT group versus 38% in the cTURBT group ($p = 0.07$). Upon subgroup analysis, the participants with 1-3 cm tumors, single tumor, Ta disease of intermediate-risk NMIBC had the most significant benefit from ERBT. (11)

The authors of this study found that ERBT did result in a significant decrease in the one-year recurrence-free survival (RFS) rate. The ERBT also had a longer median operation time. Perioperative and safety outcomes were similar in both groups, thus rendering ERBT a safe and technically feasible procedure. The multicenter setting of this study also proves that ERBT is generalizable. (11)

9.3. Hybridblue Trial (Germany, 2012-2015)

The Hybridblue trial by Gakis et al. was published in 2020. Six German academic centers were included in the study between 2012 and 2015. This multicenter randomized, controlled trial was designed to investigate the application of HybridKnife technology for ERBT combined with PDD using hexaminolevulinate (HAL). Hydrodissection has been successfully applied in the treatment of gastrointestinal cancers, improving staging and detection of lymphovascular invasion and risk factors. (14)

The water-jet assisted ERBT includes four specific steps, which are:

1. Marking of the lesion
2. Tumor elevation using an injection of saline fluid into the connective tissue below the mucosa
3. Incision in a circumferential manner
4. *En bloc* resection followed by tumor retrieval

The Hybridblue study aimed to determine 'whether transurethral (fluorescence-guided) *en bloc* submucosal hydrodissection of bladder tumor […] technique improves the quality of resection and is clinically safe in terms of perioperative outcomes compared with conventional TURBT in pts with NMIBC' (14). Excluded from this study were patients with tumors less than 0.5 cm in diameter, muscle-invasive tumors, any instillation therapy received in the previous eight weeks, tumors too large to be resected and retrieved without intravesical fragmentation, and more than five lesions in a single patient. Additionally, any chemotherapy instillation in the first 48 hours following the resection was not allowed. (14)

To provide uniform conditions for the resections, all included centers participating in the study received the same instrument using a 26-F resectoscope. They were also outfitted with the same electric generator. (14)

When performing the resection, the surgeons were allowed to use the I-type or T-type of the HybridKnife, according to their preference. (14)

For the retrieval of the specimen following the *en bloc* resection, an endoscopic bag was inserted through the working channel, flushing of the bladder or using forceps to grab the specimen.

Surgeons performing the procedure underwent special surgical training, including ex vivo working stations. (14)

The patients received HAL at least one hour before the surgery; they were examined intraoperatively using white light (WL) and blue light (BL). (14)

Re-resection and intravesical therapy were done according to the EAU guidelines. Follow-up cystoscopies were recommended at three, six, nine, and 12 months. (14)

This study primarily focused on gaining insight into the number of specimens resected, which could be reliably evaluated for muscle invasiveness. Other endpoints included rates of complete resections (R0), muscularis propria content, duration of resection and specimen retrieval, length of the postoperative catheterization, length of the stay in the hospital, rates of complications (stratified according to Clavien-Dindo classification (15)), RFS and PFS. (14)

After exclusion, 56 patients were assigned to the ERBT group, 59 to the cTURBT group. The primary outcome, the rate of specimens that could be reliably evaluated for muscle invasiveness, was statistically significantly superior in the ERBT group. Similarly, the rate of R0 resections was also statistically significantly higher in the ERBT group, and the rate of not completely assessable margins (RX) was significantly lower in the ERBT arm. However, the authors found no statistically significant difference in the rate of DM in the specimens. (14)

Additionally, statistically significantly more lesions could be detected when BL was used. (14)

There was no difference between the two groups regarding the retrieval time of the specimens. However, the operative time was statistically significantly longer in the ERBT group. There was also no difference in the complication rates, with no Clavien-Dindo complications exceeding grade III in either group. (14)

RFS at the 3- and 12-month follow-ups were also not statistically significantly different between the ERBT and cTURBT groups. (14)

In summary, this study showed that *en bloc* hydrodissection of NMIBC is safe and feasible. The specimens resected using the HybridKnife technology could be assessed much better when compared to cTURBT. This leads to improved staging and better tailored further treatment. Even though there was no difference regarding RFS and progression, it may be assumed that, with more practice, ERBT using HybridKnife technology may also be superior in this regard since it is a relatively new technique. (14)

9.4. Systematic Review and Meta-Analysis Comparing ERBT and cTURBT

A systematic review and meta-analysis published in 2024 by Basile et al. specifically focused on data regarding RFS and PFS at 12 and 24 months. Other parameters included in this analysis were DM sampling rate, muscularis mucosae (MM) detectability, bladder perforations, ONR occurrences, operative time needed, length of hospitalization and catheterization, and any residual tumor found at second-look TURBT. Seventeen articles were included with different energies used or comparing different energies. (9)

No statistically significant difference between ERBT and cTURBT groups could be found regarding RFS at 12 and 24 months, as well as PFS at 12 months. (9)

The DM sampling rate was statistically significantly superior in the ERBT group; however, significant heterogeneity was found. Additionally, it was found that surgeon experience plays a significant role in the quality of the resection, including the DM sampling rate. (9)

The risk of bladder perforation and ONR was statistically significantly lower in ERBT. (9)

The operative time was found to be statistically significantly longer in ERBT versus cTURBT, however, when only laser energy studies were included, there was no significant difference anymore. Patients receiving ERBT also had a statistically significantly shorter duration of catheterization and hospital stay. (9)

Generally, the authors determined ERBT to be a safer procedure when compared to cTURBT. There were less intra-and postoperative complications and fewer bladder perforations with ERBT lead to a higher percentage of patients being able to receive proper postoperative treatment like chemotherapy instillations. Furthermore, the superior DM sampling rate in ERBT provides better staging and thus improved and more specific further treatment. (9)

Finally, the meta-analysis proved ERBT to be non-inferior to cTURBT regarding the medium-term oncological outcomes. (9)

The non-inferiority of ERBT regarding oncological outcomes and superiority in DM sampling and complication risk make it a feasible treatment option in select patients. (9)

10. Results and Discussion

10.1. Table 6: *Surgical Outcomes and Safety Comparisons*

Study	Authors	Year	Complications in ERBT (compared with cTURBT)			DM presence ERBT	RFS in ERBT	R0 Resection ERBT, Substaging
			General	ONR	Bladder perforations			
Transurethral En Bloc Resection versus standard resection of bladder tumor: a randomized, multicenter, phase 3 trial (11)	Teoh et al.	2024	0	0	-	0	↑ 12- month RFS	0
An international multicentre randomised controlled trial of en bloc resection of bladder tumour vs conventional transurethral resection of bladder tumour: first results of the en bloc resection of urothelium carcinoma of the bladder (EBRUC) II trial (8)	Struck et al.	2024	0	-	↑ (especially with laser + lateral wall resections)	0	0 for 6-month RFS ↑ 12-month RFS	↑
Energy source comparison in en bloc resections: Subanalysis of single center prospective randomized study (16)	Diana et al.	2022	-	↑ using mono- or bipolar enegies + lateral wall resections; ↓ laser energy in lateral wall resections	-	↑	-	-
Transurethral en bloc submucosal hydrodissection vs conventional resection for resection of non-muscle-invasive bladder cancer (HYBRIDBLUE): a randomized, multicenter trial (14)	Gakis et al.	2020	0	-	0	0	0	↑
En bloc versus conventional resection of primary bladder tumor (eBloc): a prospective, multicenter, open-label, phase 3 randomized controlled trial (2)	D'Andrea et al.	2023	↓	↓	↓	↑	0	0

Table 6: *Surgical Outcomes and Safety Comparisons* (continued)

En bloc versus conventional transurethral resection of bladder tumors: a systematic review and meta-analysis of oncological, histopathological, and surgical outcomes (9)	Basile et al.	2024	↓	↓	↓	↑	**0**	**0**
Efficiency of transurethral en bloc resection vs conventional transurethral resection for non-muscle invasive bladder cancer: an umbrella review (3)	Li et al.	2024	0	↓	↓	-	↑ 3, 12-month RFS (bipolar), after no difference ↑ RFS when data on HybridKnife was left out	0
En bloc transurethral resection of bladder tumors: a review of current techniques (13)	Croghan et al.	2021	↓	↑ in bipolar ERBT compared with laser ERBT	-	↑	0/↑	↑
The impact of En bloc transurethral resection of bladder tumor on clinical, pathological and oncological outcomes: a cohort study (12)	Kannan et al.	2023	-	low	low	high	high	-
Comparison of Pathological Outcome and Recurrence Rate between En Bloc Transurethral Resection of Bladder Tumor and Conventional Transurethral Resection: A Meta-Analysis (10)	Wang et al.	2023	↓	↓	↓	↑	↑ 3-month RFS ↑ 24-month RFS 0 - 12-month	-
Safety, feasibility, and quality of thulium laser en-bloc resection for treatment of non-muscle invasive bladder cancer (17)	Assem et al.	2023	low	none	none	high	-	-

ONR = Obturator nerve reflex; DM = detrusor muscle; RFS = recurrence-free survival; 0 = not statistically significant ($p > 0.05$); ↑ increased in ERBT; ↓ decreased in ERBT

10.2. Complication rates: ERBT versus cTURBT

When comparing ERBT with cTURBT, one of the most important aspects is the operative safety. ERBT can only be applied if it is equally as safe or safer than cTURBT. This is why many studies comparing ERBT and cTURBT included the perioperative safety of the procedure in their outcomes. The main complications occurring in resections of bladder tumors are the triggering of the obturator nerve reflex (ONR), causing a jerking of the leg, which happens most commonly during resections located on the lateral bladder wall and bladder wall perforations.

All eleven of the included studies provide information on the complication rates during ERBT, while some provide information on the overall rate of complications, others only provide information on ONR and bladder perforations. (2,3,8–14,16,17)

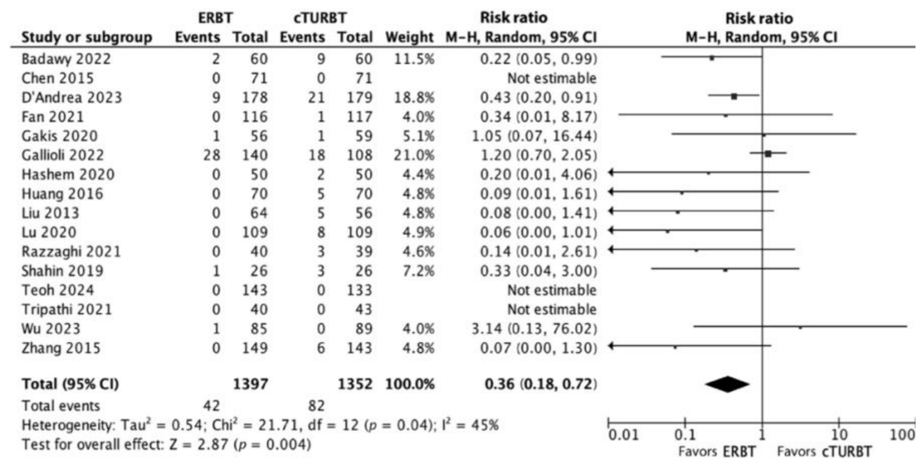


Figure 5

Bladder perforation rates in ERBT vs. cTURBT

Note. From: "En Bloc Versus Conventional Transurethral Resection of Bladder Tumors: A Systematic Review and Meta-analysis of Oncological, Histopathological, and Surgical Outcomes", 2025, Basile G, Uleri A, Leni R, Cannoletta D, Afferi L, Baboudjian M, et al.. Eur Urol Oncol., p. 10, Copyright: Basile, Uleri, Leni, Cannoletta, Afferi, Baboudijan, et al. (11)

Out of eight studies giving information on the overall complication rate during ERBT and comparing it with cTURBT, half did not find a statistically significant difference in the overall complication rate (3,8,11,14), while the other half found a statistically significant difference in favor of ERBT (2,9,10,13). The systematic literature review and meta-analysis by Basile et al. included a comprehensive overview of recent studies on the complication rates of ERBT compared with cTURBT, with the rates of bladder perforation seen in the forest plot in Figure 5 and the risk of ONR seen in the forest plot in Figure 6 (9). A non-comparative study

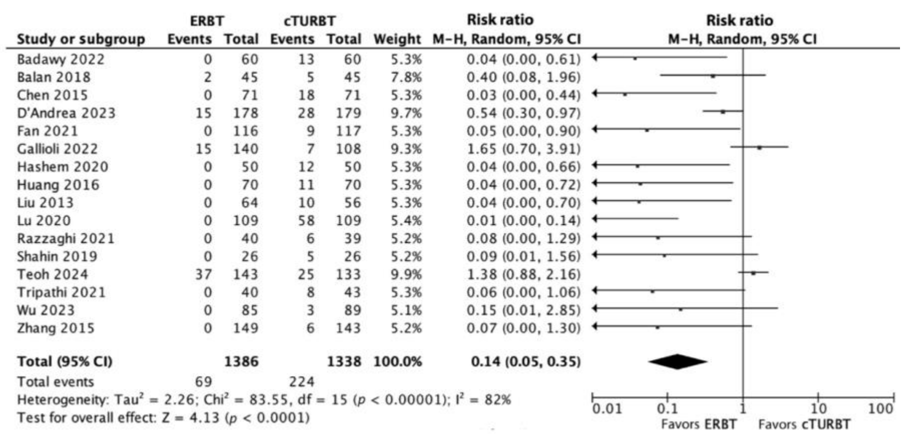


Figure 6

ONR in ERBT vs. cTURBT

Note. From: "En Bloc Versus Conventional Transurethral Resection of Bladder Tumors: A Systematic Review and Meta-analysis of Oncological, Histopathological, and Surgical Outcomes", 2025, Basile G, Uleri A, Leni R, Cannoletta D, Afferi L, Baboudjian M, et al.. Eur Urol Oncol., p. 10, Copyright: Basile, Uleri, Leni, Cannoletta, Afferi, Baboudijan, et al. (11)

by Assem et al. reported low rates of complications during laser ERBT as well. (17)

The occurrence of ONR during resections was included in nine studies. Only the study by Teoh et al. did not find a statistically significant difference between cTURBT and ERBT (11). Five studies found a statistically significant superiority regarding the occurrence of ONR in the ERBT group (2,3,9,10,13). Diana et al. found an increased number of ONR in the case of mono- and bipolar energies versus laser energy ERBT in lateral wall resections using ERBT (16), similarly, Croghan et al. found a lower rate of ONR in laser ERBT as well (13). Additionally, Diana et al. only observed ONR in lateral wall resections (16). Although the study by Kannan et al. was non-comparative, they also reported low ONR rates (12) , and the study by Assem et al. did not report any ONR occurrences during laser ERBT in their study (17).

Eight studies provided information on the rate of bladder perforations. No statistically significant difference between resection methods was only reported in the study by Gakis et al. in the Hybridblue trial (14). Four studies did find a statistically significant difference favoring ERBT over cTURBT (2,3,9,10) and the non-comparative studies by Kannan et al. and Assem et al. reported low rates and no perforations, respectively (12,17).
Unexpectedly, Struck et al. reported a statistically significantly higher rate of bladder perforations in the ERBT group. This was also the reason why this study had to be terminated prematurely since the risk during ERBT was too high. Nonetheless, Struck et al. still found ERBT to be a safe procedure comparable to cTURBT. The risk of bladder perforation was especially observed in the resection of lateral wall tumors and the use of laser energy during ERBT. (8)

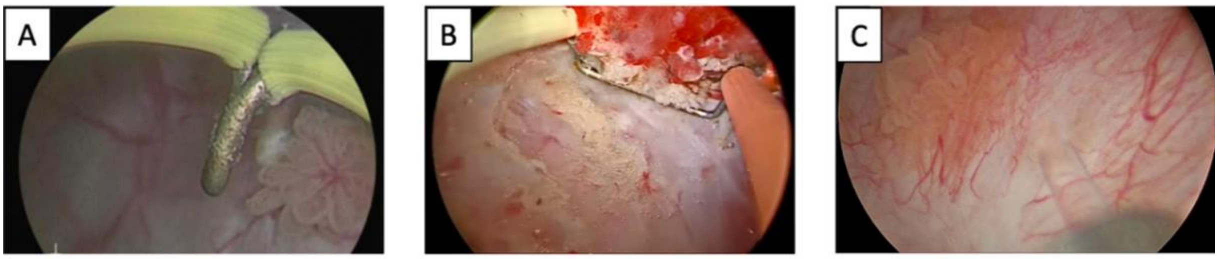
The review published in 2021 by Croghan et al. compares different energies used in ERBT. The occurrence of ONR in the case of electrocautery ERBT ranged from 0-23%, varying so greatly since there was no comparable data available regarding the tumor location and anesthesia applied. There was no statistically significant difference between electrocautery ERBT and cTURBT regarding the perforation and bleeding rates. (13)
The rate of ONR in the case of laser ERBT was statistically significantly superior in the case of ERBT compared with cTURBT. The rate of bladder perforations was mostly similar between the two groups. In the case of HybridKnife resections, there was either no difference or a decrease in the occurrence of ONR. (13)
When different energy sources were compared, there was a higher conversion rate to cTURBT in the ERBT group, where electrocautery was applied for resection. One study found no difference in the

rates of complications when holmium laser and bipolar energy were compared, however, there was an increased incidence of ONR in the case of bipolar ERBT compared with laser ERBT.
Overall, this study also determined ERBT to be a safe technique with low complication rates and proposed, that laser ERBT can reduce the risk of ONR in the case of resections of lateral wall tumors. (13)

As described above, most studies comparing the peri- and postoperative safety of ERBT with cTURBT found ERBT to be superior or similar regarding the overall complication rates, the occurrence of ONR, and the risk of bladder perforation, making ERBT a safe procedure.
Minimizing the complications occurring during resections of bladder cancer is of utter importance since a bladder perforation during or following the resection can interfere with the further treatment of the patient, including, for example, the administration of intravesical chemotherapy, and can even lead to an incomplete resection.

10.2.1. Energy Sources Used in ERBT

Overall, laser and electrocautery energies used in ERBT have similar outcomes. Multiple studies have reported a superiority of laser energy regarding the occurrence of ONR during lateral wall resections, as seen in Table 7. (16)



Collins monopolar knife (**A**), rectangular bipolar loop-*Karl Storz*, Tuttlingen, Germany (**B**) and 550 µm Thulium: YAG laser fiber (**C**)

Figure 7
Energies used in ERBT

Note. From: "Energy source comparison in en-bloc resection of bladder tumors: subanalysis of a single-center prospective randomized study", 2022, Diana P, Gallioli A, Fontana M, Territo A, Bravo A, Piana A, et al., World J Urol., p. 3, Copyright: Diana, Gallioli, Fontana, Territo, Bravo, Piana, et al. (15)

Table 7

Energy source comparison in ERBT regarding perioperative outcomes

Energy employed	Overall	Monopolar	Bipolar	Thulium laser	ANOVA or fisher exact test (*p* value)	Monopolar vs bipolar	Monopolar vs thulium laser	Bipolar vs thulium laser
Number of patients, *n* (%)	140	49 (35)	45 (32.1)	46 (32.9)	–	–	–	–
Lesion location, *n* (%)					0.505	–	–	–
Posterior/trigone	39 (27.9)	15 (30.6)	15 (33.3)	9 (19.6)				
Lateral walls	79 (56.4)	25 (51)	25 (55.6)	29 (63)				
Anterior/dome/neck	22 (15.7)	9 (18.4)	5 (11.1)	8 (17.4)				
Surgery duration, mean (SD)	33.4 (17.5)	31.8 (16.9)	34.7 (17.6)	33.8 (18.3)	0.72	–	–	–
Conversion to cTURBT, *n* (%)	6 (4.3)	2 (4.1)	2 (4.4)	2 (4.3)	1	–	–	–
Obturator nerve reflex, *n* (%)	**15 (10.7)**	**5 (10.2)**	**10 (22.2)**	**0 (0)**	**0.001**	0.159	**0.056**	**< 0.001**
Perforation, *n* (%)	28 (20)	7 (14.3)	13 (28.9)	8 (17.4)	0.193	0.129	0.781	0.221
Planned early CT instillation, *n* (%)	69 (49.3)	26 (53.1)	22 (48.9)	21 (45.7)	0.633	–	–	–
Performed early CT instillation of planned, n (%)	65 (94.2)	26 (100)	20 (90.9)	19 (86.4)	0.494	–	–	–
Complications, *n* (%)					–	–	–	–
No complications	111 (79.3)	43 (87.8)	23 (73.3)	35 (76.1)				
Clavien-dindo 1–2	23 (16.4)	5 (10.2)	8 (17.8)	10 (21.7)				
Clavien-dindo 3	6 (4.3)	1 (2)	4 (8.9)	1 (2.2)				
Overall complications, *n* (%)	29 (20.7)	6 (12.2)	12 (26.7)	11 (23.9)	0.172	0.114	0.182	0.812
Major complications, *n* (%)	6 (4.3)	1 (2)	4 (8.9)	1 (2.2)	0.282	–	–	–
Artifacts	11 (7.9)	2 (4.1)	6 (13.3)	3 (6.5)	0.253	–	–	–
Detrusor muscle					0.796	–	–	–
Yes	133 (95)	47 (95.9)	42 (93.3)	44 (95.7)				
No	7 (5)	2 (4.1)	3 (6.7)	2 (4.3)				
T1 substage feasibility					1	–	–	–
Yes	25 (100)	9 (100)	8 (100)	8 (100)				
No	0 (0)	0 (0)	0 (0)	0 (0)				
Length of irrigation, mean (SD)	0.9 (0.9)	0.9 (0.9)	1 (0.9)	0.9 (0.8)	0.692	–	–	–
Length of catheterization days, mean (SD)	**2.4 (1.8)**	**1.9 (1.3)**	**2.5 (1.8)**	**2.8 (2.1)**	**0.034**	0.162	**0.033**	0.779
Length of stay, mean (SD)	2.1 (1.2)	2.1 (1.4)	2.4 (1.3)	2.1 (0.9)	0.525	–	–	–
Post-op hemoglobin, mean (SD)	9 (9.4)	6.8 (8.8)	9.7 (9.8)	10.7 (9.3)	0.167	0.374	0.166	0.891

cTURBT conventional transurethral resection of bladder tumor, *SD* standard deviation, *CT* chemotherapy, *ANOVA* analysis of variance

Note. From: "Energy source comparison in en-bloc resection of bladder tumors: subanalysis of a single-center prospective randomized study", 2022, Diana P, Gallioli A, Fontana M, Territo A, Bravo A, Piana A, et al., World J Urol., p. 4, Copyright: Diana, Gallioli, Fontana, Territo, Bravo, Piana, et al. (16)

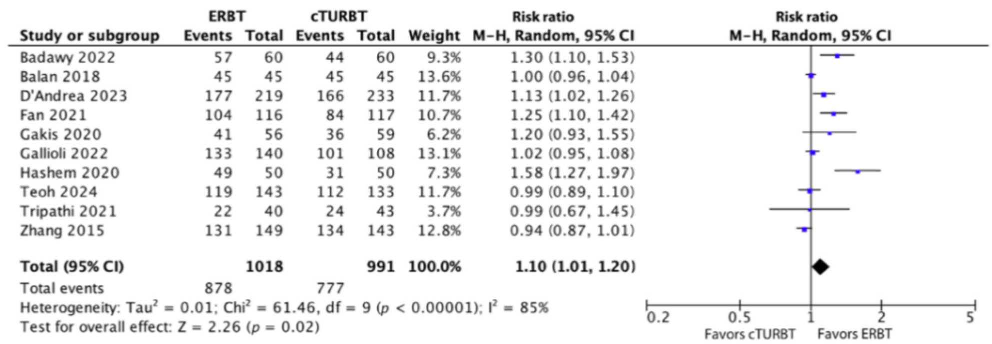
10.3. Presence of Detrusor Muscle in Specimens and Recurrence Rates

The presence of detrusor muscle (DM) in the resection specimen has long been used as a reflection of the quality of the resection. Thus, many studies comparing cTURBT and ERBT have focused on the percentage of DM in the specimens. Most have found that the rate of DM sampling is higher in the ERBT groups, therefore bringing about the hypothesis that the staging of the tumor is more accurate in the ERBT specimens. This, in turn, causes less upstaging at second-look TURBT, improved further treatment, and possibly lower recurrence rates.

Out of the included studies, ten provide information on the DM sampling rate in ERBT resections. Three of these studies did not find a statistically significant difference regarding the DM sampling rate when ERBT and cTURBT were compared (8,11,14). Five studies did find ERBT to be statistically significantly superior in this matter (2,9,10,13,16). The remaining two studies are non-comparative studies, with the study by Kannan et al. reporting 98.1% and Assem et al. reporting 87% of resected specimens containing DM (12,17).

Diana et al. also looked at different energies used in ERBT. There was a presence of DM in 87-98%, 40-100%, 51-100% in Laser ERBT, monopolar ERBT and bipolar ERBT respectively. There was no significant difference between the staging and the diagnosis of bladder carcinomas when the three mentioned energies were used, with all of them providing high quality specimens. This study also highlighted the importance of a patient-specific treatment. The energy sources used for the resection should be carefully selected based on the lesion's location to avoid complications and ensure a high-quality specimen. (16)

The eBloc study published D'Andrea et al. also provided a subanalysis for this trial, revealing that the DM sampling rate in ERBT is most commonly observed in tumors less than two centimeters in diameter, located on the left or posterior bladder wall, clinical Ta tumors, ones that are resected under photodynamic diagnosis (PDD) or tumors resected by a junior urologist. (2)



Study or subgroup	ERBT Events	ERBT Total	cTURBT Events	cTURBT Total	Weight	Risk ratio M-H, Random, 95% CI
Badawy 2022	57	60	44	60	9.3%	1.30 (1.10, 1.53)
Balan 2018	45	45	45	45	13.6%	1.00 (0.96, 1.04)
D'Andrea 2023	177	219	166	233	11.7%	1.13 (1.02, 1.26)
Fan 2021	104	116	84	117	10.7%	1.25 (1.10, 1.42)
Gakis 2020	41	56	36	59	6.2%	1.20 (0.93, 1.55)
Gallioli 2022	133	140	101	108	13.1%	1.02 (0.95, 1.08)
Hashem 2020	49	50	31	50	7.3%	1.58 (1.27, 1.97)
Teoh 2024	119	143	112	133	11.7%	0.99 (0.89, 1.10)
Tripathi 2021	22	40	24	43	3.7%	0.99 (0.67, 1.45)
Zhang 2015	131	149	134	143	12.8%	0.94 (0.87, 1.01)
Total (95% CI)		**1018**		**991**	**100.0%**	**1.10 (1.01, 1.20)**
Total events	878		777			

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 61.46$, $df = 9$ ($p < 0.00001$); $I^2 = 85\%$
Test for overall effect: $Z = 2.26$ ($p = 0.02$)

Figure 8
DM sampling rate in ERBT vs. cTURBT

Note. From: "En Bloc Versus Conventional Transurethral Resection of Bladder Tumors: A Systematic Review and Meta-analysis of Oncological, Histopathological, and Surgical Outcomes", 2025, Basile G, Uleri A, Leni R, Cannoletta D, Afferi L, Baboudjian M, et al.. Eur Urol Oncol., p. 9, Copyright: Basile, Uleri, Leni, Cannoletta, Afferi, Baboudijan, et al. (11)

Basile et al. also found ERBT to be statistically significantly superior in the DM sampling rate, as seen in the forest plot in Figure 8 (9).

Croghan et al. looked more closely at the different techniques applied in ERBT. The included techniques were electrocautery ERBT (incl. mono- and bipolar current), laser ERBT, hydrodissection with electrocautery ERBT, polypectomy snare ERBT and three studies with mixed cohorts. In the case of electrocautery ERBT, the rate of DM in the specimens exceeded 80% in all included studies, with 13 out of 16 of the studies even reporting more than 90%. Similarly, the DM rates were also statistically significantly better in the laser ERBT compared with cTURBT. Unfortunately, the rate of DM sampling was inconsistently reported in the case of waterjet hydrodissection, making it hard to draw any conclusions regarding this specific method. (13)

Most studies did not include RFS at the same time points making the findings difficult to interpret, there is also a lack of studies assessing the long-term outcomes of ERBT, warranting more research on this specific aspect.

Nine studies include RFS in their outcomes. Three of these studies did not find a statistically significant difference in the RFS (2,9,14) .

Teoh et al. found a statistically significant difference favoring ERBT in the 1-year recurrence rate. On further subanalysis of the participants, the authors found that a specific group of patients benefitted from ERBT the most. These include ones with tumors measuring 1-3 centimeters in size, single tumors, Ta disease, or intermediate-risk NMIBC patients. (11)

Struck et al. report no statistically significant difference in the six-month RFS, however, a statistically significant difference favoring ERBT in the 12-month RFS. (8)

Li et al. also report a statistically significant difference favoring ERBT regarding the three- and 12-month RFS, although there was no statistically significant difference between ERBT and cTURBT groups at any later follow-ups. The authors also found an improvement in the RFS when the data from the hydrodissection group was omitted and when bipolar energy was used during ERBT. (3)

Wang et al. report an improved, statistically significant increase in the three- and 24-month RFS, there was however, no significant difference in the 12-month RFS rate. (10)

Basile et al. did not find a statistically significant difference in the 12-month (A) or 24-month (B) RFS, as seen in the forest plots in Figure 9. (9)

To conclude, most studies favor ERBT regarding the DM sampling rate. The recurrence is equal or superior to cTURBT in most cases as well, thus making ERBT a feasible and reliable procedure to be performed. Unfortunately, most studies done on ERBT, lack a long-term follow-up. There is also a shortage of studies with similar endpoints, making it more difficult to compare them accurately. There are also no uniform requirements on the energies used or postoperative procedures like single-dose chemotherapy instillations, BCG instillations, or second-look TURBT, which could lead to different percentages of RFS in the studies.

The rate of DM in the samples also heavily relies on the surgeon’s experience and technique. One study suggests that more experienced surgeons generally have higher DM rates in their resections, but less experienced surgeons may profit from ERBT because it can give the resection procedure more structure (9). Most studies do not include a stratification according to the level of experience of their surgeons, making it difficult to interpret their findings based on the level of experience (8,11,13).

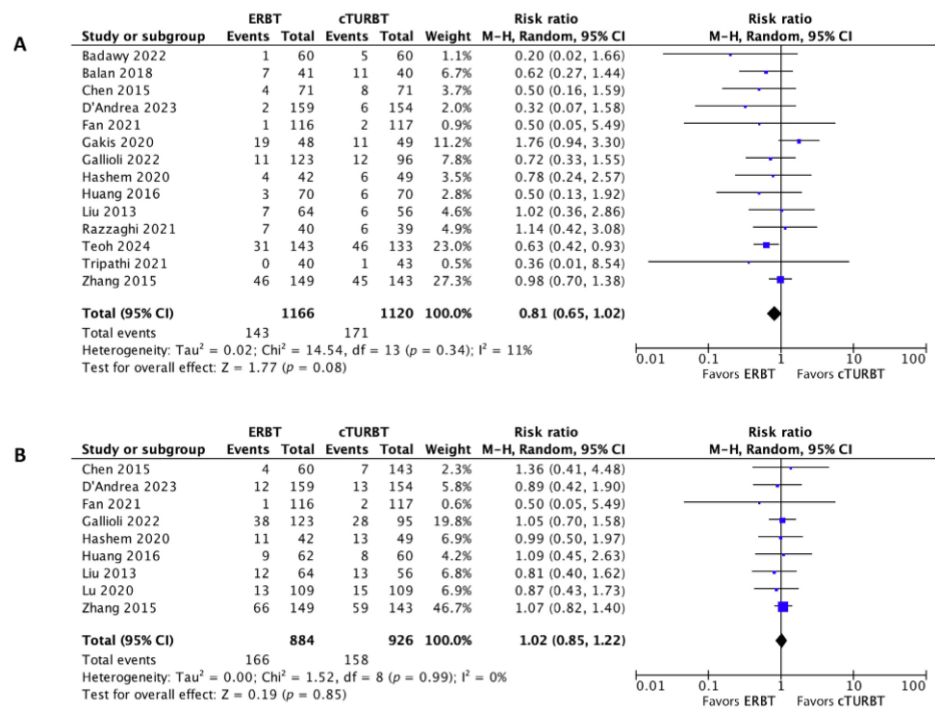


Figure 9

RFS at 12- and 24 months

Note. From: “En Bloc Versus Conventional Transurethral Resection of Bladder Tumors: A Systematic Review and Meta-analysis of Oncological, Histopathological, and Surgical Outcomes”, 2025, Basile G, Uleri A, Leni R, Cannoletta D, Afferi L, Baboudjian M, et al.. Eur Urol Oncol., p. 8, Copyright: Basile, Uleri, Leni, Cannoletta, Afferi, Baboudijan, et al. (11)

10.4. Resection Quality and Tumor Staging

The resection quality can be measured using DM sampling rate, but also using the quality of the resection margins, the ability of T1 sub-staging, and the rates of residual disease at second-look TURBT.

Seven studies looked more closely at the rate of R0 resections when the two resection methods were compared. Four studies did not find a significant difference between the ERBT and cTURBT groups (2,3,9,11), while the three others did find a statistically significant difference where the ERBT was superior (8,13,14).

Struck et al. included the histological staging quality as a secondary outcome in their study. It was found that the complete resection, meaning that the resected specimen contains at least one layer of healthy tissue (R0), was statistically significantly superior in the ERBT group. The amount of tissue margins that could not be properly assessed (RX) due to artifacts was also statistically significantly lower in the ERBT specimens. There was no significant difference between groups regarding the number of specimens with malignant cells extending to a deep or lateral margin (R1). Overall, the staging quality was found to be superior in ERBT, resulting in fewer patients requiring second resections. (8)

The Hybridblue study by Gakis et al. found a statistically significant difference in favor of ERBT regarding R0 margins as well, and the rate of RX margins was significantly higher in the cTURBT group. (14)

Croghan et al. found electrocautery and laser ERBT to be superior in the case of T1 sub-staging. Polypectomy snare ERBT had high rates of muscularis mucosae (MM) in their specimens. Between the different energies used for ERBT, there was no statistically significant difference regarding the detectability of MM. (13)

The umbrella review published by Li et al. also found a reduced rate of residual tumor in their analysis (3). Contrary to this, Basile et al. found no significant difference between cTURBT and ERBT regarding residual tumor rate and MM detectability (9).

All studies, including R0 resection rates in their analysis, found ERBT to be similar or superior to cTURBT. Higher rates of complete resections and better substaging possibilities may reduce the need for second-look resections. This has a positive effect on the treatment provided, quality of life of patients, and financial aspects.

10.5. Challenges of ERBT Implementation - Tumor Size, Location and Technical Feasibility

According to a study published by Teoh and Mostafid et al., the technical success of ERBT reached 73.3%. The authors further stratified their results according to tumor size and found that the success rates of ERBT for tumors of ≤3 cm and >3 cm were 84.3% and 29.6%, respectively. (18)

Another study mentions that tumor size was given as a reason for conversion to cTURBT. Larger tumors require fragmentation prior to extraction, Struck et al. reported that tumors with an average of 3.3 cm in diameter were fragmented intravesically. In their study, conversion to cTURBT due to size was only needed in one case, thus concluding that tumor size is not a limitation for ERBT. It is also highlighted that proper assessment of the tumor’s location, size, and anatomy prior to the resection is needed for the best quality resection. (8)

Basile et al. report ERBT failure rates ranging from 3.4% to 12%. The reasons for conversion to cTURBT were mostly tumor size or tumor retrieval challenges. (9)

Comparably, Croghan et al. also report a correlation between increasing tumor size and decreasing feasibility of ERBT. (13)
ERBT seems to be superior compared with cTURBT, especially in the case of NMIBC tumors ranging from 1-3 cm in diameter. (2)

Regarding the tumor location, ERBT also has some limitations. The bladder dome, anterior wall, or close proximity to the urethral orifice can pose some difficulties. However, most tumors are found on the bladder floor or lateral walls, thus making ERBT feasible in most cases. (14)
Opposing this, one study by Miyake et al. proposed that electrocautery ERBT may be preferred for the resection of tumors located around the orifices, since ERBT provides a much more controlled coagulation (19). Additionally, as previously mentioned, ERBT can also be safer in some cases. Laser ERBT for instance, has a decreased risk of ONR occurrence, thus also decreasing the risk of bladder perforation. (13)

In conclusion, tumor size and location are not necessarily limiting factors of ERBT. The most important aspect when considering ERBT is the careful assessment of the tumor preoperatively. This problem highlights the importance of patient-tailored treatment, thus ensuring the best possible treatment options for each patient.

10.6. Practical Considerations for ERBT Implementation

10.6.1. Surgeon Experience and Learning Curve

With ERBT being a relatively new procedure, it is important to take surgeon experience into account. Unfortunately, there are not many studies that stratify their results according to surgeon experience, making it harder to observe differences in technique and resection quality. Most studies, however, mention that ERBT may be even more successful if the surgeons gain more experience over the years.

Regarding cTURBT, senior urologists have been observed to have up to 15% more DM in their resection specimens (9). Basile et al. found that ERBT may be an especially useful tool for young practitioners in their analysis (9). It provides a more guided approach to the resection, with specific steps to be followed (11). It also increases the DM rate when the ERBT is performed by young practitioners. Additionally, with rates of ONR being lower in lateral wall resections using ERBT, the younger practitioners may face fewer complications intra- and postoperatively (9).
The conversion of ERBT to cTURBT may not only be due to resections in difficult locations, for example, but also because of a lack of experience and confidence of the surgeons (14).

10.6.2. Patient Selection

The ERBT studies especially highlight the need for patient-tailored treatment. It shows that one single method should not be applied to every patient since the tumors have different anatomies, different locations, and different sizes. A proper preoperative assessment of the lesions is of utter importance to ensure the best possible resection for each patient.

For example, sessile tumors larger than 5 mm with a possible submucosal infiltration would probably benefit from ERBT since the tumor is manipulated as little as possible and the likelihood of acquiring a good specimen for pathological analysis is greater (14).

The location of the tumor plays an important role in patient selection as well. It has been described that the difficulty of tumor resection increases for lesions in the dome, bladder neck, and the anterior wall. (16)

The most significant benefit of applying ERBT has been found in patients with a single tumor measuring 1-3 cm in diameter, patients with a Ta disease, or intermediate-risk NMIBC patients (9).

The rate of DM retrieval also depends on each specific tumor. For instance, Ta tumors, tumors less than 2 cm in diameter, tumors located on the posterior or left lateral wall, tumors resected under PDD, and tumors being resected by a more inexperienced surgeon had the best results for DM retrieval. (2)

Regarding the RFS, Teoh et al. also provided a subanalysis of their trial. The authors stated that, similarly to what has previously been mentioned, patients with a single tumor, tumors measuring 1-3 cm in diameter, patients with Ta disease or intermediate risk NMIBC patients had a superior RFS when being treated with ERBT compared with cTURBT. (11)

Patients with multiple lesions may benefit from cTURBT since ERBT is more time-consuming (9). It is possible, however, that there will not be a difference in operative time when ERBT is a more established treatment method.

11. Case Report

11.1. Presenting Symptoms

The patient, a 64-year-old male, presents to the urological specialist with painless macrohematuria with blood clots. He describes having had a similar episode a few months prior to the consultation, which resolved spontaneously.

11.2. Anamnesis

The patient has been a smoker for 40 years with 20 pack years. The only known preexisting medical condition is primary arterial hypertension, which is well-controlled with medication. The patient denies taking any anticoagulation or antiplatelet medication. He has not experienced any recurring urinary tract infections either and has not had any urological procedures. Finally, there has not been any occupational exposure to any carcinogens, like aniline dyes or aromatic amines.

11.3. Initial Assessment and Diagnostic Workup

A complete blood count (CBC) performed by the family doctor showed no abnormalities, thus ruling out anemia or infection.
The family doctor also performed a urinalysis, which showed no signs of infection but marked hematuria (ERY 200 RBCs/HPF; normal ≤3 RBCs/HPF).

The patient's persistent macrohematuria and smoking history prompted the referral to a urologist, where an ultrasound (US) of the urological system was performed.

No tumors or hydronephrosis in either kidney could be found during the US examination. In the left bladder wall, a three cm solid hyperechogenic mass was identified, raising suspicion of a urothelial tumor.

To further evaluate the US examination finding, a flexible cystoscopy was performed, confirming the growth of a three-centimeter papillary exophytic tumor located on the left bladder wall. There were no signs of an invasion into the bladder neck, urethral orifices, or trigone.

Subsequently, a computer tomography (CT) scan of the thorax, abdomen, and pelvis was done, showing the bladder tumor without any perivesical infiltration, regional lymphadenopathy, or distant metastases.

11.4. Surgical Management

In accordance with the diagnostic workup, the patient underwent TURBT of the bladder tumor using the *en bloc* technique with the bipolar resectoscope. It was possible to excise the entire tumor *en bloc*. The anatomic orientation was maintained, allowing for an accurate histopathological staging.

Following the resection, the tumor was fragmented into four smaller pieces due to the tumor size, which were then removed. The bladder was thoroughly irrigated to minimize the risk of tumor cell implantation. Complete hemostasis was achieved, and no bladder perforation was observed intraoperatively.

11.5. Histopathological Staging

The histological report revealed a non-invasive low-grade (G1) papillary urothelial carcinoma pTa. No muscle invasion was observed, the muscularis propria was present and uninvolved in the excised specimen. No lymphovascular invasion or high-grade features were found.
Since the tumor was excised completely, the patient was classified as low-risk NMIBC, requiring no further radical interventions, like a radical cystectomy.

11.6. Postoperative Care and Immediate Adjuvant Therapy

Postoperatively, the patient received single-dose intravesical chemotherapy with Doxorubicin (100 mg) six hours after the procedure. The early single-dose chemotherapy was intended to eradicate any residual tumor cells, thus reducing the risk of early recurrence.

The patient's recovery remained without complications. On the first postoperative day, the patient was discharged with instructions regarding his fluid intake, avoidance of strenuous activity, and recognition of early signs of complications (including dysuria, fever, and clot retention). After seven days, the patient stated not having any pain, dysuria, or hematuria. His urinary function remained normal, and he denied having any significant lower urinary tract symptoms.

11.7. Follow-up and Surveillance

In accordance with the EAU guidelines, a structured surveillance plan was established, which matched his diagnosis of a low-risk NMIBC.

First follow-up at three months:
The patient underwent a flexible cystoscopy where no signs of recurrence or any new lesions could be observed. The bladder and upper urinary tract ultrasonography did not show any abnormalities either.

Subsequent follow-up:

Follow-up cystoscopies were done every six months for the first two years, followed by annual cystoscopies if no signs of recurrence were detected. The bladder and kidneys were also evaluated every six months by ultrasonography.
There were no indications of any further chemotherapy since the patient had been classified as having a low risk of progression and recurrence.

The most recent follow-up has been the 24-month follow-up. The patient has remained disease-free with no sign of tumor recurrence or progression so far.

11.8. Case report: Conclusion

This case report shows the success of ERBT in practice. The patient did not experience any complications perioperatively, accurate substaging of the resected specimen was possible, and there were no recurrences or progression during the 24-month follow-up. This case shows that ERBT is a safe and feasible procedure with good postoperative outcomes.

12. Conclusions

This literature review and case report show that the *en bloc* resection of bladder tumors is a safe and feasible procedure. It is similar or even superior regarding the recurrence-free survival and progression rates. The complication rates of this procedure are also comparable or better. This review highlights the importance of patient-tailored care. A proper preoperative evaluation of the tumor can significantly impact the success of *en bloc* resections in bladder tumors, improve staging, and thus improve the subsequent treatment provided for the patient.
The resection quality is superior in *en bloc* resections, and this method can be especially helpful in the training of junior consultants.
The case discussed above underlines the findings of the included literature. The patient did not have any complications intra- or postoperatively, and no recurrences or progression during the 24-month follow-up could be observed.
Finally, it is possible that the success rates of *en bloc* resections increase as the surgeons gain more experience over time since it is a relatively new procedure.

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