



## Comparative Analysis of En-Bloc and Conventional Transurethral Resection of Bladder Tumor (TURBT) for Non-Muscle Invasive Bladder Cancer: A Systematic Review and Meta-Analysis

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### ABSTRACT

In order to treat non-muscle invasive bladder cancer, this study will compare and contrast conventional transurethral resection of bladder tumors (TURBT) with En-bloc resection (ERBT). It will also assess the efficacy, safety, and recurrence rates of these two methods. We searched PubMed and Science Direct for relevant articles published between 2013 and 2023. Articles from randomized controlled trials, retrospective analyses, and prospective studies comparing non-muscle invasive bladder cancer therapies employing en bloc versus conventional TURBT are included in this analysis. Measuring effect size was done using Mean Difference (MD) and Odd Ratio (OR) with 95% CI. There is statistical significance when the p-value is less than 0.05. Fourteen studies were eligible for inclusion. With fewer tumor recurrences (OR 0.66; 95% [CI] 0.52, 0.84; I<sup>2</sup> = 6%; P = 0.0007), ERBT proved to be superior to TURBT. There was a decrease in the occurrence of perioperative complications and outcomes associated with ERBT, including bladder perforation and obturator nerve injury. According to the fourteen articles that were included, patients receiving ERBT experienced much fewer complications, recurrences, hospital stays, and catheterization time than those receiving conventional TURBT.

Keywords: Bladder Cancer; ERBT, TURBT, NMIBC

### ABSTRAK

Untuk mengobati kanker kandung kemih non-otot invasif, studi ini akan membandingkan dan membedakan reseksi transuretral tumor kandung kemih konvensional (TURBT) dengan reseksi En-blok (ERBT). Studi ini juga akan menilai efikasi, keamanan, dan tingkat kekambuhan dari kedua metode tersebut. Kami mencari artikel relevan yang dipublikasikan antara tahun 2013 dan 2023 di PubMed dan Science Direct. Artikel dari uji coba terkontrol acak, analisis retrospektif, dan studi prospektif yang membandingkan terapi kanker kandung kemih non-otot invasif dengan menggunakan en bloc versus TURBT konvensional termasuk dalam analisis ini. Pengukuran ukuran efek dilakukan menggunakan Mean Difference (MD) dan Odd Ratio (OR) dengan 95% CI. Ada signifikansi statistik ketika nilai p kurang dari 0.05. Empat belas studi memenuhi syarat untuk dimasukkan. Dengan lebih sedikit kekambuhan tumor (OR 0.66; 95% [CI] 0.52, 0.84; I<sup>2</sup> = 6%; P = 0.0007), ERBT terbukti lebih unggul dibandingkan TURBT. Terdapat penurunan dalam kejadian komplikasi perioperatif dan hasil yang terkait dengan ERBT, termasuk perforasi kandung kemih dan cedera saraf obturator. Menurut empat belas artikel yang dimasukkan, pasien yang menerima ERBT mengalami jauh lebih sedikit komplikasi, kekambuhan, lama tinggal di rumah sakit, dan waktu kateterisasi dibandingkan dengan mereka yang menerima TURBT konvensional.

Kata kunci: Kanker Kandung Kemih; ERBT, TURBT, NMIBC

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## INTRODUCTION

The most frequent malignancy of the urogenital system is bladder cancer. At almost 90%, urothelial carcinoma is the histology most frequently observed in bladder cancer types. Urothelial cancer is defined as an invasion of the membrane basement, the propria lamina, or even deeper, brought on by a urothelial neoplastic cell (Kaseb, 2022). According to the Global Cancer Observatory, at the global level, bladder cancer ranks as the ninth most prevalent form of cancer and the thirteenth greatest cause of death. Although it is the thirteenth most common kind of cancer in Indonesia, bladder cancer is the fifteenth most common cause of death that is directly related to cancer. The incidence of bladder cancer is relatively high, with 21.376 instances, which is equivalent to 2.1 cases per 100,000 persons (Ferlay et al., 2024). Nearly seventy-five percent of all occurrences of bladder cancer are classified as non-muscle invasive bladder tumors (NMIBC). These include non-invasive papillary carcinoma (Ta), tumour invasion on subepithelial connective tissue (T1), and carcinoma in situ (Tis) (Gontero P., 2023). The standard therapy in patients with NMIBC is transurethral resection of bladder tumors or commonly known as TURBT and combined with adjuvant intravesical chemotherapy (Rayn et al., 2018).

The use of a wire loop in transurethral resection of bladder tumors (TURBT) has been considered the standard way for identifying and treating non-muscle invasive bladder cancer (NMIBC) for a very long time. This practice dates back to the 1910s. However, the standard TURBT is thought to have some problems, such as the fact that it removes tumor cells partially and doesn't include the detrusor muscle in the specimen. This removal method doesn't follow the basic rules of oncological surgery, which means it can't effectively find and treat bladder cancer (Kim & Patel, 2020a; Wang et al., 2023). In the past few years, improvements in medical tools like surgical techniques and instruments, as well as micro or small tumor imaging, have made it possible for more than one way to be used instead of conventional TURBT (Kramer et al., 2017).

The technique of En-Bloc resection (ERBT) was originally outlined by Kawada et al. in 1997 (Kawada et al., 1997) and has been utilized by urologists ever since. ERBT's primary benefit is its ability to completely remove and extract the entire tumour in one piece, ensuring a high-quality specimen. This widely performed procedure utilizes various energy sources such as the holmium laser, thulium laser, 2- $\mu$ m continuous-wave laser, Hybrid-knife, green-light laser, etc with ERBT providing nearly 95% of the detrusor muscle for a more accurate pathological diagnosis (Kramer et al., 2017).

Several investigations have looked into whether or not en-bloc TURBT (ERBT) is feasible. In this study, we compared the results of the traditional incising and scattering method with those of ERBT-based "sculpting and resecting," and we looked at how the two approaches compare in terms of recurrence.

## RESEARCH METHOD

Within the scope of this investigation, a systematic review and meta-analysis were carried out using the databases PubMed and Science Direct. The time covered by the study was from 2013 to 2023. Journal search utilizing the PICO framework with the following criteria: Patients with non-muscle-invasive bladder cancer (P), ERBT (I), TURBT (C), and outcomes such as operative time, hospitalization time, catheterization time, bladder perforation, obturator nerve reflex, and recurrence rate (O). Journal extracts are retrieved from the PUBMED and Science Direct databases using specific keyword combinations such as "TURBT," "Transurethral Resection of Bladder Tumors," "ERBT," "en bloc," "en-bloc," "bladder cancer," "bladder tumors," and "recurrence." Additionally, two studies were selected directly from the search results.

### Inclusion and Exclusion Criteria

The inclusion criteria are studies that are retrospective, prospective, and randomized controlled trials; studies in English with primary bladder cancer that has never received therapy before; non-muscle invasive bladder cancers (Ta, T1, and Tis); and the presence of comparative patient data given between TURBT and ERBT. Exclusion criteria include studies in different languages, case reports, expert opinions, systematic reviews, abstracts, and other meta-analyses.

### Study Selection and Data Extraction

The total number of journals obtained at the start of the search was 798 studies; 45 duplicated studies were eliminated, and 403 studies were filtered with automation tools for the years 2013–2023. A total of 350 studies were re-screened into 27 studies, and 1 study was not obtained in full text; 1 study showed only a recurrence rate within 3 months; 2 studies were muscle invasive; 6 studies had no specific time for follow-up; 4 studies had no recurrence data; and one study had recurrent tumors, thus obtaining 14 studies that met the inclusion criteria. The other searches obtained two studies that were obtained from previous searches. A PRISMA flowchart can be seen in Figure 1. Investigators review all titles and abstracts from the literature overview to determine the eligible trials utilizing Rayyan. The acquired studies are exported to EndNote for the assessment of full-text publications to finalize the selection of articles. The data extracted from each study included the journal and year of publication, study type, number of patients, average patient age, average tumor size, perioperative outcomes, complications, and recurrence rates at 12 and 24 months. Information was gathered with Microsoft Excel.

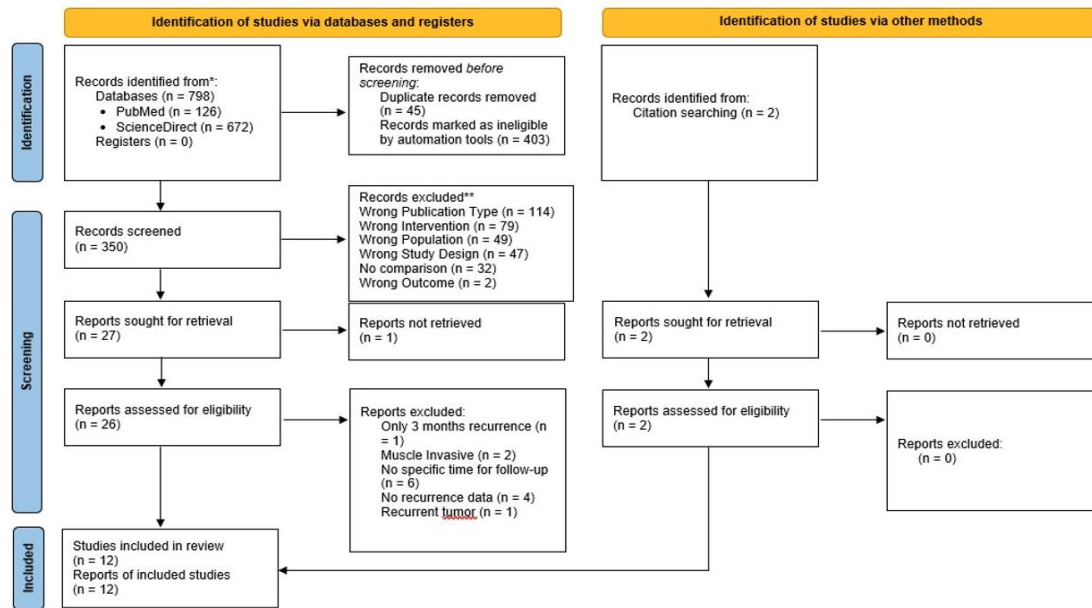


Figure 1. Search and screen articles based on the PRISMA 2020 flow diagram

Table 1. Characteristics of included studies

No	Study	Year	Study Design	Treatment En-Bloc	Age	Total	Tumor Size	T Stage	Adjuvant Therapy
					(mean)	Patients	(mean)cm		
					ERBT/TURBT	ERBT / TURBT	ERBT/TURBT	ERBT/TURBT	
1	Badawy <sup>13</sup>	2023	Prospective	Thulium Laser	64.5 / 61.83	54 / 52	1.85 / 1.81	N/A	Doxorubicin
2	Balan <sup>14</sup>	2018	Prospective	Bipolar	64.7 / 66.1	41 / 40	1.82 / 1.69	Ta 24 / 23 T1 21 / 22	Epirubicin or BCG
3	Chen <sup>10</sup>	2015	RCT	2-Micron Laser	63 / 62	71/71	2.6 / 2.3	Ta 43 / 55 T1 25 / 15 Cis 3 / 1	Epirubicin
4	Chen <sup>15</sup>	2016	Prospective	Green-Light Lithium Triborate	63.43 / 65.31	83/75	1.85 / 1.71	Ta 70 / 64 T1 13 / 11	Mitomycin C
5	d'souza <sup>16</sup>	2016	Prospective	Holmium Laser	66.3 / 67.1	23/27	1.58 / 1.41	Ta 15 / 16 T1 8 / 11	Mitomycin C or BCG
6	Hashem <sup>11</sup>	2021	RCT	Holmium Laser	60.4 / 61.1	44/49	3.2 / 2.9	Ta 2 / 2 T1 42 / 46	Epirubicin
7	Huang <sup>120</sup>	2016	Retrospective	2-micron Laser	58.31 / 57.87	70 / 70	1.63 / 1.53	Ta 40 / 35 T1 23 / 27 Cis 45511	Epirubicin
8	Huang <sup>20</sup>	2016	Restrospective	Holmium Laser	59.97 / 57.87	70 / 70	1.58 / 1.53	Ta 37 / 35 T1 28 / 27 Tis 45509	Epirubicin
9	Liu <sup>12</sup>	2013	RCT	2-mm continuous-wave laser	67.1 / 66.3	64 / 56	1.31 / 1.28	Ta 37 / 34 T1 27 / 22	Epirubicin
10	Liu <sup>21</sup>	2021	Retrospective	Thulium Laser	60.6 / 61.2	37 / 53	1.7 / 2.2	Ta 16 / 20 T1 18 / 31 Cis 3 / 2	Gemcitabine
11	Tao <sup>22</sup>	2020	Retrospective	980nm laser	61.2 / 62.5	36/48	2.2 / 2.0	Ta 24 / 37 T1 12 / 10 Cis 0 / 1	Epirubicin
12	Xu <sup>23</sup>	2017	Retrospective	Vela Laser	55.9 / 59.7	26/44	2.3 / 2.2	Ta 10 / 25 T1 12 / 16	Pirarubicin
13	Yang <sup>30</sup>	2020	Prospective	Monopolar	54.63 / 55.43	85 / 80	1.79 / 1.72	Ta 61 / 57 T1 25 / 26 T2 10 / 4	Pirarubicin
14	Zhang <sup>19</sup>	2015	Prospective	Thulim Laser	≤ 60 42 / 35* 61 - 70 57 / 63* 71 - 80 30 / 26* >80 20 / 19*	149 / 143	N/A	Ta 106 / 107 T1 43 / 36	Epirubicin
15	Zhang <sup>18</sup>	2017	Prospective	Monopolar	60.65 / 60.80	40 / 50	≤ 3cm 32 / 38* >3cm 8 / 12*	Ta 15 / 27 T1 25 / 23	Pirarubicin

RCT randomized control trial; ERBT en-bloc resection of bladder tumor; TURBT transurethral resection of bladder tumor  
\*total patients

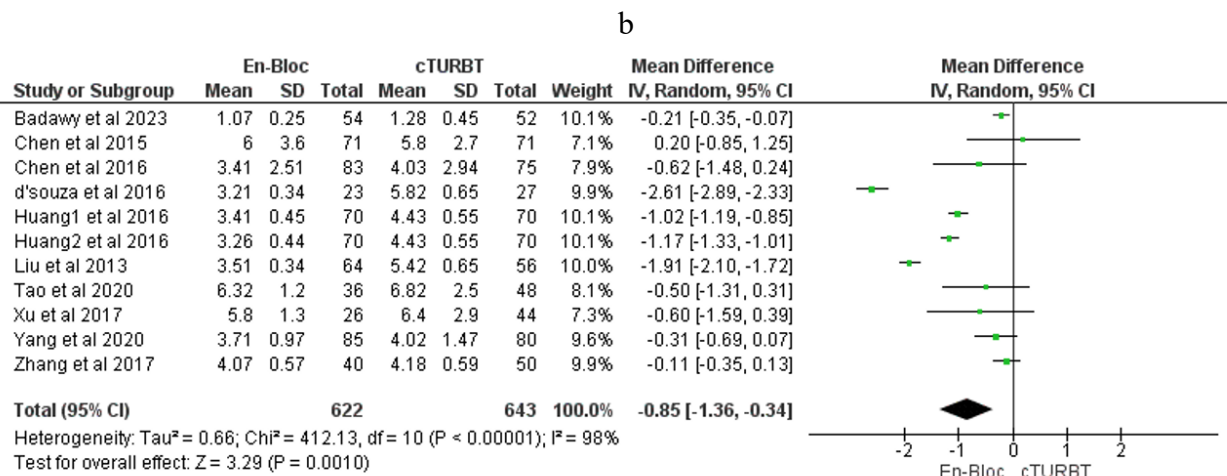
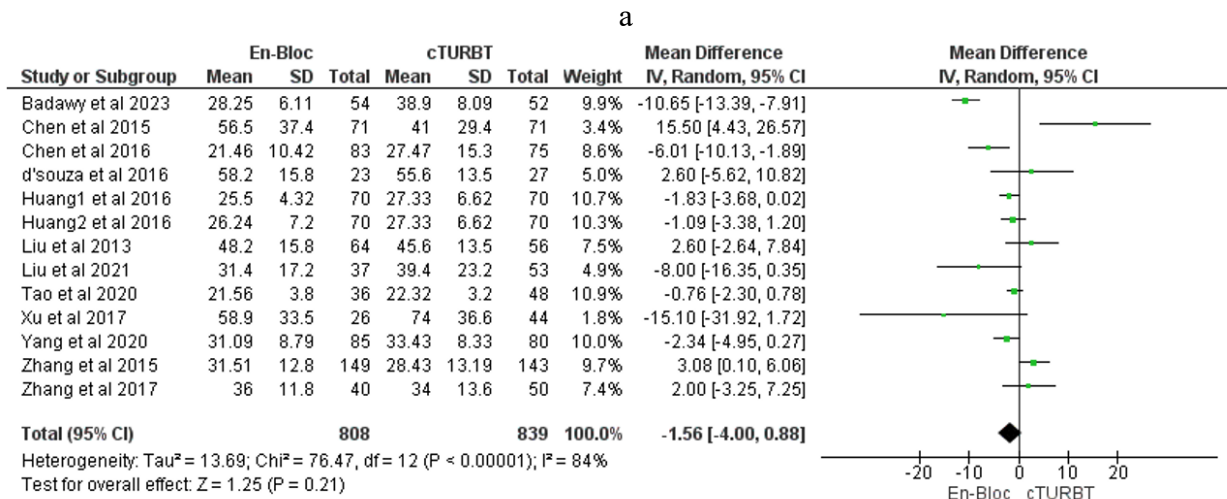
**Statistical analysis**

We used Review Manager 5.4.1 for data evaluation. Continuous outcomes were assessed using mean difference (MD) with 95% confidence intervals (CI), while dichotomous outcomes were evaluated using odds ratio (OR) with 95% CI. In cases of significant heterogeneity ( $P < 0.05$ ) and  $I^2 > 50\%$ , a random-effects model was utilized for data analysis. Otherwise, fixed-effects models were used.

**RESULTS AND DISCUSSION**

**Characteristic of included studies**

Overall, 14 studies showed clinical characteristics in 1751 patients included in the meta-analysis after screening in Table 1. Three studies were RCT(X. Chen et al., 2015; Hashem et al., 2021; H. Liu et al., 2013), seven studies were prospective(Badawy et al., 2023; J. Chen et al., 2016; D’Souza & Verma, 2016; Xenia Bălan et al., 2018; Y. Yang et al., 2020; K. Y. Zhang et al., 2017; X. R. Zhang et al., 2015) dan and four studies were retrospective.(Huang et al., 2016; Z. Liu et al., 2021; Tao et al., 2020; Xu et al., 2018) En-bloc operations were performed with different types of lasers in each study and compared to conventional TURBT. Every patient included in these studies, received intravesical post-operative chemotherapy. Each patient in each follow-up study was divided into 12 months and 24 months, depending on the study.



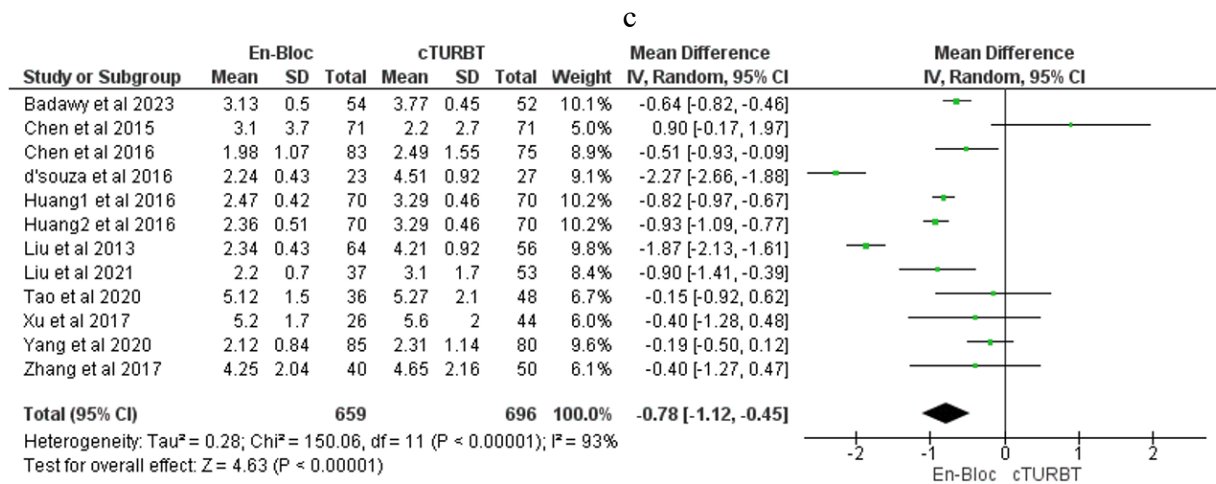


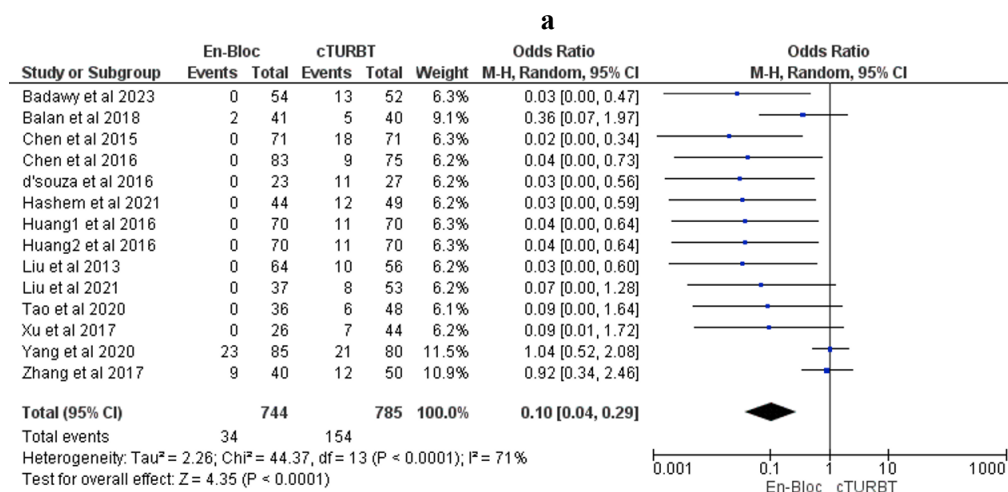
Figure 2. Forest plot for operative time (a), hospitalization time (b), catheterization time (c)

**Operative time, hospitalization time, catheterization time**

Hospitalization duration was documented in ten studies, catheterization duration in eleven studies, and operative duration in twelve studies. In accordance with ten studies (Badawy et al., 2023; Chen et al., 2016; X. Chen et al., 2015; D’Souza & Verma, 2016; Huang et al., 2016; H. Liu et al., 2013; Tao et al., 2020; Xu et al., 2018; Y. Yang et al., 2020; K. Y. Zhang et al., 2017) The HT of patients treated with ERBT was considerably lower than that of patients treated with cTURBT, the mean difference (MD) was -0.85, in favor of ERBT (random effect, 95% confidence interval (CI)[-1.36, -0.34]; I<sup>2</sup> = 98%; P = 0.001). Likewise, 11 studies(Badawy et al., 2023; Chen et al., 2016; X. Chen et al., 2015; D’Souza & Verma, 2016; Huang et al., 2016; H. Liu et al., 2013; Z. Liu et al., 2021; Tao et al., 2020; Xu et al., 2018; Y. Yang et al., 2020; K. Y. Zhang et al., 2017) provided evidence indicating that the catheterization time difference between the two groups proved to be statistically significant (MD, -0.78; 95% [CI], -1.12, -0.45; I<sup>2</sup> = 93%; P < 0.00001). However, Regarding operation duration, there was no significant disparity.(Badawy et al., 2023; J. Chen et al., 2016; X. Chen et al., 2015; D’Souza & Verma, 2016; Huang et al., 2016; H. Liu et al., 2013; Z. Liu et al., 2021; Tao et al., 2020; Xu et al., 2018; Y. Yang et al., 2020; K. Y. Zhang et al., 2017; X. R. Zhang et al., 2015) (MD, -1.56; 95% [CI], -4.00, 0.88; I<sup>2</sup> = 84%; P = 0.21)]. The ERBT group had considerably shorter hospitalization and catheterization times compared to the conventional TURBT group.(Fig. 2)

**Complications**

There was a substantial difference in the incidence of reflex nerve obturator between patients who received ERBT and those who had conventional TURBT.(Badawy et al., 2023; J. Chen et al., 2016; X. Chen et al., 2015; D’Souza & Verma, 2016; Hashem et al., 2021; Huang et al., 2016; H. Liu et al., 2013; Z. Liu et al., 2021; Tao et al., 2020; Xenia Bălan et al., 2018; Xu et al., 2018; Y. Yang et al., 2020; K. Y. Zhang et al., 2017) (MD, 0.10; 95% [CI], 0.04, 0.29; I<sup>2</sup> = 71%; P < 0.00001). The same goes for bladder perforation.(Badawy et al., 2023; J. Chen et al., 2016; D’Souza & Verma, 2016; Huang et al., 2016; H. Liu et al., 2013; Z. Liu et al., 2021; Tao et al., 2020; Xu et al., 2018; Y. Yang et al., 2020; K. Y. Zhang et al., 2017; X. R. Zhang et al., 2015) (MD, 0.17; 95% [CI] 0.09, 0.32; I<sup>2</sup> = 0%; P < 0.00001).(Fig. 3)



b

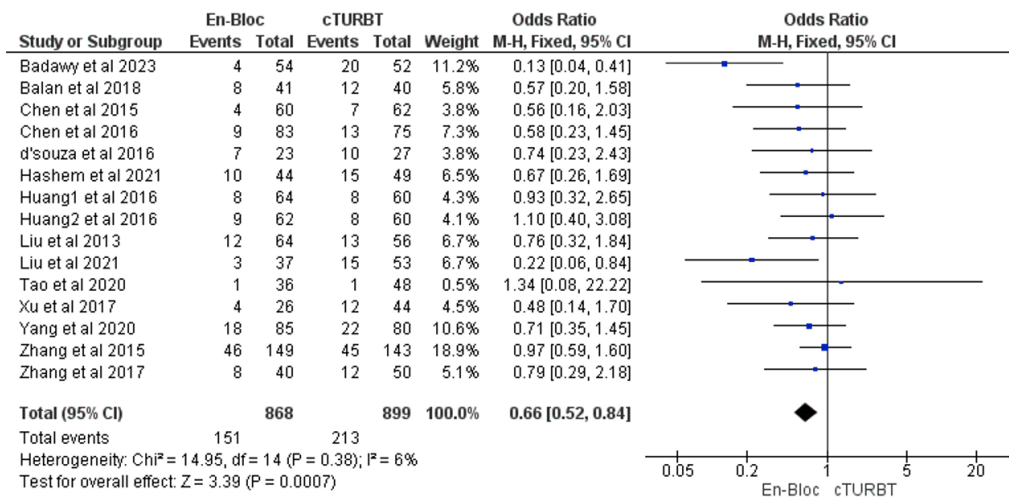
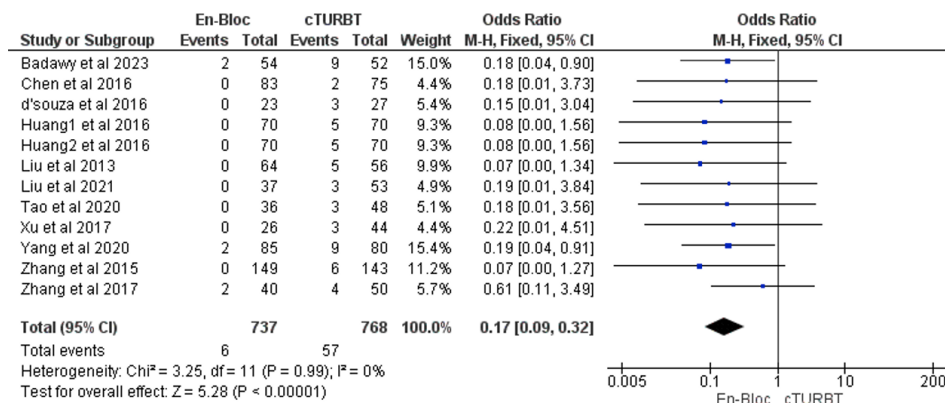


Figure 3. Forest plot for obturator nerve reflex (a), bladder perforation (b)

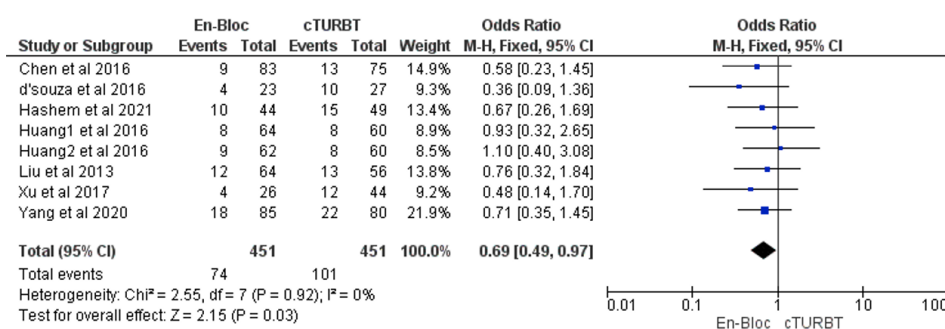
Recurrence

There are 10 studies comprising the result of 12-month(Badawy et al., 2023; X. Chen et al., 2015; D’Souza & Verma, 2016; Hashem et al., 2021; H. Liu et al., 2013; Z. Liu et al., 2021; Tao et al., 2020; Xenia Balan et al., 2018; K. Y. Zhang et al., 2017; X. R. Zhang et al., 2015) and 7 studies of 24-month recurrence(J. Chen et al., 2016; D’Souza & Verma, 2016; Hashem et al., 2021; Huang et al., 2016; H. Liu et al., 2013; Xu et al., 2018; Y. Yang et al., 2020). For both these results show that in ERBT has a lower recurrence rate compared to conventional TURBT. On 12-month follow-up obtained (Odd Ratio [OR] 0.61; 95% [CI] 0.45, 0.83; I<sup>2</sup> = 38%; P = 0.002), while on the 24-month follow-up obtained (OR 0.69; 95% [CI] 0.49, 0.97; I<sup>2</sup> = 0%; P = 0.03). Also, ERBT had a lower recurrence rate than conventional TURBT in the overall recurrence analysis (OR 0.66; 95% [CI] 0.52, 0.84; I<sup>2</sup> = 6%; P = 0.0007).(Fig. 4)

a



b



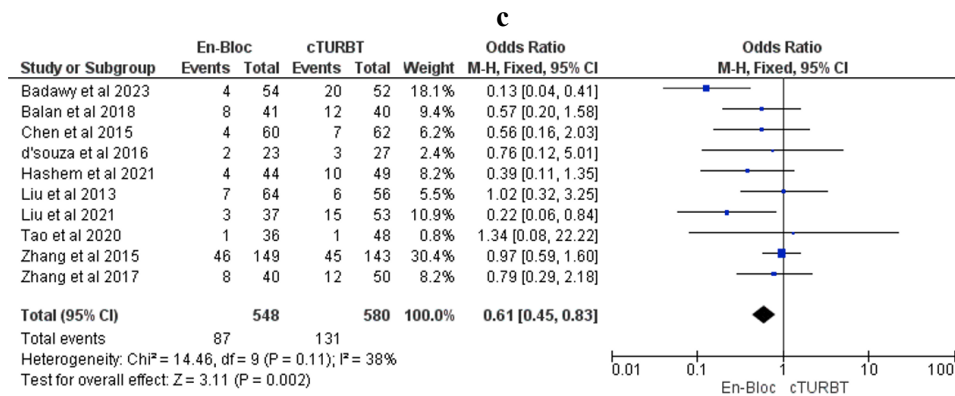


Figure 4. Forest plot for overall recurrence (a), 12-month recurrence (b), 24-month recurrence (c)

## DISCUSSION

Conventional TURBT is the gold standard for identifying and treating non-muscle invasive bladder cancer, even it has several disadvantages.(Woldu et al., 2017) In actuality, the most frequent side effects include bladder perforation, obturator nerve reflex, and partially excreted tissue that may lead to tumor recurrence(Kim & Patel, 2020b), Therefore, the question of whether En Bloc is superior in the executive sector or for diagnosis remains debatable to this day.

The fundamental principle of cancer treatment is the complete excision of the tumor. However, in conventional TURBT, a substantial number of neoplastic cells can disseminate in the bladder during this procedure. Surgeons perform Conventional TURBT using a rectoscope that has a standard electrical wire loop. Despite its long history of use, this technique still has drawbacks, including the potential for tumor cell spread, incomplete tumor removal, implantation of tumor cells, thermal damage to specimens (with temperatures ranging from 100°C to 300°C), and the inability to detect detrusor muscles due to thermal injury or damage to the tissue base. (D’Souza & Verma, 2016; Kramer et al., 2017) For tumors larger than 3 cm, the recommended approach is to dissect and remove them in small pieces, allowing the tissue to be naturally flushed out through the cystoscope sheath. However, this contradicts the principle of tumor-free removal. And also muscle detrusor is one of the criteria that indicates a complete resection.(Huang et al., 2016; H. Liu et al., 2013; K. Y. Zhang et al., 2017) This can happen due an incorrect resection depth can result in an imperfect resection, requiring the remaining tumor tissue to be removed again. Furthermore, electric cauterization might harm the tumor's most basic tissue, leading to an inaccurate histopathologic diagnosis.(Z. Liu et al., 2021; Xu et al., 2018; K. Y. Zhang et al., 2017) A deep resection increases the risk of bladder perforation and hemorrhage. Furthermore, the current flow in the device may stimulate the nerve obturator, causing contractions in the detrusor muscles that lead to bladder perfusion, particularly in tumors on the bladder's lateral wal.(Z. Liu et al., 2021) Things like this are what encourage practitioners to find more effective techniques. In recent years, new techniques have been introduced that are expected to bring changes in the field of urology in particular the implementation of bladder cancer..(Kramer et al., 2017)

En-bloc resection is the most recent innovation to emerge in bladder cancer treatment, and it has a good effect on bladder cancers. En-bloc utilization is high because it allows for more precise and controlled resection, which lowers the risk of problems during surgery, removes muscle detrusor tissue if needed, and allows for good resection of the tumor sample. The en-bloc approach involves recessing the tissue around the tumor at a distance of approximately 1 cm from the tumor, enabling intact removal of the tumors.(Sun et al., 2023) If the histological findings can verify the existence of detrusor muscle tissue at the base of the tissue, then the sampling can be considered well-categorized.(Xenia Bălan et al., 2018)

In order to determine which treatment is more successful for patients with bladder tumors that have not spread to muscle, this meta-analysis contrasts ERBT with conventional TURBT. However, this is not significant in terms of operative time and may be due to the difficulty of the operation or the operator's expertise. En-bloc transurethral resection results in much decreased obturator nerve reflex and bladder perforation rates.

In the analysis of the above data, it was found that the en-bloc that occurred bladder perforation in patients who en-bloked with the type of monopolar or bipolar resection loop, not the one using a laser. (Xenia Bălan et al., 2018; Y. Yang et al., 2020; K. Y. Zhang et al., 2017) Liu et al. discovered that employing a laser approach serves two functions: vaporization and resection. This allows for minimal bleeding during en bloc resection, and the laser power used can be adjusted based on the size of the tumor. Additionally, the laser technique is effective in inducing the coagulation of blood vessels around the tumour, reducing the outflow of tumour cells.(H. Liu et al., 2013) According to the research, the type of laser Ho:YAG or Tm:YAG is widely utilized and produces better outcomes than conventional TURBT. This is due to the type's ease of absorption by water on target tissue and superior hemostasis capabilities.(X. Chen et al., 2015) Because of the relatively weak bladder wall, with a thickness ranging from 1mm to 15mm in 25 adult cadavers,(Asfour et al.,

2019) conventional TURBT requires deeper resection, which can result in a higher risk of bladder perforation and severe bleeding, increasing the recurrence rate and progression of the tumour. (Huang et al., 2016; Y. Yang et al., 2020)

In the En-bloc technique using a laser, the current enters slowly, resulting in minimal thermal injury (with temperatures ranging from 40°C to 75°C), and the resection process is performed slowly to control depth. It is expected that the detrusor muscle remains intact in the tissue, and histopathological results become more accurate. Therefore, when the obturator nerve reflex occurs during surgery, the utilization rate of cutting and coagulation will decrease. For real-time clinical assessment of bladder tumors at the Ta stage, the superficial layer of the propria muscle can be preserved, resulting in a shallower depth of tumor resection and a lower risk of bladder perforation. (Badawy et al., 2023; D'Souza & Verma, 2016; Y. Yang et al., 2020) In the study conducted by Yang et al., compared to conventional TURBT, the incidence of obturator nerve reflex could not be avoided (23% vs. 24.14%,  $P = 0.977$ ), but the ratio of bladder perforation occurrence could be reduced to 2.08%. (Y. Yang et al., 2020) By utilizing general anesthesia, the incidence of obturator nerve reflex can be reduced, but it may lead to a higher recurrence rate compared to spinal anesthesia. (Kweon & Lee, 2018) In contrast, in a study conducted by Zhang et al., there was no significant difference between ERBT and conventional TURBT (22.5% vs. 24%,  $P = 0.867$ ). However, this study employed general anesthesia and a muscle relaxant, thereby preventing obturator nerve reflexes. (K. Y. Zhang et al., 2017)

In this data analysis, overall recurrence, as well as 12-month and 24-month recurrence rates, were examined. The results showed that en-bloc resection had significantly lower recurrence rates compared to conventional TURBT. (Fig. 4) These findings align with those reported in previous meta-analyses. (Di et al., 2023; H. Yang et al., 2020; D. Zhang et al., 2020)

Nevertheless, despite the systematic review and meta-analysis conducted, further research is necessary to ensure more significant results. Several limitations were identified in this study. Firstly, both randomized controlled trials (RCTs) and non-randomized studies were included in the analysis, potentially compromising the reliability of outcomes and hindering the ability to effectively assess the impact of study design. Additionally, some studies included pathology stage Ta, T1 tumors, while in four studies, Ta, T1, and Tis were present. There was also no information regarding whether the tumors were completely resected or the extent of tumor resection. Thirdly, the presented follow-up time was limited to 24 months only. Longer follow-up data would enable further research to determine significant differences in outcomes resulting from these treatment variations.

Finally, it is suggested that factors like the surgeon's skill, equipment availability, surgical team proficiency, smoking habits, and genetic predisposition could potentially impact the tumor recurrence rate. All the previously mentioned limitations could undermine the significance of this meta-analysis.

## LIMITATION OF THE STUDY

Although the meta-analysis showed significant advantages of en-bloc resection over conventional TURBT, such as reduced hospitalization and catheterization times, fewer complications, and lower recurrence rates, as well as better treatment of bladder cancer without muscle invasion with en-bloc resection because it produced high-quality specimens for accurate diagnosis of pathology, there were limitations in generalizing the findings. Such limitations include the need for further large-scale, high-quality RCTs to validate the superiority of certain techniques and improve overall understanding of the benefits of en-bloc resection in the treatment of bladder cancer without muscle invasion.

## CONCLUSION

According to the meta-analysis findings, en-bloc resection showed notable advantages over conventional TURBT, including reduced hospitalization and catheterization times, fewer complications, and lower recurrence rates. In addition, non-muscle invasive bladder cancer is best treated by en-bloc resection since it produces higher-quality specimens for accurate pathology diagnosis. However, further large-scale, high-quality randomized controlled trials are necessary to validate the superiority of any specific technique

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