En Bloc Versus Conventional Resection of Primary Bladder Tumor

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ABSTRACT

Background

Transurethral resection of bladder tumor (TURBT) is the crucial and standard approach in the diagnosis and management of urinary bladder cancer.

Objective

To compares conventional piecemeal and en bloc resection techniques in terms of detrusor muscle presence in resected specimens, surgical safety, and feasibility.

Method

A prospective comparative study conducted from April 2024 to March 2025 included patients with up to three bladder tumors, measuring ≤ 3 cm, who were alternately assigned to undergo either conventional piecemeal resection or en bloc resection. The primary outcome was the presence of detrusor muscle in the resected specimen. Secondary outcomes included operative time duration, bladder perforation, and obturator reflex. The quality of tissue was assessed by pathologists using a Likert scale.

Result

Eighty-seven patients were included, 43 in the conventional and 44 in the en bloc group. The baseline characteristics and tumor size were comparable. Presence of detrusor muscle in specimens was higher in en bloc group (97.7% vs 83.7%; p = 0.030). Operative duration was shorter in the en bloc group (35.55 minutes vs 43.42 minutes; p = 0.001). A case of bladder perforation was observed in the conventional group. Pathologists observed better specimen orientation and architecture in the en bloc group. Presence of tumor in re-TURBT was 16.0% in the en bloc group and 28.6% in the conventional group (p=0.497).

Conclusion

En bloc resection yielded a higher presence of detrusor muscle and shorter operative duration with better specimen quality compared to conventional piecemeal resection for tumor ≤ 3 cm.

KEY WORDS

Detrusor muscle, En bloc resection, Transurethral resection of bladder tumor

INTRODUCTION

Transurethral resection of bladder tumor (TURBT) is the standard initial treatment for bladder cancer and remains a cornerstone in the diagnosis, staging, and therapeutic management of the disease.[1-4] These steps are essential for reducing tumor recurrence and preventing disease progression, both of which continue to pose significant challenges in the long-term management of bladder cancer.[5]

Among the various TURBT techniques, conventional TURBT (cTURBT) is the most widely practiced technique. This approach involves piecemeal resection of the tumor. However, the fragmented nature of cTURBT may limit the ability to ensure complete tumor removal, complicate margin assessment, and impair pathological interpretation due to disruption of tissue architecture.[6] Additionally, the presence of free-floating tumor fragments during the procedure raises concerns about potential tumor cell reimplantation.[6,7] To overcome these limitations, en bloc TURBT (eTURBT) has been proposed as an alternative technique as this method involves resection of the tumor in a single piece along with an adequate margin of surrounding mucosa and underlying detrusor muscle.[8,9]

The presence of detrusor muscle in the resected specimen is vital for accurate pathological staging and planning further management.[10] For accurate staging, the absence of detrusor muscle is significantly associated with higher rates of residual tumor and recurrence, and understaging, except in cases of low-grade Ta tumors.[11-14]

This study was conducted to compare the surgical, pathological, and oncological outcomes of conventional and en bloc TURBT, with a particular emphasis on the presence of detrusor muscle in biopsy specimens.

METHODS

A prospective comparative study was conducted at the Department of Urology, National Academy of Medical Sciences, Bir Hospital, Kathmandu, Nepal, from April 2024 to March 2025. Ethical approval was obtained from the Institutional Review Board (approval number: 82/2081/82), and written informed consent was obtained from all participants.

Patients with suspected urinary bladder tumors underwent ultrasonography, and further characterization was done using computed tomography intravenous urogram (CT-IVU). After preoperative evaluation, all the patients with primary urinary bladder tumors were alternately assigned to undergo either cTURBT or eTURBT. Inclusion criteria included primary bladder tumors ≤ 3 cm in diameter and a maximum of three lesions. Exclusion criteria included tumors > 3 cm, more than three tumors, and synchronous or previous upper urinary tract urothelial carcinoma.

All procedures were performed under spinal anesthesia with ultrasound-guided obturator nerve block by anesthesiologists. White-light cystoscopy was used for tumor assessment and resection. Resection was done using monopolar energy (Covidien 2011, Covidien Ireland Limited) with a cautery loop or Collins knife with the setting of blend cut mode (100 watts) and fulguration (70 watts).

In cTURBT, resection was performed in a piecemeal fashion, with separate sampling of the base. In eTURBT, a circumferential incision with a 5 mm peritumoral margin was made, and resection proceeded through the lamina propria until the detrusor muscle layer was visualized. The entire tumor, including its stalk or base, was excised en bloc along the muscle plane. Tissue was retrieved using a resection loop or Ellik evacuator; large specimens were fragmented into 2-3 pieces for removal. Hemostasis was secured in all cases. A three-way Foley catheter was inserted, and continuous bladder irrigation was initiated postoperatively and discontinued on postoperative day one.

Intravesical Mitomycin C was instilled within six hours of resection when no contraindications were noted. Ten cases in the cTURBT group and 12 cases in the eTURBT group were discharged on the first postoperative day, whereas other cases were discharged on the second postoperative day. Operative details were documented using a standardized bladder mapping template and an eight-item checklist recommended by the European Association of Urology (EAU) guidelines 2024.[15]

Patients were initially followed up on 10th postoperative days with histopathology reports. Re-TURBT was performed within six weeks in cases of pT1 or high-grade tumors, absence of detrusor muscle and incomplete resection as per the 2024 EAU Guidelines.[15] Further management was guided by histopathological findings and risk stratification.

A blinded qualitative assessment of all pathological specimens was conducted by five independent pathologists. Three key histological parameters were scored using a 5-point Likert scale: (1) orientation and tissue architecture, (2) artefactual changes (e.g., cautery or crush artefacts), and (3) presence and quality of muscularis propria (detrusor muscle). Scores ranged from 1 (poor quality/ severe artefacts) to 5 (excellent quality/minimal artefacts).

The primary outcome was the presence of detrusor muscle in the pathological specimen. Secondary outcomes included operative duration, obturator reflex, bladder perforation, and status of lateral and deep resection margins. Bladder perforation was diagnosed intraoperatively by direct cystoscopic visualization or postoperatively via cystogram or ultrasonography.

Data were collected using a structured proforma and analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive and comparative statistics were applied. Categorical variables were analyzed using

Chi-square or Fisher's exact tests, and continuous variables with Student's t-test. A p-value < 0.05 was considered statistically significant.

RESULTS

Eighty-seven patients who fulfilled the inclusion criteria underwent TURBT during the period, out of which 43 were in the cTURBT group and 44 were in the eTURBT group. The mean tumor size, number and location of the tumor were comparable between the two groups (Table 1).

Table 1. Baseline characteristics of participants

Parameter	cTURBT (n=43)	eTURBT (n=44)	p-value
Median age, in years (IQR)	65(56-71)	59.50(50-71)	0.085
Sex, n (%)			0.061
Male	30 (69.8%)	38 (86.4%)	
Female	13 (30.2%)	6 (13.6%)	
Mean tumor size, in mm	24.26 ± 4.23	22.02 ± 7.76	0.100
Mean number of tumors	1.53 ± 0.70	1.48 ± 0.70	0.702
Tumor location			0.481
Right lateral wall	10 (23.3%)	14 (31.8%)	
Left lateral wall	13 (24.2%)	9 (20.5%)	
Anterior wall	1 (2.3%)	0(0)	
Posterior wall	18 (41.9%)	20 44.5%)	
Trigone	0(0)	1 (2.3%)	
Dome	1 (2.3%)	0(0)	

IQR – Interquartile range

Perforation occurred in one case with cTURBT group (1/43, 2.3%). Mean operative time was significantly lower in the eTURBT group in comparison to the cTURBT group (35.55 min vs 43.42 min; p = 0.001) (Table 2). The presence of microscopic detrusor muscle was significantly higher in the eTURBT group compared to the cTURBT group (43/44, 97.7% vs 36/43, 83.7%; p = 0.030). The distribution of T stages of tumors was similar in the two groups. Although there was a lower rate of presence of tumor in re-TURBT in the eTURBT group, this difference was not statistically significant (4/25, 16.0% vs 6/21, 28.6%, p = 0.497). One case of pathological tumor upgradation was observed in the cTURBT group, involving progression from pT1 high grade to pT2 high grade on re-TURBT. No cases of T stage upgradation were detected in the eTURBT group (Table 2).

Feedback from the pathologist showed that the orientation and tissue architecture had mean scores of 4 (largely interpretable) in the cTURBT group and 5 (clearly interpretable) in the eTURBT group. Artefactual changes were rated as mild (score 4) in the cTURBT group and minimal or absent (score 5) in the eTURBT group. Similarly, the quality of the muscularis propria was rated as mostly intact (score 4) in the cTURBT group and clearly intact (score 5) in the eTURBT group.

Table 2. Clinico-pathologic features of participants

Parameter	cTURBT (n = 43)	eTURBT (n = 44)	p-value
Perforation, n (%)			0.309
Yes	1 (2.3%)	0(0)	
No	42 (97.7%)	44 (100%)	
Obturator reflex, n (%)			0.038
Yes	4 (9.3%)	0(0)	
No	39(90.7%)	44 (100%)	
Mean operative time, mins	43.42 ± 10.08	35.55 ± 11.60	0.001
Macroscopic detrusor muscle present, n (%)	43 (100%)	44 (100%)	
Microscopic detrusor muscle in the specimen, n (%)			0.030
Present	36 (83.7%)	43 (97.7%)	
Absent	7 (16.3%)	1 (2.3%)	
pT stage, n (%)			0.486
No tumor	2 (6.1%)	0(0)	
pTa	23 (53.5%)	24 (54.5%)	
pT1	14 (32.6%)	17 (38.6%)	
pT2	4 (9.3%)	3 (6.8%)	
Grade (WHO 2004), n (%)			0.336
Low	19 (44.2%)	19 (43.2%)	
High	22 (51.2%)	25 (56.8%)	
Re-TURBT, n (%)	21 (48.8%)	25 (56.8%)	
Presence of tumor in Re-TURBT, n (%)			0.497
Yes	6 (28.6%)	4 (16%)	
No	15 (71.4%)	21 (84%)	
Re-TURBT pT stage, n (%)			0.720
No tumor	15 (71.7%)	21 (84%)	
pTa	2 (9.5%)	2 (8%)	
pT1	3 (14.3%)	2 (8%)	
pT2	1 (4.8%)	0 (0)	
Upgradation of tumor, n (%)	1(4.8)	0 (0)	
Pathologist feedback on quality of specimen, n (pathologist)			
Orientation and tissue architecture			
4 (largely interpretable)	5		
5 (clearly interpretable)		5	
Artefactual changes			
4 (mild)	5		
5 (minimal or absent)		5	
Quality of the muscularis propria			
4 (mostly intact)	5		
5 (clearly intact)		5	

DISCUSSIONS

The key indicators of a high-quality TURBT include the completeness of tumor removal, status of resection margins, and the presence of detrusor muscle in the

specimen. The presence of detrusor muscle in the pathologic specimen is a well-recognized surrogate parameter of high-quality resection.[8,16] In addition to better preservation of architecture for pathological assessment, the eTURBT technique may provide sufficient size and depth of resection and accurate pathological diagnosis.

Hashem et al. reported an 8.5% incidence of bladder perforation in cTURBT, while eTURBT had 0%, indicating a significant reduction in complications with en bloc resection.[7] D'Andrea et al. reported perforation in 12% of cases in cTURBT and 5.6% in eTURBT out of 194 cases in each group, again demonstrating a lower complication rate in eTURBT.[17] In the current study, the eTURBT group had no bladder perforations while the cTURBT group had one. This could be attributed to improved visualization, controlled tumor excision, early control of bleeding, and reduced deep muscle injury in eTURBT.

D'Andrea et al. reported an obturator reflex incidence of 16% in cTURBT and 8.4% in eTURBT, indicating that eTURBT nearly halves the risk.[17] Similarly, the current study showed that the obturator reflex occurred in cTURBT only (4/43, 9.3%; p-value = 0.038). Absence of obturator reflex (0%) in the eTURBT group in the current study could be due to better visualization, precise tumor excision, and minimal electrical energy dispersion. Owing to the intermittent burst technique in eTURBT, in contrast to continuous current in cTURBT. However, it could not be concluded, as the procedure was done in obturator block in all cases; hence, it won't be fair to comment about the prevention of jerks with eTURBT based on the current study.

Zhang et al. and D'Andrea et al. reported almost similar operative times in the two groups.[17,18] In contrast to this finding, the current study showed the mean operative time was significantly shorter in eTURBT (35.55 min) compared to cTURBT (43.97 min) (p = 0.001). Similarly, Li et al. reported that eTURBT was more time-efficient, particularly for small to medium-sized tumors, with a mean operative time approximately 10 minutes shorter than cTURBT.[19] Less operative time in eTURBT compared to cTURBT was potentially due to more precise tumor removal and reduced need for repeated coagulation and resection cycles.

The current study showed that eTURBT is more effective in obtaining detrusor muscle during transurethral resection (p=0.030). Similarly, D'Andrea et al. suggested eTURBT was superior to cTURBT in retrieval of detrusor muscle (80.7% vs. 71.1%; p = 0.01) in their randomized, multicentric trial in 384 patients with up to three cTa-T1 NMIBC tumors of 1-3 cm in size.[17] Hashem et al. reported 98% significant improvement in holmium laser en-bloc resection (HolERBT) over 62% in cTURBT (98% vs 62%; p < 0.0019) among 100 patients with NMIBC who were randomly allocated to cTURBT or HolERBT.[7] Gallioli et al. found that the rate of detrusor muscle presence for eTURBT was noninferior to that for cTURBT (94% vs. 95%; p = 0.8) among 248 patients (108 in cTURBT and 140 in eTURBT).[20] This could be due to precise cutting with better visualization of the plane with coagulation of feeding vessels.

The current study identified the presence of tumor in 21.7% of patients undergoing re-TURBT, with a lower rate of presence of tumor in the eTURBT group than in the cTURBT group; however, this difference was statistically insignificant (p = 0.497). One case of pathological tumor upgradation was observed in the cTURBT group, involving progression from pT1 high grade to pT2 high grade at re-TURBT. No cases of upgradation were detected in the eTURBT group; two cases remained Ta, and two cases remained T1. Similarly, Yanagisawa et al., in a meta-analysis, found that in T1 patients initially treated with cTURBT, the pooled rates of any residual tumors and upstaging on re-TURBT were 31.4% and 2.8%, respectively.[21] A propensity score-matched analysis reported that the rate of any residual tumor on re-TURBT was significantly lower in the eTURBT group compared to the cTURBT group (15% vs. 36%; p=0.029), indicating improved quality of resection with eTURBT.[22]

Qualitative assessment by the panel of pathologists in the current study implied that eTURBT yielded higher quality specimens with well-oriented tissue architecture and fewer artefactual changes (cautery effect and crush artefact), improving diagnostic precision and potentially impacting clinical decision-making. Similarly, Kannan et al. suggested that eTURBT is a technique that has chances of high-quality detrusor muscle sampling with minimizing crush artifacts and cautery damage.[23]

The present study has certain limitations. Sample size was relatively small, and the follow-up period was short-term, restricting the ability to assess long-term outcomes and recurrence rates.

CONCLUSION

En bloc TURBT demonstrated a higher presence of detrusor muscle in specimens with primary bladder tumors fewer than or equal to 3, with a size up to 3 cm. Moreover, eTURBT had the shorter operative time and yielded higher-quality specimens, improving diagnostic precision and potentially impacting clinical decision-making.

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