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Factors predicting presence/absence of Detrusor muscle in TURBT specimen

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Abstract
Introduction: A high-quality transurethral resection of bladder tumor (TUR-BT) is essential for accurate staging and appropriate management of bladder cancer. The presence of detrusor muscle (DM) in the resected specimen is a recognized quality indicator. Absence of DM may result in understaging, increased recurrence, and suboptimal oncological outcomes. This study aimed to identify patient-, surgical-, and tumor-specific factors associated with the absence of DM in TUR-BT specimens.

Methods: This prospective study was conducted at INU, Bengaluru, from February 2023 to February 2024, involving 100 patients undergoing TUR-BT. Inclusion criteria were age >18 years and presence of visible bladder tumor on cystoscopy. Patients with suspected carcinoma in situ, incomplete histopathological data, or who were lost to follow-up were excluded. The presence of DM was confirmed through pathological evaluation. Variables assessed included age, sex, BMI, tumor size, configuration, multiplicity, location, operative time, and use of obturator nerve block. Statistical analysis was performed using chi-square and Mann-Whitney U tests, with a significance threshold of $p<0.01$.

Results: DM was present in 60% and absent in 40% of specimens. DM presence was more likely in patients with tumor size <3 cm (58%), single (66%), and solid tumors (66%). Tumors located on the lateral (87.5%) and posterior walls (80%) were associated with higher DM inclusion compared to roof tumors (22%). Obturator block was performed in 75% of patients with DM present. Longer operative time (average 45 minutes) was also associated with DM retrieval.

Conclusion: Tumor configuration, location, operative duration, and surgical techniques such as obturator block significantly influence DM inclusion. Recognizing high-risk constellations for missing DM can help improve TUR-BT quality through targeted training, case allocation, and increased surgeon awareness-ultimately enhancing patient outcomes.

Keywords: Detrusor muscle inclusion, TUR-BT quality indicators, Bladder tumor resection, Predictive factors in TUR-BT

Introduction
A high-quality transurethral resection of bladder tumor (TUR-BT) plays a pivotal role in the management of bladder cancer, ensuring accurate staging and informing appropriate treatment decisions. A key quality indicator of a successful TUR-BT is the presence of detrusor muscle (DM) in the resected specimen. According to evidence-based consensus statements, the absence of DM increases the risk of disease understaging and the likelihood of residual tumor, potentially leading to suboptimal clinical outcomes [4-6].

The current guidelines from the European Association of Urology (EAU) on non-muscle-invasive bladder cancer (NMIBC) recommend the presence of DM in all TUR-BT specimens, except in cases of low-grade Ta tumors. Studies have shown that when DM is absent in the initial resection, the risk of early recurrence or residual disease may be nearly doubled [1-3]. As such, achieving a high-quality TUR-BT is essential for accurate pathological assessment and effective therapeutic planning.

Objective
This study aims to evaluate the influence of patient-related, surgical, and tumor-specific factors on the absence of detrusor muscle in TUR-BT specimens. Understanding these predictors is crucial for improving surgical quality and optimizing oncological outcomes.

Background

Previous research underscores the prognostic significance of DM presence. In patients with high-grade pT1G3 bladder cancer, the absence of DM has been identified as an independent predictor of progression to muscle-invasive disease [6]. Gontero *et al*. proposed that in cases where DM is present in the initial resection, a second TUR may be unnecessary for pT1 tumors [8]. Similarly, Mariappan *et al*. reported significantly lower recurrence-free survival (RFS) in patients lacking DM in their specimens, based on a study involving 365 patients [5]. Reflecting these findings, the EAU guidelines advise re-resection in pTa high-grade tumors only if DM is absent [7].

Various strategies have been explored to improve TUR-BT quality and ensure DM inclusion. These include adherence to standardized quality indicators, the use of surgical scorecards for performance feedback, perioperative checklists, en bloc resection techniques, and virtual reality-based endourological training programs [9-12]. Each of these measures aims to raise surgeon awareness and enhance technical precision during resection.

Methods

A prospective study conducted at INU, Bengaluru for a period of 1 year from February 2023 to February 2024.

The sample size was calculated considering the power of the study 80%, a margin of error 10%, a confidence level of 95%, and a probability value of 0.5. The average number of patients who underwent TURBT for bladder tumor in a month is 8. Study to be conducted over a period of 12 months which gives population size of 96. A total of 100 sample size was taken.

Inclusion criteria

- Age more than 18 years
- Presence of macroscopic tumor on cystoscopy.

Exclusion criteria

- Suspicion of Carcinoma in Situ
- Missing information about presence or absence of DM in HPE
- Lost to follow up
- Refusal to participate

Pathological assessment was performed according to the WHO classification. Information regarding the inclusion of DM was retrieved from the histopathological report.

The primary endpoint of the study was to establish predictive factors for the absence of DM. Patient factors included were age, sex and BMI. Surgical factors included were role of obturator block and duration of surgery. Tumor factors included were tumor size, configuration and multiplicity.

Correlation of clinicopathological variables and DM status were conducted with the chi-square test and

Mann-Whitney-U test. A *p*-value <O. O1 was considered significant.

Results

Table 1: Patient Factors

	Dm Absent	Dm Present	P Value
Age (years in median)	71	70	0.3
SEX - Males - 70 Females - 30	30 10	40 20	0.4
BMI	26	25	0.6

Table 2: Surgical Factors

	Dm Absent	Dm Present	P Value
Obturator Block- Yes - 80 No - 20	20 15	60 5	<0.001
Duration of Surgery (41min Average)	36 min	45 min	<0.001

Table 3: Tumor Factors

	Dm Absent	Dm Present	P Value
Size 1-3 cm - 60 >3cm - 40	25 25	35 15	<0.001
Multiplicity Single - 75 Multiple - 25	25 10	50 15	<0.01
Pattern Papillary- 40 Solid - 60	20 20	25 40	<0.01

Table 4: Location of Tumor

Tumor Location	Dm Absent	Dm Present	P Value
Posterior Wall - 20	4	16	<0.001
Lateral Wall - 40	5	35	
Roof - 22	18	4	
Bladder Neck- 18	8	10	

A total of 100 patients were prospectively enrolled in the study. The primary endpoint was to identify predictive factors for the absence of detrusor muscle (DM) in TUR-BT specimens. Several patient-related, surgical, and tumor-specific variables-either indicative of the technical complexity of the resection or modifiable by the surgeon—were analyzed.

DM was present in 60% of cases and absent in 40%, aligning with findings from prior studies. The median age of the cohort was 70 years, with a male predominance (70% male, 30% female).

Surgical Factors

- Patients who underwent an obturator nerve block (75%) were more likely to have DM present in the resected specimen.
- Longer operative time was associated with the inclusion of DM. The average duration of surgery in the DM-positive group was 45 minutes, suggesting that a more meticulous and prolonged resection may improve specimen quality.

Tumor Characteristics

- **Tumor size:** DM was more frequently present in patients with tumors <3 cm (58%).
- **Tumor multiplicity:** Single tumors were associated with higher DM inclusion (66%) compared to multiple tumors.
- **Tumor configuration:** Solid tumors were more likely to be associated with DM presence (66%) compared to papillary tumors.
- **Tumor location:** Tumors located on the lateral wall (87.5%) and posterior wall (80%) had significantly higher rates of DM presence, whereas tumors on the bladder dome/roof showed the lowest rate of DM inclusion (22%).

These findings suggest that tumor morphology, location, and intraoperative strategies-such as the use of obturator nerve block and adequate resection time-play a key role in ensuring DM retrieval, thus contributing to TUR-BT quality and staging accuracy.

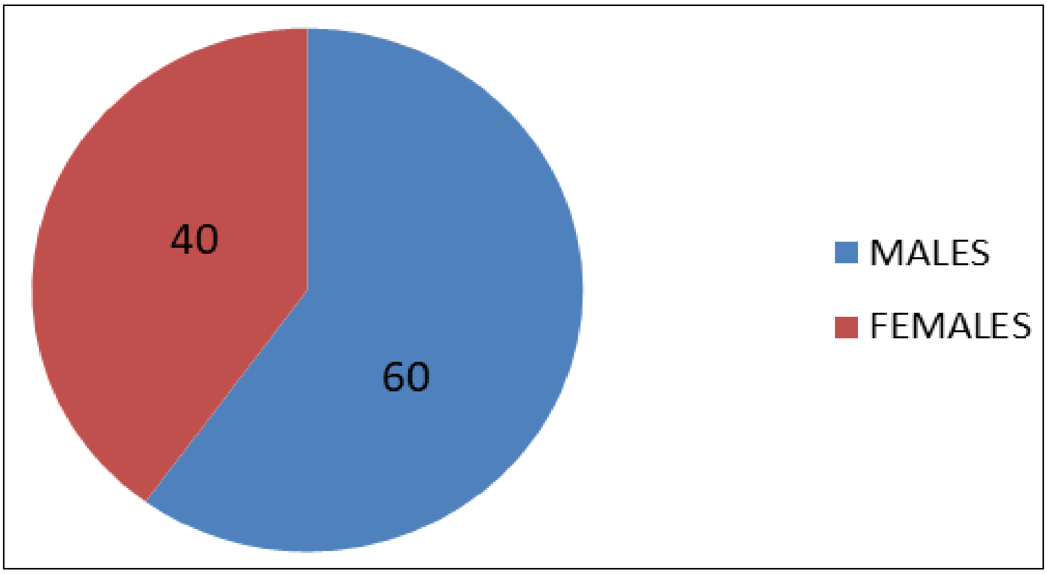

Fig 1: Total cohort population in the study

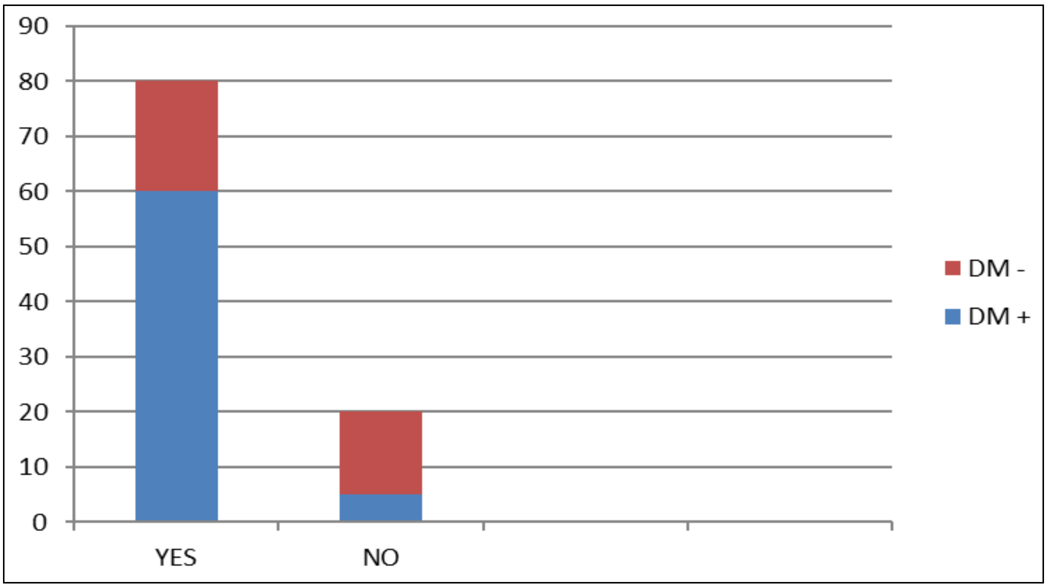

Fig 2: Role of obturator block on present/absent DM

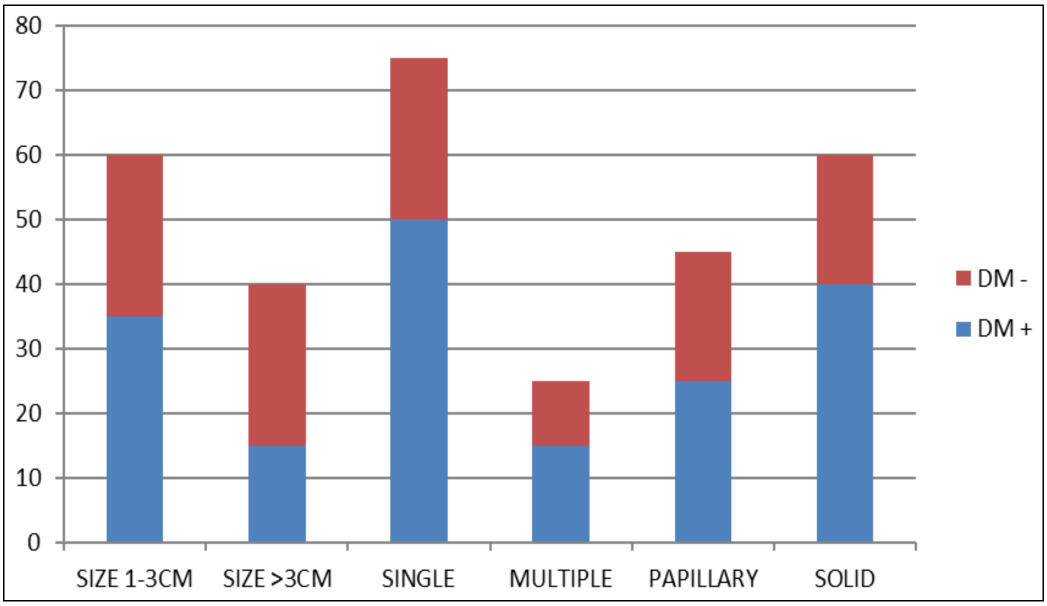

Fig 3: Tumor factors affecting the present/absent DM

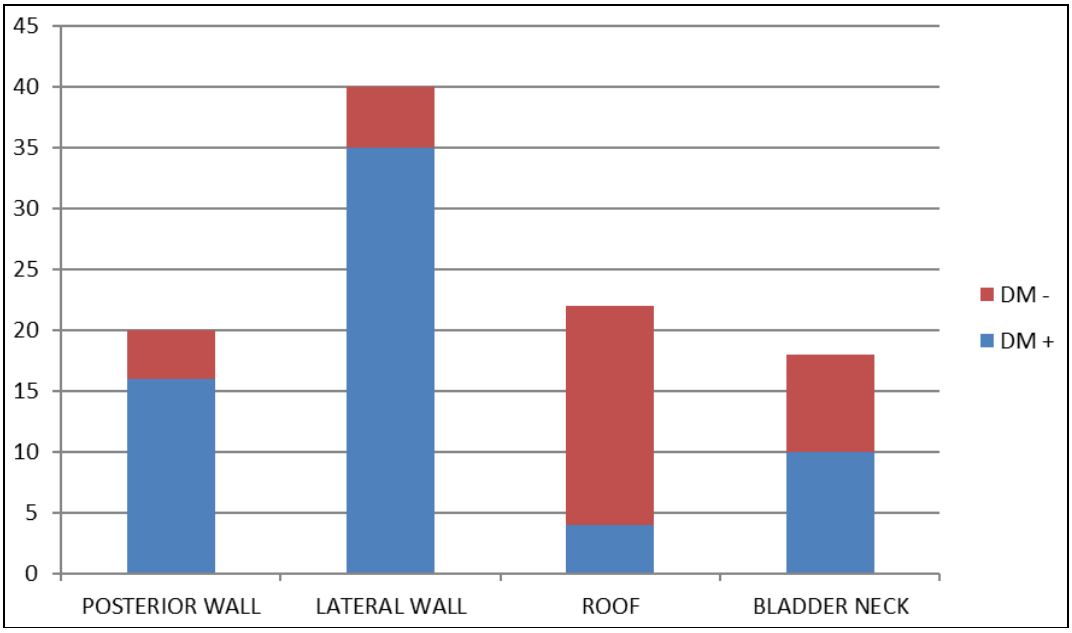

Fig 4: Tumor location affecting the present /absent DM

Discussion

In the present cohort, detrusor muscle (DM) was identified in 60% of TUR-BT specimens, which aligns with findings from previous studies reporting DM presence rates of 64% [13] and 69.1% [2]. These results are consistent with the existing literature and support prior observations made by other research groups [3, 8, 9].

Shoshany *et al*. analyzed a cohort of 332 patients undergoing TUR-BT and found that larger tumor size, multifocality, high-grade tumors, and solid tumor morphology were all associated with higher rates of DM presence [2]. Similarly, Mariappan *et al*., in a study involving 356 patients, demonstrated that larger tumor size and higher tumor grade were significant predictors for the inclusion of DM in the specimen [4]. These findings suggest that urologists may be more inclined to perform deeper resections when they suspect lamina propria or muscle invasion. Conversely, when low-risk NMIBC is anticipated, surgeons may prioritize the avoidance of complications such as bladder perforation over obtaining DM.

Solid tumors may also encourage more aggressive resections, as the perceived risk of perforation is lower compared to papillary or superficial lesions. Interestingly, patients in whom DM was present were more likely to have received intraoperative muscle relaxation, which may reflect increased surgical confidence in performing deeper resections, particularly in anatomically sensitive areas such as the lateral bladder walls.

Moreover, longer operative duration was independently associated with the presence of DM, both in the overall cohort and specifically in patients undergoing TUR-BT for first-time bladder cancer diagnosis. This suggests that a more meticulous and time-intensive resection may contribute to improved specimen quality and accurate staging.

Conclusion

Several risk factors for missing DM, including configuration, localization, and duration of operation, were identified. This might help urologists to better identify complex operations. It seems to be clinically relevant to identify specific constellations, where the risk of missing DM is higher. Training programs, allocation of operations to different skill levels, but also individual urologists' awareness could profit from this information. As the presence of DM influences the oncological outcome in high-risk tumors, TURBTs should be performed with the deserved diligence.

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