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Original Article

Comparative outcomes of holmium laser En bloc resection in superficial bladder tumors: Focus on operative time, catheterization, and hospital stay- A cross-sectional study.

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Thota Siddhartha¹, Suvit Jumde^{2}*

Assistant Professor, Department of Urology, Mahatma Gandhi Medical College and Research Institute, Puducherry, India¹

Assistant Professor, Department of Urology, Himalayan Institute of Medical Sciences, Dehradun, India²

Abstract

Background

In 2016, bladder cancer accounted for 186,000 fatalities and 437,000 new cases, making it the tenth most frequent cancer worldwide. The incidence of bladder urothelial carcinoma varies greatly by geography, with Eastern Europe and Asian nations having the lowest rates and Western Europe and North America having the greatest frequency.

Objectives- The purpose of the study was to evaluate the results of holmium laser En Bloc resection for superficial bladder cancers.

Materials and methods

It was a cross-sectional, observational study. The study was carried out in the Department of Urology, Mahatma Gandhi Medical College and Research Institute, Puducherry, India. The study was conducted for one and a half years, that is, from December 2021 to Jun 2023. In all, 24 patients were enrolled. Patients over the age of 18 with superficial bladder cancer who intend to have their bladder tumors removed by transurethral resection (TURBT) at the Mahatma Gandhi Medical College and Research Institute in Puducherry within six months of receiving approval from the institutional ethics committee are included in this study.

Results

Nine patients (37.5%) had tumors in the right lateral bladder wall, while six patients (25%) had tumors in the posterior wall. Patients with multiple lesions used a larger median number of analgesic vials after surgery (2.00; IQR: 2.00–3.00) than patients with single lesions (1.00; IQR: 1.00–2.00). With a p-value of 0.017, this difference was statistically significant.

Conclusion

For the treatment of superficial bladder cancers, holmium laser en bloc excision is a secure and efficient method. In patients with single lesions, the method was linked to significantly lower analgesic requirements, shorter catheterization and hospital stays, and acceptable operative timeframes.

Recommendations

Further research, including larger-scale studies, is necessary to validate these observations and enhance the understanding of TURBT procedures' efficacy and safety.

Keywords: Tumor, Bladder, Holmium Laser, Outcomes, Transurethral resection of the bladder tumor

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Corresponding author: Suvit Jumde*

Email: jumdesuvit@gmail.com

Assistant Professor, Department of Urology, Himalayan institute of medical Sciences, Dehradun, India



Introduction

In 2016, bladder cancer accounted for 186,000 fatalities and 437,000 new cases, making it the tenth most frequent cancer worldwide [1]. The incidence of bladder urothelial carcinoma varies greatly by geography, with Eastern Europe and Asian nations having the lowest rates and Western Europe and North America having the greatest frequency [2]. When smoking is taken into account, these inequalities are only marginally reduced [3].

Different racial/ethnic groups' acetylator phenotypes and occupational inequalities among underrepresented groups that affect exposure to industrial carcinogens are two hypothesized causes for these racial and ethnic disparities [4]. Most often, older people are diagnosed with bladder cancer. Most bladder cancer patients (about 73 percent) are over 65 [5]. For both genders, the median age at diagnosis is 71 years for women and 69 years for men [6]. Males 65 to 69 years old and those 85 and older had an incidence of 142 to 296 per 100,000, respectively, while females in the same age range have an incidence of 33 to 74 per 100,000. Current smokers experience the onset at a younger age than those who have never smoked [7]. Converging smoking behaviors are reflected in the fact that the relative risk for males and females who smoke cigarettes now vs never is the same (4.0 and 4.7, respectively) [8].

Bladder cancer is a very uncommon condition that typically manifests as a low-grade, benign disease in children and young people [9].

Parsons and associates pioneered the use of laser energy on the bladder in 1966. They used energy levels ranging from 10 to 15 J to expose an open canine bladder to 694 nm light from a pulsed ruby laser. Three to ten days later, a histological study showed that the mucosa had mild damage that was separated from the surrounding normal tissue. They suggested that, if a suitable "light pipe" could be created, this innovative energy modality might be used to endoscopically destroy bladder cancer based on these data. However, this important advance was not made until the argon ion laser and flexible quartz fiber were introduced [10].

The purpose of the study was to evaluate the results of holmium laser En Bloc resection for superficial bladder cancers.

Methodology

Study design

It was a cross-sectional, observational study. The study was carried out in the Department of Urology, Mahatma Gandhi Medical College and Research Institute, Puducherry, India. The study was conducted for one and a half years, that is, from December 2021 to June 2023.

Study population

In all, 24 patients were enrolled. Patients over the age of 18 with superficial bladder cancer who intend to have their bladder tumors removed by transurethral resection (TURBT) at the Mahatma Gandhi Medical College and Research Institute in Puducherry within six months of receiving approval from the institutional ethics committee are included in this study. Patients with a history of tumors, those who had received anti-tumor treatment before the study, and those with other severe systemic diseases, such as severe infections, renal, or liver disease, were excluded.

Data collection

Before surgery, all patients had a thorough medical history taken and had routine physical tests. Preoperatively, computed tomography, ultrasound (USG), and standard tests were used to diagnose and stage the illness. Written informed consent was obtained in the patient's preferred language.

Study procedure

Clinical results were documented, demographic data were gathered, and patients were hospitalized. Regular laboratory testing, ultrasounds, and plain X-rays of the kidney, ureter, and bladder were performed before surgery. Cystoscopy and kidney, ureter, and bladder computed tomography (CT) were used to diagnose and stage the disease before surgery.

Efforts to reduce bias

Efforts to reduce bias included consecutive patient enrollment, use of standardized surgical and data collection protocols, and blinding the data analyst to lesion type during analysis. However, being a single-

center study with a small sample size, some risk of residual confounding remains.

Statistical analysis

For both continuous and categorical variables, means and proportions were computed. The Mann-Whitney U test was used to compare the means of the non-parametric variables. Statistical significance was defined as a p-value of less than 0.05. MS Excel 2016 was used for data entry, and SPSS (Statistical Package for Social Sciences), Armonk, NY, version 26.0, was used for data analysis.

Ethical considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee of Mahatma Gandhi Medical College and Research Institute, Puducherry, India.

Informed consent

Written informed consent was obtained from all participants before their enrolment in the study.

Results

A total of 30 patients with suspected superficial bladder tumors were initially assessed for eligibility. Of these, 26 met the inclusion criteria after clinical and imaging evaluation. Two patients declined to participate, citing personal reasons. Thus, 24 patients were enrolled in the study after providing informed consent. All enrolled participants completed the surgical procedure and postoperative follow-up, and their data were included in the final analysis. There were no dropouts or losses to follow-up.

Figure 1 depicts the gender of the participants. 62.5% of the participants were male, while 37.5% of the participants were female

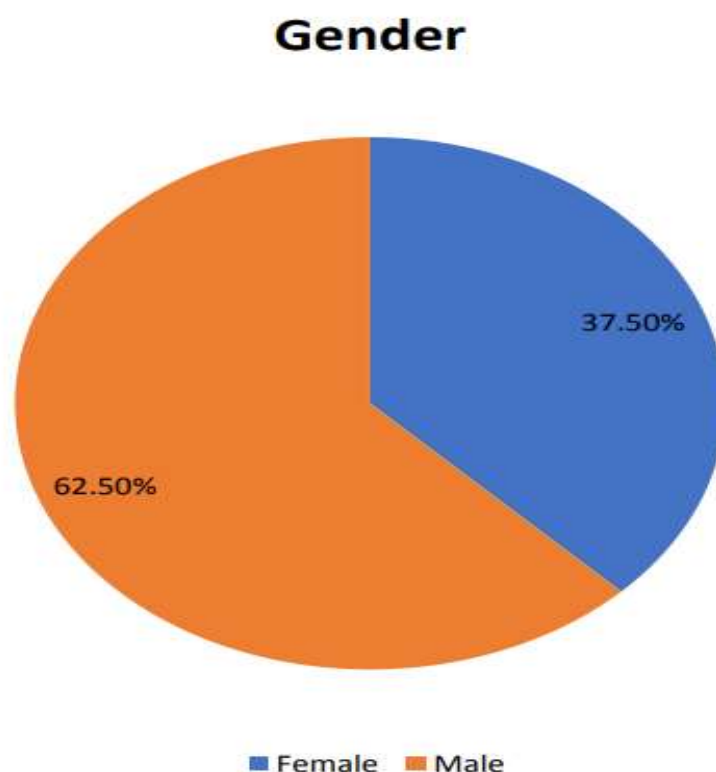


Figure 1. Gender among participants



Nine patients (37.5%) had tumors in the right lateral bladder wall, while six patients (25%) had tumors in the posterior wall. Additionally, tumors were seen in the anterior wall in two patients (8.3%), the dome in three patients (12.5%), and the left lateral wall in four patients

(16.7%). Tumor features across the research population are shown in Table 1. Ten patients (41.7%) had high-grade cancers, whereas 14 patients (58.3%) had low-grade tumors. Tumor features across the research population are shown in Table 1.

Page | 4 **Table 1. Tumor characteristics of the study population**

Tumor Characteristic	Frequency (n)	Percentage (%)
Tumor Location		
Right Lateral Wall	09	37.5%
Posterior Wall	06	25.0%
Left Lateral Wall	04	16.7%
Dome	03	12.5%
Anterior Wall	02	8.3%
Type of Lesion		
Single	17	70.8%
Multiple	07	29.2%
Tumor Staging		
T1	15	62.5%
Ta	09	37.5%
Tumor Grading		
Low Grade	14	58.3%
High Grade	10	41.7%

Patients with multiple lesions used a larger median number of analgesic vials after surgery (2.00; IQR: 2.00–3.00) than patients with single lesions (1.00; IQR: 1.00–2.00). With a p-value of 0.017, this difference was

statistically significant. A comparison of post-operative results for patients undergoing HoL-TURBT according to lesion type is shown in Table 2.

Table 2. Comparison of postoperative outcomes based on type of lesion in patients undergoing HoL-TURBT

Outcome Variable	Single Lesion (Median, IQR)	Multiple Lesions (Median, IQR)	P-value
Catheterization Time	2.00 (1.00–2.50)	1.00 (1.00–2.00)	0.144
Hospital Stay (days)	2.00 (1.00–3.00)	1.00 (1.00–1.00)	0.080
Analgesic Vials Used	1.00 (1.00–2.00)	2.00 (2.00–3.00)	0.017
Operative time	35.00 (27.50–37.50)	30.00 (25.00–40.00)	0.626

Discussion

TURBT was previously commonly used in conjunction with intravesical chemotherapy or immunotherapy for patients with non-muscle invasive bladder cancer (NMIBC) [11].

With 62.5% of the study population being male and 37.5% being female, males made up the bulk of the individuals in the study. These results are in line with the Lu et al. study, which likewise found a larger percentage of males (76%) [12]. A slightly lower percentage of males (68%)

with a mean age of 58 years was also recorded by Huang et al.83 [13]. The higher prevalence of bladder cancers in male populations may be the reason for the continuous male predominance in both the study and other investigations.

Twenty percent of the tumor lesions in the study were located in the bladder neck, with the rest lesions dispersed throughout the anterior, posterior, and lateral walls of the bladder. The distribution in question differs from that reported by Lu et al., who found that 93% of tumors were found in the bladder's trigone [12]. A comparatively

smaller proportion of malignancies (35%) were discovered in the lateral wall by Huang et al. [13].

The median tumor size in the analysis was 1.5 cm, with an interquartile range (IQR) of 1.50-2.50 cm. Seventy percent of the lesions were single. Huang et al.'s findings, which showed a mean tumor size of 1.53 ± 0.2 cm, are in line with this. In their investigation, Lu et al. [12] found a greater percentage (13.8%) of tumors larger than 3 cm [12]. Razzaghi et al. found that patients with multiple tumors had a greater percentage (41.1%) and a larger mean tumor size (2.22 ± 0.8 cm) [14].

Of the participants in the study, 37.5% were assigned to stage Ta, while the remaining 62.5% were assigned to stage T1. These results are in line with the Lu et al. study, which found that 44% of participants were in stage T1 and 56% of patients were in stage Ta [12]. A somewhat smaller percentage of individuals were in stage Ta (50%) and a higher percentage were in stage T1 (38%), according to Huang et al. [13]. Participants were more likely to be in stage Ta (66.7%) and less likely to be in stage T1 (33.3%), according to Razzaghi et al. [14].

The procedure's median operating time in the sample was 32.50 minutes, with an IQR ranging from 25.00 to 38.75 minutes. In the study, the median catheterization time was two days, with an interquartile range of one to two days. Additionally, there were 1.50 post-operative days, with an IQR of 1.00 to 2.75 days. Lu et al., Huang et al., and Razzaghi et al. reported similar outcomes [12, 13, 14].

Generalizability

The findings of this study are primarily applicable to adult patients with superficial bladder tumors undergoing holmium laser en bloc resection in similar tertiary care settings. While the results demonstrate favorable outcomes, the small sample size, single-center design, and absence of a control group may limit broader applicability. Variations in surgical expertise, patient demographics, and institutional protocols across different regions may also affect the external validity. Larger multicenter studies are needed to confirm these findings and enhance generalizability.

Conclusion

For the treatment of superficial bladder cancers, holmium laser en bloc excision is a secure and efficient method. In patients with single lesions, the method was linked to significantly lower analgesic requirements, shorter catheterization and hospital stays, and acceptable operative timeframes. These results demonstrate the clinical use, safety, and effectiveness of holmium laser

resection, bolstering its position as a dependable substitute for traditional TURBT in cases that are carefully chosen cases. These results suggest that in some patients, it may be a better option than traditional TURBT.

Limitations

There are a couple of significant drawbacks to this study, though. One of the limitations was the small number of patients, which can affect the efficiency and the duration of time.

Recommendations

Further research, including larger-scale studies, is necessary to validate these observations and enhance the understanding of TURBT procedures' efficacy and safety.

List of abbreviations

USG- Ultrasonography
CT- Computed Tomography
NMBIC- Non-muscle invasive bladder cancer
TURBT- Transurethral resection of the bladder tumor

Source of funding

There was no external funding; the study was self-funded by the department.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

All authors contributed to the study design, data collection, analysis, and manuscript preparation.

Data availability

The data generated during this study are available from the corresponding author upon reasonable request.

Author Biography

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