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Comparison of outcome of conventional bipolar vs. laser *en bloc* transurethral resection of bladder tumor: A prospective study

Apurv Shukla[1], Partha Protim Mondal[2], Sudipta Kumar Singh[3], Shashi Kant Tewary[4], Arvind Arvind[5], Ankit Agarwal[6], Ranjan Kumar Dey[7]

[1,5,6]Postgraduate Resident, [2]Associate Professor, [3,4]Assistant Professor, [7]Ex Professor and Ex Head, Department of Urology, RG Kar Medical College, Kolkata, West Bengal, India

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ABSTRACT

Background: Urothelial carcinoma of bladder (UBC) is the second-most common urological malignancy and represents a growing healthcare problem worldwide. Although the vast majority of newly diagnosed bladder cancers are for nonmuscle-invasive disease and may be treated with endourological procedures, correct initial staging is critical. The quality of transurethral resection of bladder tumors (TURBT) strongly determines patient prognosis and overall UBC treatment costs Goals of new strategies should include avoiding second TURBTs and lowering overall treatment regimens. **Aims and Objectives:** To compare the safety, efficacy, and outcome of conventional bipolar and laser *en bloc* resection of bladder tumors in nonmuscle-invasive bladder cancer. **Materials and Methods:** This is a prospective study. The study period will be from January 2023 to May 2024. The study is proposed to be conducted in the Department of Urology, R.G. Kar Medical College and Hospital.101 patients were included in this study. **Results:** Tumor sizes were nearly similar in both groups (mean 2.1 cm). The higher number of patients had detrusor muscle in their specimen (46 [90.2%]) in the laser group compared to the bipolar group (30 [60.0%]) ($P=0.0004$). 10 (20.0%) patients had obturator nerve reflex in bipolar group and none in the laser group. A statistically significant ($P<0.0001$) increase in operative time was observed in bipolar group (43.1000 ± 13.3589.) compared to the laser group (33.5294 ± 7.2315). Hospital stay was higher in the bipolar group (2.3200 ± 0.8437) compared to the laser group (2.1373 ± 0.3475). 10 (20.0%) patients had recurrence in the bipolar group compared to the laser group (8 [15.7%]). **Conclusion:** The laser *en bloc* TURBT demonstrated superior advantages in terms of reduced intraoperative bleeding, shorter catheterization time, quicker postoperative recovery, and decreased risk of obturator nerve reflex, thereby decreasing the risk of bladder perforation and higher detrusor muscle acquisition rate, thereby decreasing the need for restage TURBT as compared to the conventional bipolar technique. In addition, the *en bloc* approach with laser minimized tumor fragmentation, potentially reducing the risk of residual tumor cells and recurrence.

Key words: Bladder tumor; Laser *en bloc* resection; Bipolar transurethral resection of bladder tumors and postoperative recovery

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INTRODUCTION

Urothelial carcinoma of bladder (UBC) is a rising worldwide health concern and the second most prevalent urological cancer.[1] Heavy tobacco use, aging Western populations, and weak industrial safety regulations in developing nations have all increased as a result of this.[2] Accurate initial staging is crucial, even if endourological

Address for Correspondence:
Dr. Arvind Arvind, Postgraduate Resident, Department of Urology, RG Kar Medical College, Kolkata, West Bengal, India.
Mobile: +91-8130437350. **E-mail:** arvindmchuro@gmail.com

drugs can be used to treat nonmuscle-invasive bladder cancer (NMIBC), which accounts for the vast majority of newly found bladder cancers. Both the entire cost of UBC therapy and the prognosis of patients are significantly impacted by the quality of transurethral resection of bladder tumors (TURBTs).[3] Emerging treatments should aim to avoid second TURBTs and reduce overall treatment regimens.

Since the advent of laser therapy and *en bloc* resection procedures, bladder cancer has garnered more attention. Nowadays, the two most popular kinds of lasers are holmium (Ho: YAG) and thulium (Tm: YAG).[4] With the exceptional hemostatic qualities and accurate cutting skills of Holmium lasers, the main tumors are removed without causing injury, leaving sufficient tissue for histological examination. The safety and efficacy of the HoLRBT technique have not been fully investigated as they could be because of the small amount and low quality of the data that is currently available, especially for primary tumors.

Although conventional bipolar TURBT (B-TURBT) is effective, it is associated with complications such as obturator reflex and tumor fragmentation. Laser *en bloc* TURBT offers potential improvements, including better margin control and lower recurrence.

Reduction of perioperative complications, enhancement of resection quality, and reduction of recurrence rates at resection sites are the three objectives of laser *en bloc* resection of bladder tumors (ERBT). In view of the aforementioned objectives, the current study investigates the outcomes of bladder cancer excision using laser and bipolar *en bloc* methods.

Aims and objectives

1. To evaluate the safety, effectiveness, and results of laser *en bloc* resection of bladder tumor versus conventional B-TURBT in cases of NMIBC
2. To look into the consequences of tumor recurrence throughout the long term.

MATERIALS AND METHODS

Study design

This was a prospective study.

Study period

The study period was from January 2023 to May 2024.

Study venue

The study was conducted in the Department of Urology, R.G. Kar Medical College and Hospital.

Study population

Patients of bladder mass attending the Urology out-patient deaprtment or admitted to the Urology wards.

Institutional Ethical Committee of R.G. Kar Medical College (Registration no. ECR/322/Inst/WB/2013/RR-20)- Approved the study in January 2023.

Inclusion criteria

1. Histologically confirmed NMIBC
2. Patients with tumor size ≤3 cm
3. No history of prior bladder cancer.

Exclusion criteria

1. Patients with muscle-invasive bladder cancer
2. Patient with multifocal tumors
3. Patients having coagulopathy or significant comorbidities.

Study tools

Holmium 100W (Ho: YAG) with laser fiber 550 micron were used for laser TURBT and 26 F bipolar resectoscope sheath with working element were used for conventional B-TURBT.

Study technique

A total of 101 patients with urinary bladder mass were worked up on an out-patient department/in-patient department basis and divided into two groups. After taking a detailed history and clinical examination, these patients underwent TURBT.

- Group A: Conventional B-TURBT
- Group B: Laser *en bloc* TURBT (e.g., Holmium laser).

In Group A, conventional B-TURBT was done with the help of 26 F bipolar resectoscope sheath and working element and in Group B, Ho: YAG laser *en bloc* resection (L-EBRT) was done with the setting 1.0–2.0 J and 15–30 Hz, resulting in total energy of 20–40 W. In this 550-micron laser fiber was used, and tumor was resected *en bloc*. In both, small tumor was resected and the specimen were sent for histopathological examination and seen for detrusor muscle acquisition rate.

Statistical analysis

The Centers for Disease Control and Prevention trademark Epi Info™ 3.5.3 was used to determine the sample size. Data were put into a Microsoft Excel spreadsheet, and statistical analysis was conducted using the Statistical Package for the Social Sciences 27.0 and Graph Pad Prism version 5. The mean and standard deviation for numerical variables and the count and percentages for categorical variables were used to summarize the data. Depending on

the situation, either the Chi-square test or Fischer's exact test was used to compare unpaired proportions. P<0.05 was considered to be statistically significant.

Outcome measures

- Operative time
- Obturator reflex incidence
- Perforation rate
- Duration of catheterization
- Hospital stay
- Detected detrusor muscle in specimen
- Tumor recurrence at 6 and 12 months.

RESULTS

The two groups (B-TURBT vs. L-EBRT) are compared, as shown in Table 1. The gender distribution and tumor size were almost similar in both the groups. Age was slightly higher in the bipolar group (52.98±7.42) as compared to the laser group (51.29±9.14), but this was not statistically significant (P=0.312).

In B-TURBT, 10 (20.0%) patients had incidence of obturator nerve reflex (ONR), but none in the L-EBRT group had an incidence of ONR. Moreover, this was statistically significant (P=0.0007).

There were 2 (4.0%) bladder perforations in the B-TURBT group, but none in the L-EBRT group. However, P=0.14912 indicated that this was not statistically significant. Therefore, the incidence of ONR and bladder perforation was higher in the bipolar group than in the laser group.

In B-TURBT, 30 (60.0%) patients had detrusor muscle acquisition. In L-EBRT, 46 (90.2%) patients had detrusor muscle acquisition rate. Moreover, this was statistically significant (P=0.0004).

Hence, there was a higher detrusor muscle acquisition rate in the laser group.

In B-TURBT, the mean operation time (mins) (operation theatre time) of patients was 43.10±13.35.

In L-EBRT, the mean operation time (mins) of patients was 33.52±7.23. Moreover, this was statistically significant (P<0.0001). Hence, the operation time was significantly less in laser group compared with bipolar group. Furthermore, mean hospital stay (days) was less in laser group (2.13±0.34) as compared to bipolar group (2.32±0.84), but this was not statistically significant (P=0.1564).

Mean catheterization time was also less in laser group (1.76±0.47) as compared to bipolar group (2.34±2.45) but this was not statistically significant (P=0.1035).

The two groups, recurrence rates were similar as well, however this was not statistically significant (P=0.571).

DISCUSSION

The present study was a prospective study. This study was conducted from January 2023 to May 2024 in the Department of Urology, R.G. Kar Medical College and Hospital. A total of 101 patients were included in this study.

50 patients were bipolar group.

51 patients were laser group.

Of the 101 participants in our study, most were between the ages of 51 and 60 (43 [42.6%]). The bipolar group was slightly older than the laser group (51.2941±9.1439.) (52.9800±7.4244), However, there was no statistically significant difference in age (P=0.3121). A related study found that the median patient age was 77-years-old.[5] An intraperitoneal hole, which usually affects the posterior wall, was present in twelve people. Primary repair was used in two instances to address the concomitant intestinal damage. Chang et al.,[6] reported that Patients in the laser and resectoscope groups had median ages of 69.2 and 68.0, respectively. Compared to 92.0% of the laser

Table 1: Intraoperative and postoperative characteristics of patients undergoing B-TURBT and L-EBRT

Variable	B-TURBT (n=50)	L-EBRT (n=51)	P-value
Age (years)	52.98±7.42	51.29±9.14	0.312
Tumor size (cm)	2.19±0.48	2.18±0.48	0.952
ONR	10 (20%)	0	0.0007
Perforation rate	2 (4.0%)	0	0.14912
Detrusor muscle acquisition rate	30 (60.0%)	46 (90.2%)	0.0004
Operative time (min.)	43.10±13.35	33.52±7.23	<0.0001
Hospital stay (days)	2.32±0.84	2.13±0.34	0.156
Catheterization time (days)	2.34±2.45	1.76±0.47	0.103
Recurrence at 6 m and 12 m	10 (20.0%)	8 (15.7%)	0.57113

Data displayed as n (%) or mean±standard deviation (range). B-TURBT: Bipolar transurethral resection of bladder tumor, L-EBRT: Laser *en bloc* resection of tumor, ONR: Obturator reflex Incidence

group, 70.0% of the conventional transurethral resection of bladder tumor (cTURBT) group had the detrusor muscle (P=0.005). The LEBRT group experienced fewer significant surgical complications (P=0.046) and bladder perforations (P=0.041).

The bipolar and laser groups experienced different rates of ONR in a statistically significant way (P=0.0007). ONR was present in [10 (20.0%)] bipolar group subjects but not in the laser group.

Only (2 [4.0%]) of the patients in the bipolar group and none of the patients in the laser group experienced bladder perforations; this difference was not statistically significant (P=0.14912). For the transurethral excision of cancers on the posterolateral bladder wall, 60 patients undergoing spinal anesthesia (SA) were included in a similar study conducted by Khorrami et al.,[7] Two patient groups were chosen at random. While the second group only received SA, the first group received both SA and transvesical ONB. Monopolar cautery was used to perform TURBT on the patients. The leg jerking of these two groups was found to be similar. Using a nerve stimulator, they located the obturator nerve next to the lateral bladder wall. Additionally, Xishuang et al.,[8] noted that the PK-TURBT and HoL-TURBT groups had less intraoperative and postoperative issues, including bleeding, bladder perforation, ONR, and postoperative bladder irrigation, than the CM-TURBT group. Furthermore, Golan et al.,[5] looked into the clinical characteristics and long-term outcomes of patients who required open surgical repair for bladder perforations and TURBTs. They found that bladder perforations that need open surgical repair during TURBT are more common in older patients with severely pretreated bladders and big tumors on the posterior wall. Also, Kramer et al.,[2] showed that Because of the nature of the energy source, it is highly improbable that employing lasers will result in bladder perforation from the obturator nerve reaction. Recurrence rates are decreasing in the infield. Additionally, according to Teoh et al.,[9] As a non-inferior oncological strategy for TURBTs, ERBT has attracted a lot of attention. With an acceptable degree of confidence, ERBT was associated with a reduced rate of bladder perforation (risk ratio 0.30, 95% confidence interval [CI] 0.11–0.83, I^2=1%, P=0.02) and a shorter irrigation time (mean difference −7.24 h, 95% CI −9.29–−5.20, I^2=85%, P<0.001) than TURBT.

Motlagh et al.,[10] found that Out of seven randomized controlled trials (RCTs), the pooled recurrence risk ratio (RR) for serious adverse events (SAEs) like bladder perforation and persistent hematuria was 0.16 (95% CI 0.06–0.41) in favor of transurethral en bloc resection of bladder tumors (TUEB). Similar study by Chang et al.,[6] observed that significant surgical complications (P=0.046) and bladder perforation (P=0.041) were less common in the LEBRT group. Furthermore, Xu et al.,[11] found that transurethral laser surgery was associated with a lower incidence of ONR (odds ratio [OR]=0.04; 95% CI 0.02–0.09; P<0.00001) and bladder perforation (OR=0.09; 95% CI 0.04–0.23; P<0.00001), a higher rate of detrusor muscle acquisition (OR=5.28; 95% CI 2.42–11.49; P<0.0001), shorter duration of hospitalization and catheterization (mean difference = −0.96; 95% CI −1.59–−0.33; P=0.003), lower rates of bladder irrigation (OR=0.21; 95% CI 0.13–0.35; P<0.00001), and recurrence at 12 months (OR=0.66; 95% CI 0.48-0.9, P=0.008) and 24 months (OR=0.6; 95% CI 0.41–0.86; P=0.005).

In our study, Tumor Size was nearly similar in both the groups (mean=2.1cm). In other studies, Agarwal et al.,[12] found that The conventional TURBT (CT) group's mean tumor size was 3.3 cm, while the en bloc TURBT (ET) group's was 2.8 cm. Tumor location, grade, and stage were similar among groups. In the ET versus CT groups, The rates of progression and recurrence were 19% and 33.3%, respectively (P=0.32) and 28.6% and 62.5%, respectively (P=0.03). The CT and ET groups had comparable recurrence-free survival rates of 28.5 (95% CI: 35.4–54.7 months) and 45.1 (95% CI: 19.0–38 months) (P=0.018).

It was found that a higher number of patients had detrusor muscle in their specimen (46 [90.2%]) in the laser group compared to the bipolar group (30 [60.0%]) and this was statistically significant (P=0.0004), but Chang et al.,[6] observed that the detrusor muscle was present in 92.0% of the laser group and 70.0% of the cTURBT group, which indicated a statistically significant difference (P=0.005). Additionally, Gallioli et al.,[13] discovered that the presence of the detrusor muscle at final histopathology was the main result. The presence of detrusor muscles was not less in TURBT than in ERBT (94% vs. 95%; P=0.8). Compared to 100% of ERBT instances, T1 substaging was possible in 80% of cTURBT patients (P=0.02). The two groups' incidence of complications, hospital stays, postoperative adjuvant therapy, and catheterization times were similar (P>0.05).

The bipolar group had somewhat more recurrent patients (10 [20.0%]) than the laser group (8 [15.7%]), according to our data. The value of P=0.57113 was not statistically significant. Agarwal et al.,[12] found in another study that the ET group had a progression rate of 19% versus 33.3% (P=0.32) and a recurrence rate of 28.6% versus 62.5% (P=0.03). The equivalent recurrence-free survival rates in the CT and ET groups were 28.5 (95% CI: 35.4–54.7 months) and 45.1 (95% CI: 19.0–38 months) (P=0.018). A P-value of 0.46 was found for the progression-free survival rates in CT and ET, which were 44.26 (95% CI: 39.0–57.5 months) and 48.32 (95% CI:

35.5–53.0 months), respectively. ET significantly decreased the recurrence rate as well as the time to recurrence. Also Motlagh et al.,[10] found that Five non-randomized controlled trials (NRCTs) had a combined 3-month RR of 0.46 (95% CI 0.29–0.73), and four NRCTs had a combined 12-month RR of 0.56 (95% CI 0.33–0.96). For four and seven RCTs, the pooled 3- and 12-month recurrence RRs were 0.89 (95% CI 0.69–1.15) and 0.57 (95% CI 0.25–1.27), respectively. Seven RCTs (n=1077) met the requirements to be included in the network meta-analysis. Bipolar, laser, and hybrid knife TUEB all had 12-month recurrence rates that were the same as cTURBT. Furthermore, Gallioli et al.,[13] discovered that through a median follow-up of 15 months (interquartile range 7–28), the recurrence rate for cTURBT was 18% and the rate for ERBT was 13% (P=0.16). The quick follow-up and the single high-volume institution are two of the drawbacks. Furthermore, Liu et al.,[14] found no appreciable changes in the incidence, total recurrence, or 1st time to recurrence of urethral strictures. The 2-μm laser resection technique fared better than TURBT in reducing rates of intraoperative and postoperative complications even though there was no further advantage in terms of tumor recurrence.

We found that the bipolar group had a statistically significant (P<0.0001) increase in OT time (min) (43.1000±13.3589) in comparison to the laser group (33.5294±7.2315).

Although there was no statistically significant (P=0.1564), we found that bipolar group's hospital stay (days) was somewhat longer (2.3200±0.8437) than the laser group's (2.1373±0.3475). A related study by Gallioli et al.,[13] found that the rates of problems, hospital stays, catheterization times, and postoperative adjuvant therapy rates were comparable (P>0.05) between the two groups. Recurrence rates for cTURBT and ERBT were 18% and 13%, respectively, during a median follow-up of 15 months (interquartile range 7–28) (P=0.16).

Our research showed that the bipolar group had a larger catheterization time (days) (2.3400±2.4546) than the laser group (1.7647±0.4728), this is was not statistically significant (P=0.1035). Compared to 100% of ERBT cases, T1 substaging was feasible in 80% of cTURBT patients (P=0.02) according to Gallioli et al.,[13] The two groups had similar rates of complications, postoperative adjuvant therapy rates, hospital stays, and catheterization times (P>0.05). Similar study by Hashem et al.,[15] The groups' baseline tumor and patient characteristics were similar. Following HolERBT and cTURBT, residual tumors were found in 7% and 27.7% of patients, respectively (P=0.01) (Figure 1). In 62% of cTURBT cases and 98% of HolERBT cases, detrusor muscle was sampled (P<0.001). Only 18.4% of cTURBT patients were able to undergo

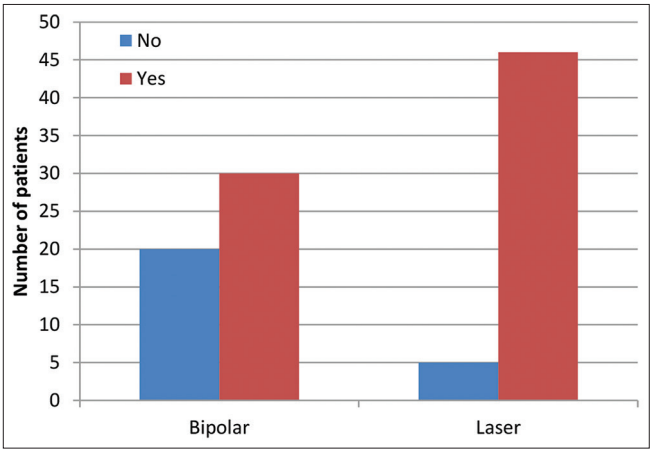

Figure 1: Detrusor muscle acquisition rate in bipolar transurethral resection of bladder tumor versus laser *en bloc* resection of tumor

lamina prorpia invasion substaging, compared to 68.2% of HolERBT cases (P<0.001). HolERBT was associated with shorter hospitalization (P=0.001) and catheterization (P<0.001) durations than cTURBT.

Limitations of the study

1. Small sample size.
2. Study has been done in a single centre.

CONCLUSION

En bloc resection maintains the complete tumor architecture, including the muscle layer, which is essential for precise staging and directing further treatment, it enables better pathological examination. By reducing the tumor fragmentation, *en bloc* technique with laser may lessen the chance of recurrence and leftover tumor cells. The main drawback of *en bloc* resection is the inability to remove big tumors. Even if both (laser or bipolar) techniques were successful in getting rid of bladder tumors, laser *en bloc* therapy seems to offer more safety and efficacy, which makes it a desirable choice for treating bladder cancer.

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Author's Contributions:
AS- Definition of intellectual content, Literature survey, Prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article; **AA-** Concept, design, clinical protocol, manuscript preparation, editing, and manuscript revision; **PPM-** Design of study, statistical Analysis and Interpretation; **SKS-** Review Manuscript; **SKT-** Review Manuscript; **AA-** Literature survey and preparation of Figures; **RKD-** Coordination and Manuscript revision.

Work attributed to:
Department of Urology, RG Kar Medical College, Kolkata, West Bengal, India.

Orcid ID:
Dr. Apurv Shukla - https://orcid.org/0009-0009-6019-7726
Dr. Partha Protim Mondal - https://orcid.org/0000-0001-9971-6698
Dr. Sudipta Kumar Singh - https://orcid.org/0000-0002-4876-1090
Dr. Shashi Kant Tewary - https://orcid.org/0000-0002-4958-7872
Dr. Arvind Arvind - https://orcid.org/0009-0001-5834-9438
Dr. Ankit Agarwal - https://orcid.org/0009-0007-4979-2191
Dr. Ranjan Kumar Dey - https://orcid.org/0000-0003-0364-4218

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