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Original Article

THULIUM LASER TURBT: IS IT BETTER THAN

CONVENTIONAL? A RETROSPECTIVE SINGLE CENTER

STUDY OF 134 CASES

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ABSTRACT:

Background: To compare thulium laser en-bloc resection of bladder tumor (ThuLEBT) and the conventional TURBT (transurethral resection of bladder tumors). Methods: The present retrospective study was conducted in patients with bladder tumors including the recurrent tumors. The patients were divided equally into two groups; group A for ThuLEBT and group B for mono-polar. Thulium laser, 150 Watt with a 600-micron fiber and the energy level of 30 watts was used for group A. For the mono-polar group, Covidien monopolar electrosurgery was used with cutting energy of 100 volts and cauterization energy of 60 volts. Results: A total of 134 patients with the mean age of 54 years were included in the study, 67 patients in each group. According to the histopathological reports 62 patients were in clinical stage Ta, i.e. confined to the mucosa, 55 patients were in stage T1 who underwent intravesical immunotherapy following ThuLEBT or TURBT, and other 17 patients had muscle-invasive bladder cancer. In group B, six patients had hematuria postoperatively, seven patients were noted as bladder perforation, partial resection was performed in three patients and mild transurethral resection syndrome was noted in two patients. No major complications were noted in group A. Three patients from group A, needed hospital admission due to other co-morbidities and from group B, 17 patients underwent hospitalization postoperatively for pain, hematuria or other treatment-related issues. Conclusion: Thulium laser is advantageous over conventional TURBT; hence, it can be the new gold standard for the initial treatment of bladder tumors.

Keywords: Bladder perforation, co-morbidities, complications, hematuria, transurethral resection syndrome, tumor

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INTRODUCTION

Globally bladder cancer stands at tenth position among all the cancers with greater prevalence in men than women. An addition of almost 550,000 new patients with bladder cancer was noted in the year 2018 [1]. Despite advances in technology and treatment methods, recurrence rates and associated side effects are higher indicating modifications in the present techniques or determining newer efficacious methods. However, transurethral resection of bladder tumor (TURBT) remains the mainstay of initial diagnosis and treatment of bladder tumors. This therapy enables precise diagnosis and removal of all the visible bladder lesions [2].

Conventionally, TURBT is conducted using monopolar cautery that is associated with risks such as hypotonic fluid absorption leading to the electrolyte imbalance, partial resection, significant blood loss, and bladder perforation due to obturator reflex [3]. To achieve better prognosis with complete tumor resection and minimal complications, conventional TURBT has undergone several modifications and newer techniques such as plasma kinetic-TURBT (PK-TURBT), holmium laser TURBT, and the most advanced thulium laser en-bloc resection of bladder tumor (ThuLEBT) were explored [4].

Holmium and ThuLEBT types are commonly used in recent times for bladder tumors and both have similar safety and effectiveness as compared to the TURBT [5,6]. However, tissue bearing effect is absent in case of ThuLEBT due to its continuous beam at approximately 2013 micron and it allows for a smooth incision and tissue vaporization [7-9]. Thulium laser is presently preferred over conventional method for bladder resection for the exophytic bladder tumors of size not greater than 3 cm. This technique is a good alternative for patients, on antithrombotic agents, and in patients in whom muscle relaxants are contraindicated [10]. The oncologic safety and superior pathological quality with the existence of the muscle layer [11,12]. Clinicians find ThuLEBT favorable due to simplicity and reliability of the method [13]. Studies demonstrate that tumors can be removed completely and the need for the number of second TURs might be reduced after using ThuLEBT [14]. The present study was conducted to compare ThuLEBT with the conventional mono-polar TURBT.

MATERIALS AND METHODS

Study design and patient selection

The present retrospective study was conducted at Centre for Advanced Urology and Kidney Diseases (AUKD), Bhangagargh, Guwahati, Assam, India. This study was conducted during June 2016 up to May 2019. This study involved patients with bladder tumors including the recurrent tumors. The patients were divided into two groups; group A for ThuLEBT and group B for mono-polar. Both the groups had equal number of patients each regardless of their age, tumor size and number.

Technique

Thulium Laser, 150 Watt from Quanta System with a 600-micron fiber with the energy level of 30 watts was used for group A. The laser energy was delivered in a continuous wave pattern. For the mono-polar group, Covidien Monopolar electrosurgery was used with cutting energy of 100 volts and cauterization energy of 60 volts. All the patients

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were treated under general or spinal anesthesia. An initial cystoscopy was performed at first under anesthesia followed by TURBT or ThuLEBT for all the patients as per EAU guidelines to review the location of the tumor, number, and size of tumors, and for any other suspicious lesions.

Outcomes

The primary outcomes of this study were associated with ThuLEBT and included duration of operation, complications, requirement of hospitalization and recurrence of bladder mass.

Statistical analysis

Data were analysed using Statistical Package for The Social Sciences (SPSS) software (version 23.0). The qualitative data were presented as number and percentages, while quantitative data was presented as mean (standard deviation [SD]) or median (range), depending on the normal or skewed distribution of data. P value <0.05 was considered as significant.

RESULTS

A total of 134 patients were included in the study, 67 patients in each group. According to the histopathological reports 62 patients were in clinical stage Ta, i.e. confined to the mucosa, 55 patients were in stage T1 who underwent intravesical immunotherapy following ThuLEBT or TURBT, and other 17 patients had muscle-invasive bladder cancer. The mean age of the patients was 54 years. The men and women ratio for this study was 3:1. The average operating time required was 33 minutes for group A and 21 minutes for group B.

Six patients in the mono-polar group presented with hematuria post-operatively, in which two patients needed a blood transfusion. Clot evacuation was done in three patients. A significant amount of hemoglobin drop was noted in the TURBT group postoperatively. No major complications were noted in the ThuLEBT group. Out of 24 patients in group B, who had bladder polyp in lateral wall obturator jerk led to bladder perforation in seven patients, and in group A, where 34 patients had lateral was mass, no obturator jerk was felt. Mild transurethral resection (TUR) syndrome was noted in two patients in group B. A total of three patients from TURBT group were reported as partial resection. The complication rate for TURBT group was noted as 29.85%, wherein ThuLEBT group did not show complication. The overall complication rate was 14.93%.

All the patients except for 20, from groups A and B, were treated on a daycare basis. Three patients from group A, needed hospital admission due to other co-morbidities and from group B, 17 patients underwent hospitalization postoperatively for pain, hematuria or other treatment-related issues. The p value for overall hospital stay was >0.0011.

For all the patients in group B, Foley's catheter was removed on POD three to five except for the patients with bladder perforation where it was kept for 10-15 days. In 48 cases of group A it was removed after 4 h, wherein the catheter in other 19 cases were removed on day 2-3. Post-operative normal saline irrigation was continued for 4-24 h in a total of 63 patients where the three-way catheter was introduced.

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Three patients from group B, and two patients from group A were found with recurrence of bladder mass in the follow-up cystoscopy. Cystoscopy check was planned quarterly for another two years and then half-yearly for three years followed by yearly for lifetime in the high-risk patients. The overall complication rate of group B was 25.37 % and for group A, it was 4.47 %. The P-value for complication rate was >0.0001.

Characteristics	Group A (ThuLEBT) N=67	Group B (Mono-polar) N=67	Total N=134	P value
Operative time (minutes), mean	33	21	27	< 0.001
Hemoglobin drop	3 (4.48)	30 (44.78)	<u>33 (24.63)</u> 20 (14.93)	<0.001
Hospital admission	3 (4.48)	17 (25.37)	20 (14.93)	<0.001
Recurrence of bladder mass	2 (2.99)	3 (4.48)	5 (3.73)	>0.05
Data is presented as n (%).				

Table 1. Characteristics of patients and tumors at resection

DISCUSSION

The purpose of TURBT is to diagnose, stage and remove all the visible lesions, and conventional TURBT has been serving well for past decades. However, there were always some complications that the surgeons had to deal with while treating bladder mass in a conventional way. The common complications are bleeding, pain and bladder perforation.

In this case series, efforts were made to compare the conventional TURBT with ThuLEBT and found that the average operating time taken for the ThuLEBT group was 33 minutes which was more compared to the conventional mono-polar that is 21 minutes. It was because of the time taken by the laser for precise cutting of the tumor. According to Wei et al. the ThuLEBT takes more time than the conventional TURBT. But, due to the absence of major complications and to achieve a good quality specimen ThuLEBT can be adapted [14].

A significant amount of hemoglobin difference was noted in patients from the TURBT group during the pre- and post-operative period, which was negligible in the ThuLEBT group. This might be due to the peri- and post-operative bleeding caused by the resection

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with a wire loop. The average hemoglobin drop noted for the TURBT group was 0.9 and for the ThuLEBT group, it was reported as 0.3 with an overall P value of <0.0001.

Furthermore, six patients treated with mono-polar TURBT presented hematuria postoperatively in which clot evacuation was needed for three. On the other hand, the complication rate in ThuLEBT group was almost negligible. Gregg JR et al. mentioned that the general complication rate after TURBT was around 8.1% though the complications are short term [15]. The most serious risk of the conventional TURBT is bladder perforation which may lead to laparotomy and in turn increasing patient morbidity [16]. The most common site for bladder perforation is the lateral wall due to the presence of obturator nerve in this area [17]. Any electrical stimulation nearby the obturator nerve may lead to an adductor spasm of the nerve causing obturator jerk which may lead to bladder perforation [16]. In the present study, out of 24 patients, having bladder polyp in the lateral wall from the monopolar TURBT group, bladder perforation was observed in seven patients that required a longer catheterization time to heal. Nevertheless, the use of light as an energy source in ThuLEBT group resulted in the absence of obturator jerk. A meta-analysis by Bai et al. concluded that ThuLEBT is safer than TURBT with respect to bladder injury, bladder perforation, acute peri and postoperative bleeding with an overall complication rate of 1.4% for ThuLEBT and none of the complications were life-threatening [8].

According to Tekgül ZT et al. during TURBT serious surgical complications can worsen with TUR syndrome leading to inferior oncological outcomes [18]. The TUR syndrome occurs in conventional TURBT due to use of hypotonic irrigation fluid during the procedure causing electrolyte imbalance [19]. However, in this study 1.5% glycine was used as an irrigating solution for the mono-polar group and normal saline for the ThuLEBT group. Two patients were reported with TUR syndrome in group B. At times, mild forms of TUR syndrome is left undiagnosed which when becomes severe can turn out to be life-threatening [20]. However, this syndrome cannot be seen in procedures that use normal saline as irrigating fluid such as plasma kinetic and laser resections [21].

A perfect TURBT is tough to attain because of different tumor dimensions, difficult sites, poor cystoscopic assessments, and inexperienced surgeons. In the present series, all the tumors in group A were resected in toto, and in group B, were in fragments. The histopathological reports for both the groups were satisfactory; but, for ThuLEBT group perfect staging of the tumor was more feasible. Among 67 patients, three patients from the TURBT group were noted as partial resection. This was due to the poor visibility due to peri-operative bleeding, obturator jerk or maybe due to other reasons.

All the patients in this study were treated as daycare except for 20 patients. Three patients from group A were hospitalized due to other co-morbidities and for group B a total of 17 patients needed hospital admission due to hematuria, pain or other treatment-related issues. Daycare treatments significantly reduced patient's hospital stay, treatment cost leading to better recovery and high patient satisfaction.

European Organization for Research and Treatment of Cancer (EORTC) stated that the recurrence rate of bladder tumors is highly affected by the quality of resections [3]. The deep cutting efficiency and absence of detrusor muscle in the specimen generates uncertainty in achieving perfect tumor resection. So, in order to achieve a quality of

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resection and to decrease the recurrence rate "en-bloc" resection was finally adapted [22]. The present study also showed less recurrence with ThuLEBT procedure.

A good prognosis is always directly proportional to the quality of the tumor excised. The TURBT causes fragmentation and thermal damage to the specimen [23]. The excellent hemostatic property of ThuLEBT allows precise tumor excision with a clear visual field which improves the specimen orientation and gives an easy access to the detrusor muscle [24] and this enables easy and accurate reporting of histological data and depth of invasion [9,25]

Li K et al. demonstrated that ThuLEBT showed a significant difference than PK-TURBT presenting with shorter operation duration, shorter hospitalization, lower catheterization time and lower post-operative irrigation timings [26]. Thus, ThuLEBT is now becoming the new alternative to the conventional TURBT procedure with its smooth incision, tissue vaporization, and en-bloc resection which represents feasible, safe, and effective procedures in the treatment of bladder cancer [14].

Limitations

This is a retrospective study comprising of small sample size. However, multicenter, large scale, randomized controlled trials are needed to establish this technique.

CONCLUSION

Thulium laser provides a perfect clear field of operation, proper en-bloc histopathological specimen orientation and avoids complications associated with conventional TURBT along with the possibility of daycare resection. Considering these advantages, ThuLEBT can be the new gold standard for the initial treatment of bladder tumors.

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