

COMPARISON BETWEEN LASER LITHOTRIPSY AND IN SITU ESWL FOR MANAGEMENT OF LOWER URETERAL CALCULUS

SHARIF MOHAMMAD WASIMUDDIN¹, ISTEFAQ AHMED SHAMEEM², MD. GOLAM MOWLA CHOWDHURY², MOHAMMAD SARUAR ALAM³, S.M. MAHBUB ALAM³

¹Department of Urology, Sir Salimullah Medical College & Mitford Hospital, Dhaka, ²Department of Urology, BSMMU, ³Department of Urology, Dhaka Medical College Hospital, Dhaka

Abstract:

Objective: To compare the effectiveness of the in situ ESWL and LASER lithotripsy in the treatment of lower-ureteral calculus.

Method: The study was conducted from November 2013 to October 2014 in the departments of urology, BSMMU and Dhaka Medical College Hospital. Forty four patients were selected using purposive sampling method.

From selected patients 22 patients grouped as ESWL group and 22 patients grouped as LASER group.

For ESWL group, patient is in supine position, stone was visualized with fluoroscopy and coupling was done. Level of shockwave energy was progressively stepped up (2000 to 2500 shocks at a frequency of 80 shocks per minute) till satisfactory stone fragmentation within patient's comfort. On the other hand cystoscopy followed by ureteroscopy with the help of guide wire was done and stone fragmentation was achieved by LASER lithotripsy for LASER group.

The follow up was done after 1 week, 1 month and after 3 months. Data of the variables of interest were collected using a structured data collection format.

Results: Immediate stone clearance was much higher in LASER group (90.91%) than that of ESWL group (63.63%). After one month and three months LASER group showed 95.45% stone clearance and ESWL group showed 86.36% and 90.90% stone clearance respectively.

Some immediate complications found in this study were considerably higher in ESWL group than those of LASER group. Haematuria in ESWL group was 31.81% and 9.09% in LASER group. Fever was observed in 40.90% cases in ESWL group compared to 13.63% cases in LASER group. Ureteral injury was observed in 4.54% cases in LASER group compared to none in ESWL group.

The complication rate was lower in LASER group (31.82%) than that in ESWL group (45.45%) but the difference was not statistically significant ($P > 0.05$).

The entire outcomes suggest that LASER lithotripsy is a better treatment option than in situ ESWL for the management of lower ureteral calculus on the basis of much higher immediate stone clearance and insignificant post operative complications.

Conclusion: For treatment of lower ureteral calculus Ureteroscopic LASER lithotripsy provided significantly higher immediate stone free rate compared with in situ extra corporeal shock wave lithotripsy.

Key words: Laser lithotripsy, ESWL

Bangladesh J. Urol. 2017; 20(1): 31-35

Correspondence: Dr. Sharif Mohammad Wasimuddin, Registrar, Department of Urology, Sir Salimullah Medical College & Mitford Hospital, Dhaka 1100, Bangladesh, Email: smcollins27@live.com

Introduction

The lower ureter is the location of the great majority of ureteral stones[1]. Stones with a diameter of <5 mm have a high chance of spontaneous expulsion ranging from 71% to 98%². In contrast, active intervention is often required for lower ureteral stones of >5 mm[2].

The introduction of extracorporeal shock wave Lithotripsy (ESWL) has revolutionized the treatment of urinary stones with the concept of disintegrates stones. With technological advancement in lithotripsy design and fluoroscopic imaging and increasing experience, in situ (no instrumentation) ESWL has been accepted as the treatment of choice for ureteral stones worldwide[3]. In Bangladesh ESWL was introduced in 1993 with Siemens Lithostar plus lithotripter in BSMMU, Dhaka[4].

In recent years, the development of new generation lithotripters using electromagnetic energy has increased the efficacy of ESWL for the treatment of ureteral stones located in the lower ureter without the need for any type of anesthesia[5]. The reported advantages of ESWL include: less invasiveness, short hospitalization, and a lower complication rate.

Management of lower ureteral calculi by URS and LASER lithotripsy is based on stone fragmentation into smaller pieces which are allowed to pass spontaneously or removed with an endoscope. To achieve this, energy should be transmitted to the stone through an endoscope (intra corporeal lithotripsy). Ureteroscopy and lithotripsy shares the advantages of a more rapid stone clearance but often requires anaesthesia, longer hospitalization, and it is often associated with a higher incidence of complications[6]. The development of new endoscopic techniques such as LASER lithotripsy has led some authors to consider URS a more appropriate first-line treatment for lower ureteral stones[7].

The aim of the present study is to compare in situ ESWL and Intracorporeal LASER lithotripsy as first-line treatment option for patients with solitary, unilateral, lower ureteral stone.

Methods:

The study was conducted during the period from November 2013 to October 2014 in departments of urology, BSMMU and Dhaka medical college hospital. Forty four patients were selected using purposive sampling method.

From selected patients 22 patients grouped as ESWL group and 22 patients grouped as LASER group.

For ESWL group, patient is in supine position, stone was visualized with fluoroscopy and coupling was done. Level of shockwave energy was progressively stepped up (2000 to 2500 shocks at a frequency of 80 shocks per minute) till

satisfactory stone fragmentation within patient's comfort. On the other hand cystoscopy followed by ureteroscopy with the help of guide wire was done and stone fragmentation achieved by LASER lithotripsy for LASER group.

The follow up was done after 1 week, 1 month and after 3 months. Data of the variables of interest were collected using a structured data collection format. Collected data were processed and analyzed using computer software SPSS. Student's t test, Fisher's exact test and chi-square test were used to analyze the data.

Results:

The findings of the study showed age and sex were almost homogeneously distributed in both groups. Mean \pm SD of age was 37.54 \pm 10.93 years in ESWL group and 38.23 (\pm 11.99) years in LASER group. Male predominance was observed in both groups with 77.27% male in ESWL group and 72.73% in LASER group. Stone size was also found almost identical in both groups. About 77.27% of the patients in ESWL group and 86.36% of the patients in LASER group had stones 9-10mm in size. On the other hand 22.72% of the patients of ESWL group and 13.64% of LASER group had stones 6-8mm in size.

Immediate stone clearance was much higher in LASER group (90.91%) than that of ESWL group (63.63%) (P-value – 0.034). After one month and three months LASER group showed 95.45% stone clearance and ESWL group showed 86.36% and 90.90% stone clearance respectively.

Immediate complications found in this study considerably higher in ESWL group than those of LASER group. Haematuria in ESWL group was found in 31.81% when it was found 9.09% in LASER group. Fever observed in 40.90% cases in ESWL group compared 13.63% cases in LASER group (P value- 0.044). Ureteral injury observed in 4.54% cases in LASER group compared to none in ESWL group.

Comparison of complications after one month showed 9.09% patients in both groups suffered from pain. None of the patient in ESWL group developed infection while 4.54% patient in LASER group developed infection. Comparison of complications after three months showed that none of the patient in any group developed ureteral stricture. No patient in ESWL group developed infection on the other hand 4.54% patient of LASER group developed infection.

The complication rate was lower in LASER group (31.82%) than that in ESWL group (45.45%) but the difference was not statistically significant (P >0.05).

These entire outcomes suggest that LASER lithotripsy is a better treatment option than in situ ESWL for the management of lower ureteral calculus on the basis of much higher immediate stone clearance and insignificant post operative complications.

Table- I
Distribution of the respondents by age group:

Age group	ESWL group		LASER group		P value
	N	%	N	%	
<20 Years.	1	4.55	1	4.55	0.54
21-30 Years.	3	13.63	4	18.18	
31-40 Years.	10	45.45	7	31.81	
>40 Years	8	36.36	10	45.45	
Mean (±SD)	37.54 (±10.93)		38.23 (±11.99)		

t=0.61, df=42, # Student's t-test was used to find out significance

Table-II
Comparison of immediate complication between groups:

Complications(Immediate)	ESWL group		LASER group		P value
	N	%	N	%	
Haematuria	7	31.81	2	9.09	0.132
Injury	0	0	1	4.54	0.500
Fever	9	40.90	3	13.63	0.044

Fisher's exact test was used to analyze the data.

Table-III
Comparison of complication after 1 month between groups

ComplicationsAfter 1 month	ESWL group		LASER group		P value
	N	%	N	%	
Pain	2	9.09	2	9.09	0.695
Infection	0	0	1	4.54	0.500

Fisher's exact test was used to analyze the data

Table-IV
Comparison of complication after 3 months between groups

ComplicationsAfter 3 month	ESWL group		LASER group		P value
	N	%	N	%	
Ureteral stricture	0	0	0	0	0.500
Infection	0	0	1	4.54	

Fisher's exact test was used to analyze the data.

Table-V
Comparison of outcome between groups

Outcomevariables	ESWL group		LASER group		P value
	N	%	N	%	
Immediate stone clearance	14	63.63	20	90.91	0.034
Overall stone clearance	20	90.91	21	95.45	0.500
Complication rate	10	45.45	7	31.81	0.3530

The variables,immediate stone clearance and Overall stone clearance were compared usingFisher's exact test. Chi-square test was used to analyze the complication rate.

Comparison between LASER lithotripsy and in situ ESWL for management of lower ureteral calculus

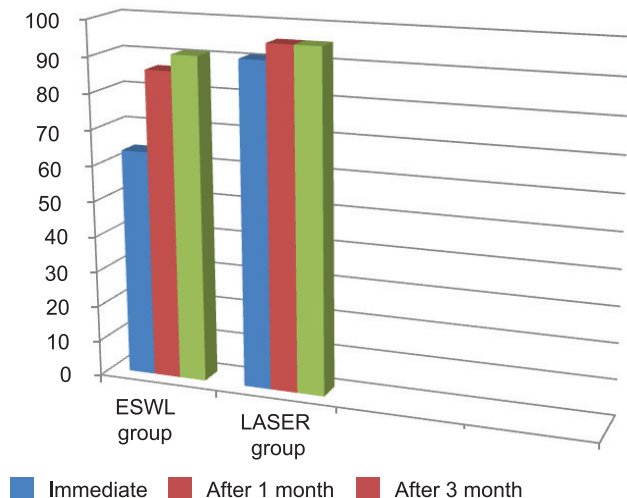


Fig.-1: Comparison of stone clearance between groups

Discussion:

ESWL and URS are accepted treatment methods for lower ureteral calculus. However, the optimal first-line strategy is still a controversial issue [8]. Many series have been published comparing the two techniques with contrasting results [9-12].

The present study has been designed to compare the efficacy and safety of intracorporeal LASER lithotripsy with in situ extracorporeal shock wave lithotripsy for the management of lower ureteral calculus.

In this study, Age ranges were equal for both groups (18 to 70 years). Age distribution were almost homogeneously distributed in both the groups ($P > 0.05$).

The mean age of the patients having ureteral stones were higher in some studies in developed countries [13-14]. Relatively younger patients developed stone diseases in our country. Dietary habit and hot climate might have some influence in formation of urinary tract stones in the early age in our country.

Ureteroscopic Holmium:YAG laser lithotripsy was used in 168 patients of ureteral calculi (mostly lower ureteral stone, 108). The stone free rate was 94% (102 out of 108) in case of lower ureteral stone. The complication rate was 5% (8 cases). They concluded that ureteroscopic Holmium:YAG laser lithotripsy is a highly effective safe treatment modality [15].

In a prospective non randomized study of total 124 patients with lower ureteral calculi done by P. Honeck, *et al.*, 2000, among them 62 patients treated with ESWL and 62 patients treated with LASER lithotripsy. About

84% stone free rate occurred within 7 days after ESWL and 98% after URS. This result shows a significant success rate in favor of LASER lithotripsy ($P = 0.005$) [16].

All these studies showed that they are comparable with this study in view of immediate stone clearance.

To compare the success, efficacy and complication of URS and ESWL for treatment of symptomatic small non obstructing lower ureteral calculi a prospective study was conducted. A total 280 patients were included in this study of those 160 patients were treated by URS and 120 patients were treated by ESWL. Ureteroscopy achieved complete stone clearance in 98.7% of patient, of the 120 patients treated by ESWL 90% achieved stone free status at 3 months [17].

Verze P, *et al.*, 2010 conducted a prospective randomized study on 273 patients with single, monolateral, radiopaque, distal ureteral stones of 0.5-1.5cm. One hundred and 37 patients underwent ESWL and 136 patients underwent URS. Patients in the ESWL group achieved a 92.70% overall stone free rate with a 44.88% re-treatment rate and an 11.02% auxiliary procedure rate. Patients in the URS group achieved a 94.85% overall stone free rate with a retreatment rate 7.75% [14].

Miguel A, *et al.*, 2009 assessed 164 patients with ureteral stones from April 2006 to April 2008. In group-A 83 patients treated with retrograde ureteroscopy and holmium: YAG endoscopic lithotripsy, and group-B, 81 patients treated by ESWL. The overall success rate for retrograde ureteroscopy and laser lithotripsy was 96.4% (80/83 patients). The success rate for the first ESWL session was 48%, and after repeat ESWL was 64% (52/81 patients). There was a significant difference ($P < 0.001$) favoring laser lithotripsy [13].

All these studies showed that they are comparable with this study in view of stone clearance.

Some immediate complications found in this study considerably higher in ESWL group than those of LASER group. Similar results are found in previously conducted studies [18].

Two patients in ESWL group failed to clear stones after 3 months. One case was treated with URS and other case was treated with open operation. In LASER group one patient failed to clear stone as URS could not be negotiated through ureteral orifice. Open procedure was needed for that case.

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The results are almost similar in other previously conducted study[14, 19].

If outcome is considered it is seen that both study group experienced a favorable outcome. However, in terms of immediate stone clearance LASER group was significantly better than that of ESWL group.

Conclusion:

In conclusion, treatment of lower ureteral calculus with Ureteroscopic LASER lithotripsy is a better option in terms safety and immediate higher stone clearance rate than in situ extra corporeal shock wave lithotripsy.

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