Original Article

ESWL with URS Lithoclast

# Extracorporeal Shock Wave Lithotripsy versus Ureteroscopy Lithoclast in Management of Upper Ureteric Stones

**Nisar Ahmad, Khalid Khan, Saqlain Amjad, Ajmal Rasheed and Usama Iftikhar**

## ABSTRACT

**Objective:** To compare the efficacy of Extracorporeal Shock Wave Lithotripsy (ESWL) with URS Lithoclast in management of upper Ureteric stones

**Study Design:** Retrospective study

**Place and Duration of Study:** This study was conducted at the Department of Urology, Sahiwal Teaching Hospital, Sahiwal, from June, 2021 to January, 2022 for a period of eight months.

**Materials and Methods:** Two groups were formed of total 70 patients. In the group undergoing ureterorenoscopy surgery was done by giving general anesthesia. Swiss pneumatic lithoclast, 0.8 mm or 1 mm probe, was used to break down the stone. SWL was performed on all patients using the standard procedure using Storz Modulith SLX-MX electromagnetic lithotripter equipment (3rd generation). A shock wave was delivered to the patient every 60 seconds until the desired result was achieved. If the stone was > 1.5 cm, a double J stent was typically used. The procedure was performed by a consultant doctor who specializes in the ESWL machine.

**Results:** Stone-free rate after first and second session in SWL was lower than URS group, but the difference was not statistically significant. The mean procedure time of SWL and URS was 65.88±2.05 and 87.98±9.22, respectively, (p=0.000). The mean number of sessions and hospital stay in both the groups was almost equal, (p≥0.050). The clavien grading system was applied to examine the complications in both the groups.

**Conclusion:** It can be concluded that stone free rate of proximal Ureteric stones after single session of ESWL and URS showed significantly better outcome in URS group of patients

**Keywords:** Extracorporeal shock wave lithotripsy, ureteroscopy, Lithoclast, management, upper Ureteric stones, laparoscopy, invasive, non-invasive.

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## INTRODUCTION

Urolithiasis is most common reasons of urinary tract morbidity in the world. The emergence of minimally invasive procedures has changed the treatment of urinary tract stones during the last few decades [1,2]. In past few decades ureteral stones were treated by open ureterolithotomy. After that due to establishment of more refined procedure, such as use of shock wave lithotripsy devices i.e., semi-rigid ureteroscopes, flexible ureterorenoscopy and laparoscopic procedures, to treat ureteral stones the therapeutic approach changed dramatically. All of these modalities, if administered properly, can be highly effective in children and adults[3,4]. The choice of procedure is up to the preferences of the patient and surgeon [3,4].

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Treatment of proximal ureteral stones can be done by minimally invasive technique, shock wave lithotripsy, and can be done on outpatient basis. But, a long treatment duration, a high rate of retreatment, and poor patient compliance in some cases are the major drawbacks of shock wave lithotripsy [4,5]. In past few years the surgeons prefer the ureterorenoscopic treatment of ureteral stones and it has become more popular approach. Due to high stone free rate (>90%), for the patients with distal ureteral calculi, ureterorenoscopy is highly recommended. [6] For proximal ureteral stone, due to larger working distance in males, surgeons are cautious of using semi-rigid URS, in comparison to females. [7] Because of difficulty in entrance and migration of stones towards proximal end during procedures, the success rate of ureterorenoscopy is considerably low in comparison to distal ureteral stones. It is also said that the expenses of lithotripsy group's treatment were way low in comparison to the ureterorenoscopy group. [8] The discussion for best treatment approach for ureteral stones is still not over [8]. Patients unable to visit hospital frequently prefer ureterorenoscopy treatment strategy due to its high rate of success in first time, as compare to shock wave lithotripsy [9]. In developing

countries like Pakistan where people have low income and are unable to afford treatment approaches like ureterorenoscopy or shock wave lithotripsy due to high rates of private hospitals, patients choose one technique according to their economic status[10]. Patients' financial loads are still discussed in the literature [8, 10].
Financial burdens and outcomes of these restrictions of the patients were also observed in this study for stone free rates. No study in the past excluded the patients that are obese, with distance more than 10cm between skin to stone distance and patients with stone density more than 1000 HU for comparative analysis of ureterorenoscopy and shock wave lithotripsy modalities for treatment of proximal ureter stones. In this study these complicating elements were also excluded. Due to which our study is first to do comparative analysis on the use of ureterorenoscopy and shock wave lithotripsy for treating proximal ureteral stones with all those elements mentioned above excluded.

# MATERIALS AND METHODS

Two groups were formed of total 70 patients. Clearance was received from the ethics from department of urology, Sahiwal Teaching Hospital, Sahiwal before the beginning of this retrospective assessment. After proper counseling of patients on the benefits and downsides of both treatment procedure and are allowed to choose between ureterorenoscopy or shock wave lithotripsy according to departmental policy. Radiological tests as X-ray KUB, computed tomography (CT) and urine ultrasonography was done along with acquiring the physical examination and medical history in order to diagnose the patients. The stone size was determined using largest stone size. Patients with proximal ureteral stones already had CT scan were included in this study in order to know about the density of the stone and distance of skin to stone. Patients with distal and mid-ureter stones, proximal radiopaque and single ureteral stone with a size less than 2cm, multiple ureteral stones,; age more than or equal to 18 years, body mass index of 30 kg/m$^2$, congenital genitourinary anomaly, skin-to-stone distance of > 10 cm, stone size more than 2 cm, stone density of more than 1000 HU, urinary tract infection (UTI), distal ureteral obstruction and coagulation disorder were all included in this study.
In the group undergoing ureterorenoscopy surgery was done by giving general anesthesia. Swiss pneumatic lithoclast, 0.8 mm or 1 mm probe, was used to break down the stone. If the stone is disintegrated completely with smallest residual procedures on each operational inspection and cleared of the ureter the procedure is considered as a success. However, if the stone is not broken down completely or pass to the kidney the procedure is considered as a failure. After two weeks and three months, post-procedural follow-up visits were conducted using plain X-ray KUB and urine ultrasonography to determine if any dilatation of ureter or residual fragment > 4mm following the URS procedure (kidneys, ureter, and bladder). For up to a year, the patients were examined using ultrasonography for hydro-nephrosis.
SWL was performed on all patients using the standard procedure using Storz Modulith SLX-MX electromagnetic lithotripter equipment (3rd generation). A shock wave was delivered to the patient every 60 seconds until the desired result was achieved. If the stone was > 1.5 cm, a double J stent was typically used. If gross residual stones were visible on X-Ray KUB and urine ultrasonography 2 to 4weeks after 1$^{st}$ SWL session, a second SWL session was performed. The stone free rate was defined as no trace of a stone on a plain KUB X-ray or ultrasound 3months after last SWL session.
SPSS 23 was used for statistical analysis of the data obtained. Frequency and percentage was calculated for qualitative variables while mean and standard deviation was calculated for quantitative variables. Chi square test was applied to check the significance between two groups. P value of less than or equal to 0.05 was considered as statistically significant.

# RESULTS

Seventy patients were enrolled in our study. The patients were equally randomized into two groups as n=35 SWL and n=35 URS.

**Table No.1: Demographic characteristics of both the groups**

| Variable | Group | | P-value |
|---|---|---|---|
| | SWL (n=35) | URS (n=35) | |
| Age (years) | 36.37±4.79 | 36.77±5.01 | 0.734 |
| BMI (kg/m$^2$) | 25.16±2.01 | 25.39±2.04 | 0.634 |
| **Gender** | | | |
| Male | n=26 (74.3%) | n=25 (71.4%) | 0.788 |
| Female | n=9 (25.7%) | n=10 (28.6%) | |
| Stone size (mm) | 11.98.1.08 | 12.31±1.22 | 0.239 |
| **Location of stone** | | | |
| Right side | n=8 (22.9%) | n=10 (28.6%) | 0.874 |
| Left side | n=27 (77.1%) | n=25 (71.4%) | |
| Skin to stone distance (cm) | 9.64±0.84 | 9.54±0.78 | 0.618 |
| Hounsfield unit of stone | 800.34±20.43 | 799.08±24.54 | 0.817 |
| Hypertension | n=8 (22.9%) | n=3 (8.6%) | 0.101 |
| Diabetes mellitus | n=11 (31.4%) | n=8 (22.9%) | 0.420 |

There was no statistical difference between demographic characteristics and both the groups, (p≥0.050). (Table. 1).

**Table No.2: Procedural outcomes of both the groups**

| Outcome | Group | | P-value |
|---|---|---|---|
| | SWL (n=35) | URS (n=35) | |
| Stone-free rate after first session | n=25 (71.4%) | n=29 (82.9%) | 0.255 |
| Stone-free rate after second session | n=28 (80.0%) | n=30 (85.7%) | 0.145 |
| Stone-free rate after third session | n=31 (88.6%) | -- | -- |
| Procedural time (minutes) | 65.88±2.05 | 87.98±9.22 | 0.000 |
| No. of session (procedure) | 1.24±0.38 | 1.34±0.39 | 0.270 |
| Hospital stay (days) | 1.21±0.41 | 1.32±0.48 | 0.281 |
| Stone retropulsion into kidney | -- | n=2 (5.7%) | -- |

**Table No.3: Clavien grading of both the groups**

| Clavien grade | Group | | P-value |
|---|---|---|---|
| | SWL (n=35) | URS (n=35) | |
| 0=No complications | n=16 (45.7%) | n=5 (14.3%) | 0.109 |
| 1=Deviation from normal post procedural course without need for intervention | n=2 (5.7%) | n=6 (17.1%) | |
| 2=mild complications needing intervention | n=8 (22.9%) | n=11 (31.4%) | |
| 3a=post-procedural complications needing intervention without use of general anesthesia | n=2 (5.7%) | n=2 (5.7%) | |
| 3b=Complications needing intervention under general anesthesia | n=2 (5.7%) | n=4 (11.4%) | |
| 4a=life-threatening complication needing intensive care management (single organ dysfunction) | n=2 (5.7%) | n=5 (14.3%) | |
| 4b= life-threatening complication needing intensive care management (multiple organ dysfunction) | n=3 (8.6%) | n=2 (5.7%) | |
| 5=Death | n=0 (0.0%) | n=0 (0.0%) | |

Stone-free rate after first and second session in SWL was lower than URS group, but the difference was not statistically significant. The mean procedure time of SWL and URS was 65.88±2.05 and 87.98±9.22, respectively, (p=0.000). The mean number of sessions and hospital stay in both the groups was almost equal, (p≥0.050). (Table.2). The clavien grading system was applied to examine the complications in both groups and presented in table 3.

# DISCUSSION

Over the recent decades a lot of advancements have been achieved in the treatment of urinary stones. In most recent advancements, minimally invasive techniques such as totally non-invasive SWL and endoscopic surgeries are at the top. As a result of these novel techniques, open surgeries have almost become obsolete [11,12]. While choosing the type of technique i.e. URS, SWL, laparoscopic or open, for urinary lithiasis, multiple factors are to be considered such as size, location, composition of stone, patients' choice and surgeon's inclination. In current guidelines URS and SWL are considered to be the treatment of choice for Ureteric stones [12]. ESWL is a non-invasive type procedure commonly performed in outpatient settings which has its own demerits such as high treatment rate, long treatment time and low compliance by the patients [9,12]. Standard guidelines indicate that ESWL is treatment of choice for stones <1cm but no definite guidelines are available over its use in stones of size more than 1cm in proximal ureter [13m 14].

With recent advancements small-caliber-semi rigid-ureteroscopes have been introduced. As an alternate to ESWL, a combination of intracorporeal lithotripsy and URS has been seen effective [13]. A previous study conducted in population of Pakistan indicated that even though ESWL is a preferred choice for proximal ureteral stones, the combination of URS and intracorporeal lithotripsy is also a safe option for relatively quicker relief from symptoms in treatment of proximal ureteral stones [15].

The use of URS has been shown to be associated with higher stone free rates in patients with stones smaller than 10mm in distal ureter and stones >10mm in proximal ureter [10]. Among the deciding factors for efficacy of URS, size, position are the most important but experience and skill of the surgeon is also of high significance [17]. Patients' preference is the most common deciding factor in making a choice of the treatment to be used. Due to invasive nature of URS and risk of anesthesia complications most patients opt for non-invasive or minimally invasive options, whereas some patients might prefer quickest removal of stones and relief of symptoms, thus avoiding multiple session that could be required in cases of ESWL [18,19]. In a past study where URS was compared to ESWL, although stones free status was greater among URS

patients, it was associated with higher complications rate and longer hospital-stay [19].

Similarly, Lee et al. [20] reported no significant difference when comparing URS with ESWL in terms of patients' satisfaction. In an Egyptian study mean cost of URS and ESWL were assessed to be EGP 6500 and EGP 5700 respectively (EGP=Egyptian Pound) [21]. Similarly cost for ESWL was lower than URS in study by Lee et al. [20]. However, types of ESWL devices used in these studies are different therefore no definite recommendations can be made. The results of current study are needed to be studied further with larger sample size and multicenter prospects. This study had a limitation of small sample size and being a retrospective single center study. Patients' satisfaction with URS or ESWL was not taken into account in this study.

# CONCLUSION

It can be concluded that stone free rate of proximal Ureteric stones after single session of ESWL and URS showed significantly better outcome in URS group of patients with comparable rate of complications in both groups, with hospital stay and treatment expenses being significantly lower in ESWL group.

**Author's Contribution:**

| | |
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| Concept & Design of Study: | Nisar Ahmad |
| Drafting: | Khalid Khan, Saqlain Amjad |
| Data Analysis: | Ajmal Rasheed, Usama Iftikhar |
| Revisiting Critically: | Nisar Ahmad, Khalid Khan |
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**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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