

ORIGINAL ARTICLE

Comparison between Intracorporeal Pneumatic Lithotripsy and Extracorporeal Shock Wave Lithotripsy (ESWL) in terms of efficacy and Safety for Management of Proximal Ureteric Stones

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ABSTRACT

Objective: To compare efficacy and safety of intracorporeal pneumatic lithotripsy versus extracorporeal shock wave lithotripsy (ESWL) in patients of upper ureteric stones having stone size from 10 to 15 mm.

Study Design: Randomized control trial

Setting: Study was done at department of Urology, Nishtar Hospital Multan. The duration of the study was from January 2021 to January 2022.

Methodology: 140 patients were divided into two groups randomly. In group A ureterorenoscopy (URS) with Pneumatic Lithotripsy was used for proximal ureteric stones management. URS was performed under general anesthesia. In group B, ESWL was done for the management of proximal ureteric stones identified by ultrasound and fluoroscopy. SPSS version 23 was used for data analysis.

Results: In this study In Intracorporeal Pneumatic Lithotripsy group the stone cleared in 90% patients and in ESWL group the stone cleared in 78.6% patients (p-value=0.595). In Intracorporeal Pneumatic Lithotripsy group the pain was present in 14.3% patients and in ESWL group the pain was present in 18.6% patients (p-value=0.494). In Intracorporeal Pneumatic Lithotripsy group the bleeding was noted in 25.7% patients and in ESWL group the bleeding was noted in 40.0% patients (p-value=0.072).

Conclusion: This study concluded that intracorporeal pneumatic lithotripsy is a good alternate of ESWL for the management of upper ureteric stones (having size from 10 to 15mm).

Keywords: Urolithiasis, Intracorporeal Pneumatic Lithotripsy, Extracorporeal Shock Wave Lithotripsy, Ureteric Stone

INTRODUCTION

Urolithiasis is a common health problem, having incidence range from 11-13% in male and 5.6-7% in female population usually in older age¹. Its prevalence rate is much higher in Asian countries, in Pakistani population it was reported up to 16% till year of 2012². Prevalence of urolithiasis is up to 13% and 9% in North America and Europe respectively and increasing continuously from last decade³.

Apart from genetic factors, dietary habits and climate changes excessive use of latest imaging techniques like ultrasonography, CT and MRI also contributing factor. Older age of peoples is also an important contributor of increased prevalence of urolithiasis, which was reported in previous literature^{4,5}.

Initially open ureterolithotomy techniques was in practice for management of ureteric stones, with passage of time there was refinement in machinery of ESWL, semi-rigid URS, flexible URS and laparoscopic procedures that revolutionized the management of ureteric stones. All of these techniques have great success rate if used at right time and with right indications^{6,7}.

In ESWL high resolution ultrasonic waves projected on spotted point inside the body from an external source that breaks stones through intervening the soft tissues⁸. This procedure can be performed in outpatients department because of its minimally invasive technique. Along with its benefits numbers of disadvantages are also associated like poor compliance of patients and retreatment rate⁹.

An alternative of ESWL is URS used for treatment of ureteric stones of proximal location and has gained popularity in recent years¹⁰. However, URS requires considerable surgical skills and anesthesia and is associated with complications such as retropulsion of stone, postoperative bleeding, infection, and ureteral stricture¹¹. There is very limited local data on comparison of these two techniques so this study is conducted to create local data. In resource poor countries like Pakistan, the technique with more safety and efficacy will not only save the resources by

reducing postoperative morbidity but will also reduce the pressure on the pressure on already overburdened settings.

METHODOLOGY

This RCT was carried out from January 2021 to January 2022 in department of Urology, Nishtar Hospital Multan after approval from ERC. Inclusion criteria was all adult patients having age 18-60 years, both genders and patients with diagnosis of proximal ureteric stones having size from 10 to 15mm. Patients excluded from study were, patients with untreated urinary tract infections, not willing to participate in the study, with congenital anomalies of urogenital tract, with bleeding disorders, having radiolucent stones and patients with solitary functioning kidney.

Total number of 140 patients, who were presented in stone clinic of Nishtar Hospital Multan with diagnosis of proximal ureteric stones were included. All patients were informed regarding study protocol and outcome. The patients were chosen through non random sampling technique for both intracorporeal pneumatic lithotripsy and ESWL.

In intracorporeal pneumatic lithotripsy group; ureterorenoscopy with Pneumatic Lithotripsy was used for management of proximal ureteric stones. URS was performed under GA. After insertion of a guide wire into ureter, a semi rigid ureterorenoscope of 8Fr/9.5Fr was used. Stones were broken with Pneumatic Lithotripsy, and stone fragments were removed with different devices. After removal of stone fragments DJ stent was placed. Prophylactic antibiotics were continued till 24 hours after procedure intravenously. After 24hrs patients were oral antibiotics were given for 7 days. On first postoperative day Foley's catheter was removed. Patients were followed up after 1 month by plain X-ray or KUB USG. DJ stent was removed after 6 weeks of the procedure. Procedure was considered successful if there was no residual fragments or if remnant of stone fragments was <4 mm in size.

In case of failure of ureterorenoscopy patient was excluded from study and was considered for any other treatment option. In

case of any perforation during procedure, DJ stent was placed, procedure was abandoned and patient was excluded from study. To avoid retropulsion of stone, stone cone was used. If despite these measurements, retropulsion of stone occurs, then DJ stent was placed and patient was referred for ESWL.

In case of symptoms produced due to DJ stenting like UTI and hematuria, urine culture and sensitivity was done and patient was treated accordingly by oral antibiotics for 1 week. In case of LUTS produced due to DJ stenting, patient was treated with anticholinergic drugs. If despite all these measures, symptoms related to DJ stenting are not settled then early removal of DJ stent was considered.

ESWL was done for the management of proximal ureteric stones identified by ultrasound and fluoroscopy. Modulith SLX lithotripter with electromagnetic source of energy was used for ESWL. Maximum 3 sessions of ESWL was done with interval of 2 weeks between each session. Patients were followed up weekly with plain X-ray or KUB ultrasound for 2 months. The procedure was considered successful if there was no residual fragments or if remnant of stone fragments were <4 mm in size.

RESULTS

Among 140 patients in group A patients mean age was 39.51 ± 11.78 years and in group B was 36.97 ± 10.51 years. Similarly in group A 53(75.7%) patients were male and from group B 54(77.1%) patients were male. Similarly from group A 17(24.3%) patients were females and 16(22.9%) patients were females.

In group A, ureteric stone mean size was 12.33 ± 2.09 mm and in group B was 1.37 ± 1.64 mm. According to statistics the difference was statistically insignificant. i.e. p -value=0.890. From group A right side proximal ureteric stone was found in 47(67.1%) patients and from group B the proximal ureteric stone was found in 28(40%) patients. Similarly from group A left side proximal ureteric stone was found in 23(32.9%) patients and from group B the proximal ureteric stone was found in 42(60%) patients. According to statistics significant difference was observed between proximal ureteric stone and study groups, i.e. p -value=0.001. (Table-1)

Similarly in group A 21(30%) patients were diabetic and from group B 16(22.9%) patients were non diabetic. According to statistics the difference between diabetes mellitus and study groups was statistically insignificant. i.e. p -value=0.338. In group A 15(21.4%) patients were hypertensive and from group B 14(20.0%) patients were hypertensive. According to statistics the difference between hypertension and study groups was statistically insignificant. i.e. p -value=0.835. In group A the stone cleared in 63(90%) patients and in group B the stone cleared in 55(78.6%) patients. According to statistics the difference between the stone clearance and study groups was insignificant. i.e. p -value=0.063. (Table-2)

In group A, pain was present in 10(14.3%) patients and in group B the pain was present in 13(18.6%) patients. According to statistics the difference between study groups and pain was insignificant. i.e. p -value=0.494. In group A the bleeding was noted in 18(25.7%) patients and in group B the bleeding was noted in 28(40.0%) patients. According to statistics the difference between study groups and bleeding status was insignificant. i.e. p -value=0.072. (Table-3)

Table-1: Demographics, Size of ureteric stone and position of proximal ureteric stone

Characteristics	Group A	Group B	P value
Age	39.51 ± 11.78	36.97 ± 10.51	0.180
Male	53 (75.7%)	54 (77.1%)	0.842
Female	17 (24.3%)	16 (22.9%)	
Size of Ureteric Stone	12.33 ± 2.09	1.37 ± 1.64	0.890
Proximal ureteric stone Right	47 (67.1%)	28 (40.0%)	0.001
Proximal ureteric stone Left	23 (32.9%)	42 (60.0%)	

Group A=Intracorporeal Pneumatic Lithotripsy
Group B= ESWL

Table-2: Co-morbid disease

Characteristics	Group A	Group B	P value
Diabetes			
Yes	21 (30.0%)	16 (22.9%)	0.338
No	49 (70.0%)	54 (77.1%)	
Hypertension			
Yes	15 (21.4%)	14 (20.0%)	0.835
No	55 (78.6%)	56 (80.0%)	
Stone Clearance			
Yes	63 (90.0%)	55 (78.6%)	0.063
No	7 (10.0%)	15 (21.4%)	

Table-3: Distribution of pain and bleeding among groups

Characteristics	Group A	Group B	P value
Pain			
Yes	10 (14.3%)	13 (18.6%)	0.494
No	60 (85.7%)	57 (81.4%)	
Bleeding			
Yes	18 (25.7%)	28 (40.0%)	0.072
No	52 (74.3%)	42 (60.0%)	

DISCUSSION

A study from Pakistan reported that proximal ureteric stones can be treated successfully with SWL, but symptoms of proximal ureteral stones can be relieved safely and quickly by using intracorporeal lithotripsy with ureterorenoscopic manipulation¹².

A study conducted by Al-Marhoon et al¹³ reported that shock wave lithotripsy of ureteral stones shows minor complication of pain in 21% of patients. In another study conducted by Salem et al reported minor extravasations in 4% of patients in URS group that were managed by inserting DJ stent. In our study only 3% of patients developed mild extravasations. End results and outcomes associated with URS and ESWL techniques were reported different in different studies.

Cui et al. did not found any significant difference in stone free rate in ESWL and URS groups (p -value 0.61)¹⁵. In a study Manzoor et al reported that success rate of ESWL is 49.2% and URS is 57.8%, findings were statistically significant $p=0.008$. In proximal ureteric stones ESWL is the treatment of choice that can be replaced with intracorporeal lithotripsy and ureterorenoscopic manipulation.

Both techniques are associated with different complications like steinstrasse and ureteric perforation. In our study ureteral perforation was noted in 1% of patients. In study conducted by Aboutaleb et al in 2016 ureteric perforation was observed in 7.3% of patients in URS group and 0% in ESWL group, similarly steinstrasse was found in 3.7% of patients in URS group and 34.8% in SWL group. Another trial was conducted by Lee et al and reported that patients satisfaction regarding intervention have no significant difference regarding URS and ESWL.

Stone size is also an important factor in success rate of procedure, URS have success rate about 80% if stone size is ≤ 10 mm and located in distal ureter, similar stone free rate was observed if stone spotted in proximal ureter and having size above 10mm¹⁸. In some studies skill and experience of operating urologist also studied and positive correlation was concluded¹⁹.

A meta-analysis also found very heterogeneity in data regarding outcomes of ESWL and URS with pneumatic lithotripsy and concluded that it may be the experience and techniques of operating surgeons or may be the nature of the stones that are associated with variability in the outcomes of ESWL and URS with pneumatic lithotripsy. So the effectiveness of URS with pneumatic lithotripsy over ESWL has still not been well established in patients of ureteric stones having stone size >10 mm²⁰.

CONCLUSION

This study concluded that intracorporeal pneumatic lithotripsy is a good alternate of ESWL for the management of upper ureteric stones (having size from 10 to 15mm).

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