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Review Article

TO DETERMINE THE EFFICACY OF INTRAVENOUS HYDRATION ALONG WITH DIURESIS AND LIMITED INVERSION DURING ESWL IN PATIENTS WITH LOWER POLE STONES AT SIUT

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Abstract:

Introduction: *The incidence of urolithiasis increases significantly in stone belt areas like Indo-Pak. Extracorporeal shock wave lithotripsy (ESWL) is recognized as safe procedure that carries an important role in managing upper tract stones. Aim of study is to determine the efficacy of intravenous hydration along with diuresis and limited inversion during ESWL in patients with lower pole stones which causes good fragmentation and better clearance of stone.*

Methods: *This was a descriptive case series study, included 215 adult patients having single lower calyceal stones \leq 2 cm on x-ray and ultrasound conducted in Sindh Institute of Urology & Transplantation (SIUT) from 23 January 2018.to 22nd July 2018. ESWL was supplemented by 1 Liter intravenous hydration started 5 minutes before the procedure, diuresis with intravenous Injection Furosemide 40mg 5 minutes before procedure and inversion of operating table to 20 degree. Final outcome i.e. in terms of efficacy was assessed after 3 months. All the demographic information was entered in pre-designed Performa.*

Results: *- The average age of the patients was 33.47 \pm 9.95 years. Efficacy of intravenous hydration along with diuresis and limited inversion during ESWL in patients with lower pole stones was 86.51% (186/215)*

Conclusion: *ESWL treatment is still being preferred as a noninvasive and successful method in the treatment of lower pole stones and with I/V hydration cause good clearance of lower pole stone fragments*

Key Words: *Extracorporeal shock wave lithotripsy, Urolithiasis, Intravenous hydration, Lower pole stones*

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INTRODUCTION:

The incidence of urolithiasis is 5-15% in the west [1]. It increases significantly up to 30-40% in stone belt areas like Indo-Pak [2]. There are varieties of techniques available for treatment of urinary calculosis [3]. One of the management options is ESWL, that can treat >90% of stones in adults [4]. Despite the progress in minimally invasive surgery and endourology ESWL is recognized as safe procedure that carries an important role in managing upper tract stones [4]. In Extracorporeal shock wave lithotripsy (ESWL) a source external to the patient's body generates shockwaves. Specifically, energy source rapidly deposits pulses of energy into a fluid environment, which results in generation of a shockwave. These shockwaves transmitted into the body and targeted on the particular point i.e. stone and cause fragmentation of it.

ESWL has lowest success rate in complete clearance of lower pole stones [5]. There are various factors responsible for low success in clearance rate that is stone size, composition, anatomy of collecting system, imaging modality and stone burden [5]. ESWL provides 90% fragmentation in lower pole stone but fragments clearance is only 60% [5,6]. A study conducted by Ather MH et al reported the efficacy of oral hydration along with diuresis and minimal inversion treated with ESWL in patient with lower pole renal stone of 83.3% [4].

The aim of my study is to assess the efficacy of intravenous hydration, diuresis and minimal inversion as only one study is available from Pakistan on this particular topic conducted in 2009 with sample size of only 100 patients, this provides me strong rationale to conduct this study with 215 patients which is more than double to the sample size of previous study. My study will provide current and local statistics of stone clearance in patients undergone ESWL in lower pole stones. If we found a significant efficacy of intravenous hydration, diuresis and minimal inversion, then we will recommend it as first line of treatment of lower pole renal stone in future.

METHODS:

This was a descriptive case series study, included 215 adult patients having single lower calyceal stones ≤ 2 cm on x-ray and ultrasound conducted in Sindh Institute of Urology & Transplantation (SIUT) from 23 January 2018 to 22nd July 2018. ESWL was supplemented by 1 Liter intravenous hydration started 5 minutes before the procedure, diuresis with intravenous Injection Furosemide 40mg 5 minutes

before procedure and inversion of operating table to 20 degree. By using WHO sample size calculator Efficacy of intravenous hydration, diuresis and minimal inversion is i.e. 83.3% [4].

Confidence interval = 95%, Margin of error = 5%. Final outcome i.e. in terms of efficacy was assessed after 3 months. All the demographic information was entered in pre-designed Performa.

- Inclusion criteria included adult patients between age of 18 years to 60 years with the duration of complains of at least 6 months having single lower calyceal stone ≤ 2 cm on x-ray and ultrasound.
- Patients with known co morbidities i.e. Hypertension, diabetes mellitus, renal failure etc, Multiple stones or Stone size > 2cm on x-ray and ultrasound, anatomically deformed kidney i.e. malrotated, horseshoe kidney on x-ray IVP and ultrasound or Prior surgical intervention on history or Urinary tract infection on culture and sensitivity, or coagulation disorder on history or investigation, Pregnancy on ultrasound were excluded from study.
- ESWL was supplemented by 1 Litre intravenous hydration started 5 minutes before the procedure, diuresis with intravenous Injection Furosemide 40mg 5 minutes before procedure and inversion of operating table to 20 degree. Storz SLX F2 Lithotripter was used & up to 3000 shockwaves was given Final outcome i.e. in terms of efficacy was assessed after 3 months. Efficacy was confirmed with plain X-ray KUB and Ultrasound KUB.
- The data was entered and analyzed in to SPSS (v-17), mean \pm standard deviation and confidence interval was calculated for age, duration of disease and size of stone. Frequency and percentage were calculated for gender and outcome variables i.e. efficacy (yes/ no). Effect modifier was controlled through stratification of age, gender, duration of disease and size of stone by chi-square test taken $P \leq 0.05$ as significant.

RESULTS:

There were 215 adult patients having single lower calyceal stones ≤ 2 cm on x-ray and ultrasound included in this research. It was observed that most of the patient's ages were between 21 to 40 years as presented in figure 1. The average age, stone size and duration of complain was 33.47 ± 9.95 years, 1.04 ± 0.27 cm and 3.8 ± 1.55 months respectively (table 1). There were 65.12% male and 34.88% female as shown in figure 2.

Efficacy of intravenous hydration along with diuresis and limited inversion during ESWL in patients with lower pole stones was 86.51% (186/215) Efficacy was not significant among different age groups as shown in table 2. Similarly efficacy was also observed above

and equal to 85% in male and female Similarly efficacy was also observed with respect to duration of complain and size of stone but no significant effect was observed as shown in table 3.

TABLE 1

Patients characteristics of age, stone size and duration of complain

Statistics		Age (Years)	Stone Size (cm)	Duration of Complain (Months)
Mean		33.47	1.04	3.80
Std. Deviation		9.95	0.27	1.55
95% Confidence Interval for Mean	Lower Bound	32.13	1.01	3.60
	Upper Bound	34.81	1.08	4.01
Median		33	1	4
Minimum		18	0.5	1
Maximum		60	2	7
Interquartile Range		15	0.40	3

TABLE 2

Efficacy of intravenous hydration along with diuresis and limited inversion during eswl
With respect to age groups
N= 215

Age Groups (Years)	Efficacy		Total	P-Value
	Yes	No		
18 to 20 Years	15(88.2%)	2(11.8%)	17	0.54
21 to 30 Years	71(88.8%)	9(11.3%)	80	
31 to 40 Years	66(88%)	9(12%)	75	
41 to 50 Years	23(76.7%)	7(23.3%)	30	
51 to 60 Years	11(84.6%)	2(15.4%)	13	

TABLE 3

Efficacy of intravenous hydration along with diuresis and limited inversion during eswl
With respect to age groups
N= 215

Duration of complain (months)	Efficacy		Total	P-Value
	Yes	No		
1 to 3 months	9(86.5%)	14(13.5%)	104	0.99
4 to 6 months	96(86.5%)	15(13.5%)	111	

Chi-Square =0.0001

DISCUSSION:

The incidence of urolithiasis is 5-15% in the west [1]. It increases significantly up to 30-40% in stone belt areas like Indo-Pak [2]. There are varieties of techniques available for treatment of urinary calculosis [1]. one of the management options is ESWL, that can treat >90% of stones in adultsⁱ. despite the progress in minimally invasive surgery and endourology ESWL is recognized as safe procedure that carries an important role in managing upper tract stones [4]. In Extracorporeal shock wave lithotripsy (ESWL) a source external to the patient's body generates shockwaves. Specifically, energy source rapidly deposits pulses of energy into a fluid environment, which results in generation of a shockwave. These shockwaves transmitted into the body and targeted on the particular point i.e. stone and cause fragmentation of it.

ESWL has lowest success rate in complete clearance of lower pole stonesⁱⁱ. There are various factors responsible for low success in clearance rate that is stone size, composition, anatomy of collecting system, imaging modality and stone burden [5]. ESWL provides 90 % fragmentation in lower pole stone but fragments clearance is only 60% [3,5]. A study conducted by Ather MH et al reported the efficacy of oral hydration along with diuresis and minimal inversion treated with ESWL in patient with lower pole renal stone of 83.3% [4].

The aim of my study is to assess the efficacy of intravenous hydration, diuresis and minimal inversion as only one study is available from Pakistan on this particular topic conducted in 2009 with sample size of only 100 patients, this provides me strong rationale to conduct this study with 215 patients which is more than double to the sample size of previous study. My study will provide current and local statistics of stone clearance in patients undergone ESWL in lower pole stones. If we found a significant efficacy of intravenous hydration, diuresis and minimal inversion, then we will recommend it as first line of treatment of lower pole renal stone in future.

ESWL shows good results in the treatment of kidney stones up to 2.0 cm and is an alternative to ureteroscopy in the management of ureteral *calculi* [3].

Proper selection of pts for ESWL respond good result [4].

A multivariable model had an overall accuracy of 66% on Receiver Operator Curve (ROC) analysis to predict

for successful SWL outcome.ⁱⁱⁱ Stone size and stone location are predictive factors on the outcome of ESWL^{iv}. Patients who do not require treatment with a JJ prior to ESWL will only rarely need treatment with a JJ after ESWL, irrespective of stone size and intra renal stone location.^v

ESWL is a useful tool for treating small renal calculi; it works either by fragmenting the stones or by acting as a pushing force [10].

Renal and ureteral stones are a common problem in primary care practice [10].

In septic patients with obstructing stones, urgent decompression of the collecting system with either percutaneous drainage or ureteral stenting is indicated in combination with appropriate antimicrobial therapy [2].

The density and ability of a stone to resist ESWL is based in part on the composition of the stone. Stones composed of calcium oxalate dihydrate, magnesium ammonium phosphate, or uric acid tend to be softer and to fragment more easily with ESWL. Stones composed of calcium oxalate monohydrate or cystine, on the other hand, are less susceptible to ESWL. To a degree, this can be predicted with CT scanning by measuring the radio-opacity of stones. A recent retrospective study showed that ESWL monotherapy is more likely to be effective against stones with a Hounsfield unit [HU] < 815 Hounsfield units [HU]) than those with a higher radio-opacity [9].

Skin to stone distance, which can be easily measured on CT scan, appears to predict the success of ESWL. Distances reaching greater than 10cm appears to have a negative effect on successful stone treatment [2].

CONCLUSION:

ESWL treatment is still being preferred as a noninvasive and successful method in the treatment of lower pole stones. The preferred imaging method is important while determining the ESWL success and more accurate evaluation might be made with a non-contrast abdominal CT use.

Ethical Approval

IRB Number: 206

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