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Original article

Anatomical factors predicting lower calyceal stone clearance after extracorporeal shockwave lithotripsy



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KEYWORDS

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Abstract

Objective: To determine the role of the lower pole infundibular parameters as predictors of stone clearance following extracorporeal shock wave lithotripsy (ESWL).

Subjects and methods: Between March 2001 and February 2004, 243 renal units in 239 patients with isolated lower calyceal stones were treated by ESWL. Stone-free status was assessed after 3 months by plain X-ray abdomen and a kidney ultrasound scan. Persistent stone fragments ≥ 6 months after the completion of treatment was defined as residual stone. Radiographic parameters were obtained from intravenous urography (IVU). SPSS version 15.0 was utilized for all statistical analysis.

Results: The median age of all patients was 38 years (range: 20–70 years). The male to female ratio was 2.1:1. The mean stone size was 1.3 ± 0.7 cm. Overall, 144 renal units (60.9%) had undergone one or two sessions of ESWL, 43 (17.7%) 3, while 46 (18.9%) ≥ 4 sessions, with mean of 2.1 sessions.

Stone-free rates differed significantly between favorable and unfavorable infundibular length (IL), and infundibular width (IW) (p value = 0.01, $p = 0.0001$, respectively). Infundibulopelvic (IP) angle had no statistically significant effect on stone-free rate ($p = 0.1$).

The effect of stone size on stone-free rate in two groups revealed better overall results in favorable anatomy group than in unfavorable group in stone sizes, 0.5–1.0 cm, 1.1–1.5 cm, 1.6–2 cm and 2.1–2.5 cm (76.7%, 87.5%, 100%, and 56.2% vs. 41.1%, 55.5%, 66.6%, and 50%; $p = 0.04, 0.10, 0.10, 0.80$, respectively).

Conclusions: This study shows that lower infundibular length and width are significant anatomical factors in determining stone clearance following ESWL treatment of lower calyceal stones and these should be assessed before planning the treatment for lower calyceal stones.

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Introduction

Stone disease is endemic in Pakistan and constitutes 60% of the urological workload [1,2]. Extracorporeal shock wave lithotripsy (ESWL) is the treatment of choice for majority of urinary calculi, especially those smaller than 2 cm in size [3,4]. However, the efficacy of ESWL as a primary treatment for lower pole stones remains controversial. The problem in lower pole stones is fragment retention rather than stone disintegration. One important factor that predicts the success of ESWL in lower pole stones is the calyceal anatomy [5–10]. The lower pole infundibular (IF) length, infundibular width (IW) and the infundibulopelvic (IP) angle on intravenous urography (IVU) have been shown to impact stone clearance [6,8,10–13]. Among these radiological parameters, the definition of IP angle has varied among the studies and remains problematic and controversial [14]. Measurement of the angle by Elbahnasy depended on fixed points and hence provided more consistent landmarks [6]. He used ureteropelvic axis rather than pelvic axis and vertical axis of the lower infundibulum. The use of ureteropelvic axis rather than pelvic axis resulted in a more acute angle, thus a lower cut off point was advisable. Different investigators used different cut-off values of the IP angle resulting in conflicting results [4,8–14]. However, the mean angle in many studies was around 40–50 degrees rather than 90 degrees found in the original resin endocast study of 146 cadaveric kidneys [4,5]. Therefore, we set a cut-off point at 45 degrees to see if this cut-off value is useful.

In this study, we aimed to evaluate the role of radiographic spatial anatomy using the above infundibular parameters as predictors of stone clearance following ESWL.

Subjects and methods

The study was carried out at adult urology department of Sindh Institute of Urology and Transplantation (SIUT), Karachi, Pakistan. Between March 2001 and February 2004, 243 renal units in 239 adult patients (>20 years) of either gender with isolated lower calyceal stones were treated by ESWL. Electromagnetic lithotripter Doli (Doli 50 (1995 Make), Dornier, Germany) was used to treat stones. Therapy was usually started at power 20 and increased up to power 60 and number of shock waves per session was 3000. The interval between the sessions was a minimum of one week. Stone free status was assessed 3 months after the last shock wave lithotripsy session by plane X-ray abdomen and renal ultrasound. Stone fragments less than 4 mm in size were subjected to inversion therapy and mechanical percussion. Any evidence of persistent stone fragment 6 months after the completion of treatment was defined as residual stone.

Written informed consent was obtained from all study participants and the ethical review committee of the institute approved the study.

We grouped the radiological anatomy parameters of the lower pole into favorable and unfavorable categories to determine the effect of this grouping on the stone clearance rate. Favorable anatomy group comprised of IL of ≤ 30 mm, IW of ≥ 5 mm, and IP angle of $\geq 45^\circ$. Unfavorable group had just the opposite values.

Data analysis

The software program statistical package for social sciences (SPSS) for Windows version 15.0 (SPSS Inc., Chicago, IL, USA) was

Table 1 The main demographic and stone-related characteristics.

Total number of patients	239
Males, n [%]	164 (68.6)
Females, n [%]	75 (31.3)
Male to female ratio	2.1:1
Median age [in years]	38
Age range [in years]	20–70
Mean stone size [in cm]	1.3 \pm 0.7 cm
Stone size, range [in cm]	0.5–2.5

utilized for all statistical analysis. Mean \pm standard deviation (SD) and median (range) were computed for continuous variables like age and duration of disease. Numbers and percentages were used to summarize the categorical variables like gender distribution, stone clearance rate and failure rate. The chi-square test was applied to see the association of lower pole anatomical factors with stone-free rate. $P < 0.05$ was considered as significant.

Results

A total of 239 patients and 243 renal units were treated for inferior calyceal calculi with ESWL. The median age of all patients was 38 years (range: 20–70 years). The peak age group in this series was 20–40 years comprising 73.4% of all patients. The male to female ratio was 2.1:1.

The mean stone size was 1.3 \pm 0.7 cm. The majority of renal units (167, 68.7%) had stone size between 0.5 cm and 1.5 cm. Twenty-eight renal units (11.5%) had stones of 1.6 to 2.0 cm and 48 units (19.75%), 2.1 to 2.5 cm in size. The main demographic and stone related parameters are given in Table 1.

One hundred forty four renal units (60.9%) had undergone one or two sessions of ESWL, 43 (17.7%) three, while 46 (18.9%) had four and five sessions (Fig. 1), with a mean of 2.1 sessions.

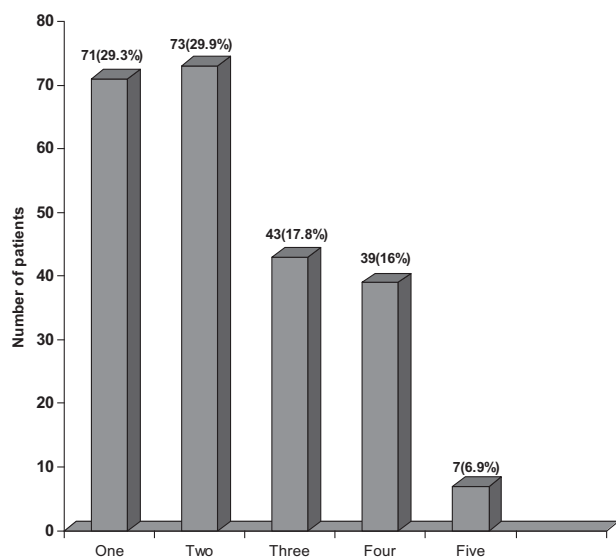


Figure 1 Frequency of treatment sessions of ESWL for lower calyceal stones in 239 patients.

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