INTERNATIONAL JOURNAL OF MEDICAL AND APPLIED SCIENCES
E-ISSN:2320-3137

Research Article

FACTORS INFLUENCING LOWER CALYCEAL STONE CLEARENCE IN ESWL

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Abstract :

OBJECTIVES OF STUDY: We assessed the efficacy of ESWL (**DORNIER COMPACT SIGMA**)MONOTHERAPY for isolated lower pole nephrolithiasis and compared treatment efficacy with respect to stone factors like size and lower calyceal anatomy includes lower calyceal infundibular length,width and infundibulopelvic angle. **INCLUSION CRITERIA:** Calculus size<2cms, simple or compound lower calyx, bilateral lowercalyceal calculi. **EXCLUSION CRITERIA**:Pregnancy,congenital anamolies of urinary tract,history of previous surgery for urolithiasis,partial staghorn calculi or calculi in multiple calyces,combined therapy with open surgery or percutaneous nephrolithotomy,bleeding diathesis. **RESULTS :**In our study 59 renal units were included . Patients were stratified into four groups based on stone size. These groups included stone sizes of 5 mm,(1), 6-10 mm(32), 11-15 mm(18) and 16-20 mm(8). Stone clearance in lower calyx depends on stone size **,**stone size <5mm clearance rate was 100%,6-10mm(93.93%),11-15mm(87.78%) and 16-20mm (37.5%) respectively and number of shock waves depends on stone burden .Stone <5mm requires average shock waves of 2127,6-10mm(2221),11-15mm (2639),16-20mm (2881). Stone size <5mm and 6-10mm were cleared in single sitting ,stone size 11-15mm and 16-20 mm needed more than two sittings. Stone clearance rate depends on anatomy of lower calyx in terms of in fundibular length(IL)IL<3mm(89.48%),IL(66.67%),in fundibulo pelvic angleIP>9O^0(89.65%),IP<90^0 (76.66%)and in fundibular width(IW),IW>4mm(85.29),IW<4mm(80%) respectively. **CONCLUSION:** Various factors affect lower calyceal stone clearance include infundibulopelvic angle, infundibular width, length, compound calyx, stone size,stone number. In our study for calculi size less than 10 mm,clearance rate was not depended on above factors. For calculi between10-15mm clearance rate depended on above factors with calculi size between15-20mm,clearance rate was less inspite of favourable factors, pcnl might be one of the favoured options for calculus size greater than 15mm.

KEYWORDS:ESWL, INFUNDIBULOPELVIC ANGLE(IP), INFUNDIBULAR LENGTH(IL), INFUNDIBULAR WIDTH(IW),IVP.

.INTRODUCTION

The phenomenon that sound waves can be focused has been known since antiquity. The ancient Greeks, as taught by Dionysius, used this knowledge to construct vaults that allowed them to over hear the conversations of their imprisoned enemies. In 1969 Dornier began a study of the effects of shockwaves on tissue, in the course of this effort the engineers discovered that shockwaves generated in water could pass through living tissue (except for the lung) without discernible damage to the tissue but that brittle materials in the path of the shockwaves would be fragmented.

In 1972, on the basis of preliminary studies performed by Dornier Medical Systems, an agreement was reached with Egbert Schmiedt, director of the urologic clinic at the University of Munich, to proceed with further investigation of the therapeutic potential of this technology (Chaussy and Fuchs, 1986). This research was supported by the West German Federal Ministry of Research and Technology, and the development of the Dornier lithotripter progressed through several prototypes, ultimately culminating in February 1980 with the first treatment of a human by SWL.

Lower Pole Calculi and shock wave lithotripsy, the overall stone-free rate for SWL applied to lower pole calculi was 60% .The reasons for poor clearance of fragments from the lower pole after SWL are unclear. Intuitively, the gravity-dependent position of the lower pole calyx may impede the passage of stone fragments (Elbahnasy et al, 1998b)[(4)]. Anatomic factors were first suggested by Sampaio and Aragao (1992, 1994)[(1)], who described the anatomy of the lower pole by use of polyester resin endocasts of the intrarenal collecting system obtained from adult cadavers .The authors hypothesized that a lower pole with multiple infundibula might have poor drainage and consequently less possibility of eliminating stone fragments than would an inferior pole drained by a single infundibulum receiving fused calyces.

Finally, the authors examined the angle formed between the lower infundibulum and the renal pelvis and hypothesized that an angle greater than 90 degrees should facilitate drainage of fragments from the lower pole.

MATERIALS AND METHODS:

From August2009 to December 2012, 59 samples, 50 patients aged (10 to70 yrs) with lower calyceal kidney stones were treated using Dornier compact sigma . Before lithotripsy, all patients were evaluated routinely with renal function tests, urinalysis, urine culture, abdominal X-ray and intravenous pyelogram (IVP) and/or ultra sonography(USG). Treatment with antibiotics was administered before ESWL when the urine culture was positive. All procedures were performed under USG guidance with Dornier compact sigma ESWL MACHINE in supine position as an outpatient procedure. The shock wave numbers ranged between 1500 and 3500)shock wave/session (mean 2250) . All patients underwent DJ stenting before procedure, ESWL was done under SA/SEDATION. Follow-up included physical examination, urinalysis and plain abdominal film,USG, Plain abdominal film was taken on the day after ESWL and monthly in the first three months, USG KUB was done at one and 3 months post eswl. Cases were designated as stone-free, clinically insignificant residual fragments that are nonobstructive and non infectious stone fragments of 4 mm or less. ESWL was considered a failure if residual stone fragments of size>4mmremained after three months or if an auxiliary procedure on retreatment was required.

RESULTS

In our study 59 renal units were included among 44 were male patientas and 15 pts were female,3 units were peadiatric age group and 56 units were adult age group,24 units were right sided ,26 were left sided and 9 units were bilateral. Patients were stratified into four groups based on stone size. These groups included stone sizes of 5 mm,(1), 6-10 mm(32), 11-15 mm(18) and 16-20 mm(8). Stone clearance in lower calyx depends on stone size**(**FIGII)stone size <5mm clearance rate was 100%,6-10mm(93.93%),11-15mm(87.78%) and 16-20mm (37.5%) respectively and number of shock waves depends on stone burden(FIGI) .Stone <5mm requires average shock waves of 2127,6-10mm(2221),11-15mm (2639),16-20mm (2881)and total number of sittings depends on stone burden(FIGIII).Stone size <5mm and 6-10mm were cleared in single sitting ,stone size 11-15mm and 16-20 mm needed more than two sittings.

Stone clearance rate depends on anatomy of lower calyx in terms of infundibularlength(IL)(TABLEI),IL<3mm(89.48%),IL(66.67%),infundibulopelvicangle(IP)(TABLEII),IP>9O^{0}(89.65%),IP<90^{0} (76.66%)and infundibular width(IW)(TABLEIII),IW >mm(85.29),IW<4mm(80%)respectively.

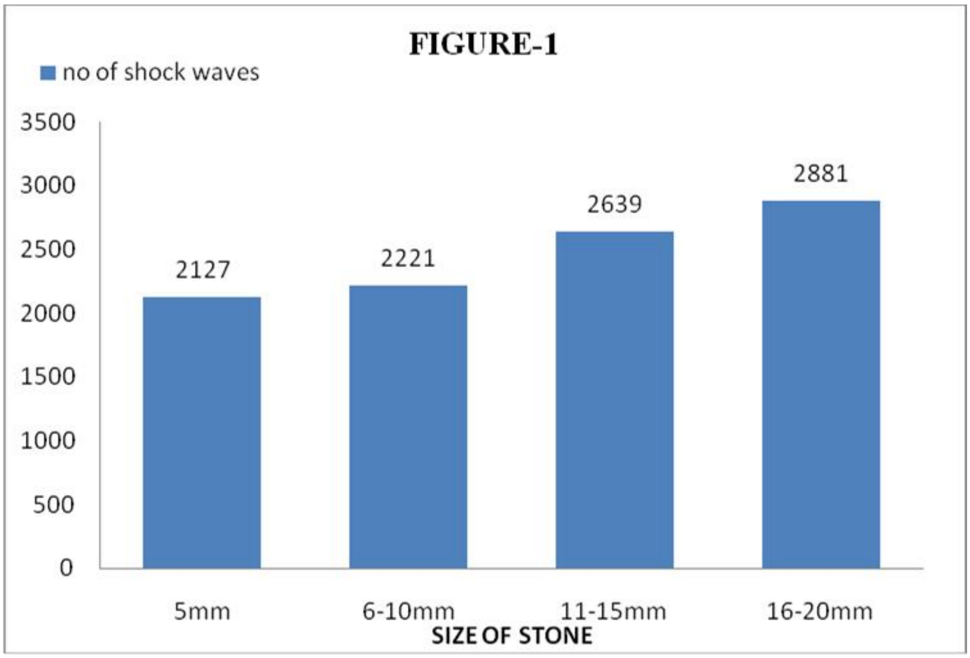

FIGURE 1 NO.OF SHOCK WAVES GIVEN TO EACH GROUP.

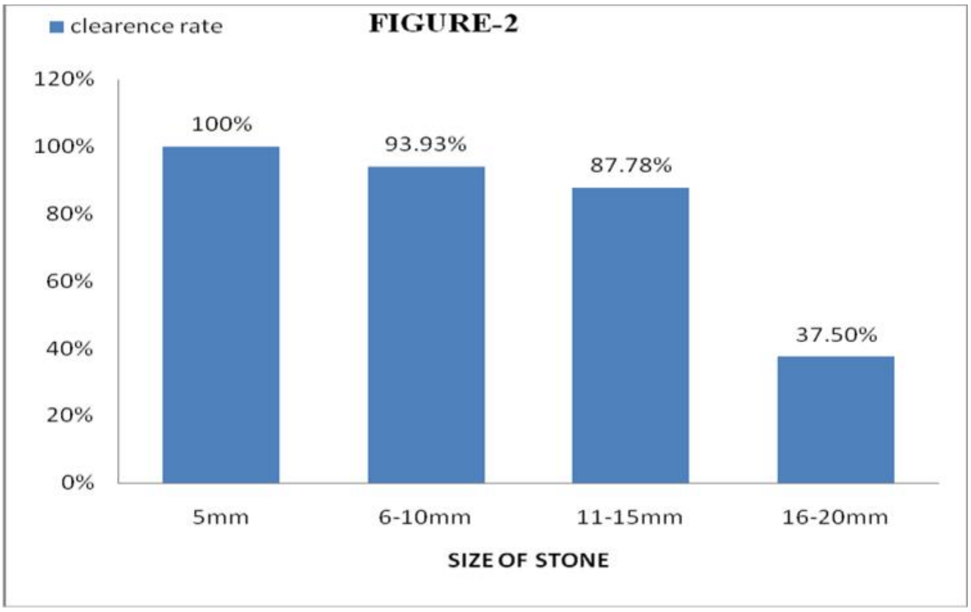

FIGURE 2 CLEARENCE RATE OF EACH GROUP.

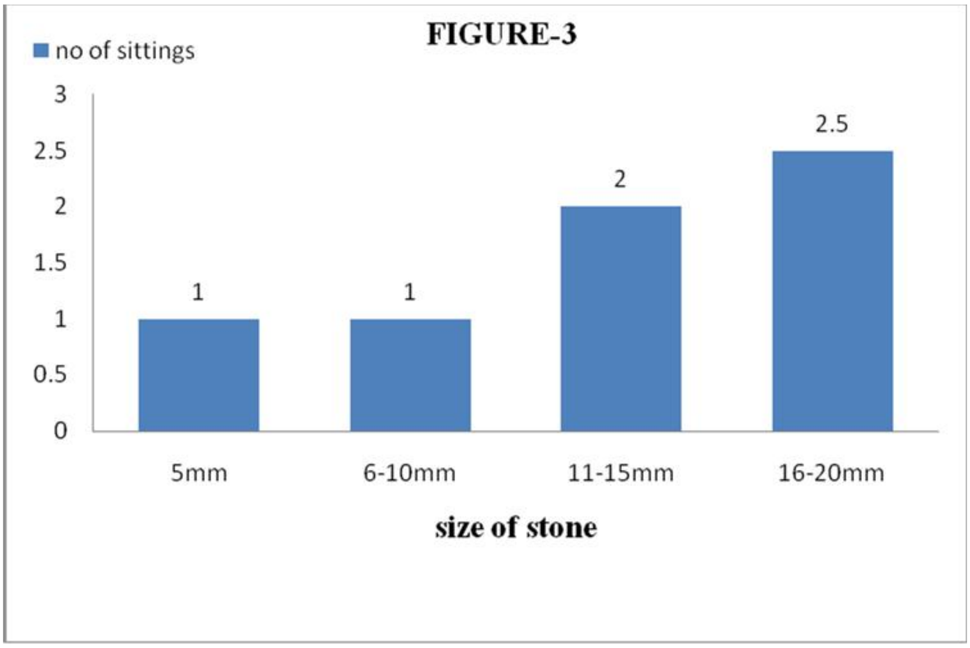

FIGURE 3 NO OF SITTING IN EACH GROUP

Table1

INFUNDIBULAR LENGTH (IL)	NO OF PATIENTS	STONE CLEARENCE RATE
IL-<30mm	38	89.48%
IL->30mm	21	66.67%

INFUNDIBULAR LENGTH VS STONE CLEARENCE.

TABLE-2

INFUNDIBULOPELVIC ANGLE-IPA	NO OF PATIENTS	STONE CLEARENCE RATE
IPA>90	29	89.65%
IPA<90	30	76.66%

INFUNDIBULO PELVIC ANGLE VS STONE CLEARENCE

TABLE-3

INFUNDIBULAR WIDTH -IW	NO OF PATIENTS	STONE CLEARENCE RATE
IW>4mm	34	85.29%
IW<4mm	25	80%

INFUNDIBULAR WIDTH VS STONE CLEARENCE.

DISCUSSION

Treatment outcome after lithotripsy depends on several Factors. The type of lithotriptor, stone characteristics (number, size, composition and location),and renal anatomy and function are important factors for determining treatment characteristics and outcome. Although the role of shockwave lithotripsy for management of lower pole nephrolithiasis has been questioned in some studies [7], many have suggested it as the primary treatment modality for lower pole stones of less than 2 cm [8,9]. Recently, several retrospective studies have further investigated the influence of lower pole anatomy on stone clearance.

Retention of residual fragments in the lower pole calices was noted to be a major problem with ESWL not only for stones originally in the lower calices, but also when fragments of stones located elsewhere migrated there [10]. For this reason, we have assessed the efficiency of ESWL monotherapy for isolated lower pole nephrolithiasis with favorable anatomy and we compared it with regard to different stone sizes.

Sampaio and Aragao [3,8] analyzed the inferior-pole collecting system anatomy in 146 three-dimensional polyester resin corrosion endocysts of the pelvicaliceal system and they described the caliceal anatomy of the lower pole and its possible impact on stone clearance with ESWL. They described three anatomical features that may have a role in stone clearance: the angle between the lower pole infundibulum and renal pelvis, the diameter ofthe lower pole infundibulum, and the spatial distributionof the calices. They suggested that a lower pole IPA lessthan 90°, lower pole infundibulum diameter less than 4mm and multiple lower pole calices may decrease stoneclearance. In a prospective trial, Sampaio et al. [8] found that 39 of 52 (72%) patients became stone-free when the lower pole IPA was greater than 90 while only 5 of22 (23%) patients were stone-free when the angle was less than 90. Keeley et al. reported on 116 patients who underwent shock wave lithotripsy for lower pole stones. The lower pole IPA was the only factor to attain significance in predicting stone-free status. The stonefreerates were 34% and 66% in patients with lower pole IPA less than or greater than 100°, respectively.

Combining all three negative factors (acute angle, distorted calix and narrow infundibulum), the stone-free rate decreased to 9%. With three positive factors, the stone-free rate was 71%.Elbahnasy et al. [9] suggested an alternative method for measuring the lower pole IPA (on preoperative intravenous urography). The angle is measured between the central point of the renal pelvis and central point of the proximal ureter to determine theureteropelvic axis and the central axis of the lower pole infundibulum. They also reported that the lower pole IPA and IW have a significant role in stone clearance after shock wave lithotripsy for lower pole stones, and added IL as another significant predictive factor. Gupta et al. [10] Recently reported the results of 88 patients undergoing shock wave lithotripsy for lower pole stones.

They confirmed that the lower pole IPA was the most significant factor followed by IW. However, IL was not a statistically significant factor for stone clearance. Similar to Elbahnasy's favorable anatomy criteria[4,9], in this study we have accepted IPA≥ 90°, IL≤30 mm and IW>4mm as indicating favorable anatomy. The overall stone-free rate was 81.36%. The overall stone-free rates in stones <5 mm, 6-10 mm, 11-15 mm and 16-20 mm were 100%, 93.75%, 87.78%, and 37.5%, respectively. The difference in success between stone size groups was statistically significant ($P < 0.05$). The success rates in the first and second groups were especially higher than in the other groups ($P < 0.05$). This supports some other authors results, with the worse results in the >10 mm group, even in favorable anatomy. Extracorporeal shock wave lithotripsy appears to be successful for management of isolated lower caliceal stone disease with favorable anatomy. In this study, we have also shown that stone size(<10mm has greater clearance rate compared to stone size>15mm) and also favorable anatomy of lower calyx may also have an effect on stone clearance in ESWL.

CONCLUSION

Various factors affect lower calyceal stone clearance include infundibulopelvic angle, infundibular width, length, compound calyx, stone size,stone number,composition. In our study for calculi size less than 10 mm,clearance rate was not depended on above factors.

For calculi between10-15mm clearance rate depended on above factors with calculi size between15-20mm,clearance rate was less inspite of favourable factors, pcnl might be one of the favoured options for calculus size greater than 15mm.

As the sample size was small,though there was a trend,p-value was not significant and more samples are required to comment on efficacy ofshock wave lithotripsy in clearing the calculi size greater than 15mm in size.

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