ESWL – are there any anatomical factors really affecting stone-free rates in inferior calyx lithiasis?

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Abstract

Introduction and objectives. ESWL is still the first line approach for renal calculi even after 35 years, provided the new guidelines and indications are followed. Our objective was to find out if there was a correlation between the length or width of the calyx, the infundibulo-pelvic angle, or the infundibulo-transverse angle and the stone free rate/ and clearance rate after ESWL for lower calyceal calculi.
Materials and methods. A retrospective analysis was performed on 80 randomly chosen patients with radioopaque lower calyceal stones who were treated in our clinic between February 2014 and July 2015. Data was collected about the number of procedures needed to achieve CIRF (clinically insignificant residual fragments) or stone-free status. IVU was performed in order to measure the length and width of the inferior calyx, the infundibulo-pelvic and the infundibulo-transverse angles. Ultrasound and plain KUB X-rays were used to assess stone clearance and the size of residual fragments.
Results. 52 patients (65%) needed only 1 procedure, 24 (30%) needed 2 procedures and 4 (5%) needed 3 procedures. In our study population, the mean infundibular length was 18.2 mm (minimum 7 mm and a maximum of 38 mm), the mean infundibular width was 8.5 mm (with a minimum of 2 mm and a maximum of 18 mm). The lower pole infundibulo-pelvic angles were between 31° and 134° with a mean of 61° and the lower pole infundibulo-transverse angles between 28° and 69°, with a mean of 50.8°.
Conclusions. We found no statistically significant correlation between the number of procedures needed to achieve stone-free status and either of the anatomical measurements made.

Keywords: ESWL, lower calyx, anatomical factors, stone-free

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Introduction and objectives

The basic principle behind ESWL is the release of energy, as an acoustic wave travels through the interface between 2 tissues / zones with different acoustic impedance. The energy has a destructive role upon the 2 zones.

ESWL is a safe and easy treatment option for renal calculi. Compared to the percutaneous approaches it has fewer and less severe complications. According to literature, the efficacy of ESWL is related to size, composition and location of the stone. [2,14,15,16,17]

Lingeman and K.H. Andreassen were some of the first to observe that lower calyceal stones had a lower stone free rate after ESWL than middle and upper pole ones, the former by a meta-analysis. The success of ESWL is based on two factors: fragmentation and clearance. There are multiple methods described for increasing the clearance of resulting fragments, which include: inversion therapy, increased diuresis and lumbar percussion. The fragmentation depends on size, composition, BMI or thickness of the body wall, energy and number of impulses. [14,15,16,17]

Materials and methods

A retrospective analysis was performed on 80 randomly chosen patients with radio-opaque lower calyceal stones, who were treated in our clinic between February 2014 and July 2015. Data was collected about the number of procedures needed to achieve CIRF (clinically insignificant residual fragments) or stone-free status. IVU was performed in order to measure the length and width of the inferior calyx, the infundibulo-pelvic and the infundibulo-transverse angles. Ultrasound and plain KUB X-rays were used to assess stone clearance and size of residual fragments.

Ketoprofen was administered to all patients before the intervention for pain management. No sedation was required.

For all cases, a Storz Modulith® SLX-F2 (Storz-Medical, Kreuzlingen, Switzerland) lithotripter was used. The intensity was gradually increased during the ESWL sessions. The total amount of energy was measured by the Storz medical lithotripsy index (SMLI).

Results

Out of the 80 patients, 52 patients (65%) needed only 1 procedure, 24 (30%) needed 2 procedures and 4 (5%) needed 3 procedures in order for stone free status to be achieved. In our study population, the mean infundibular length was 18.2 mm (minimum 7 mm and a maximum of 38 mm), the mean infundibular width was 8.5 mm (with a minimum of 2 mm and a maximum of 18 mm). The lower pole infundibulo-pelvic angles were between 31° and 134° with a mean of 61° and the lower pole infundibulo-transverse angles between 28° and 69°, with a mean of 50.8°.

Table 1. Descriptive statistics

	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (median)	75th
Infundibular length	80	17.78	6.892	7	38	13.00	16.00	23.00
Infundibular width	80	8.44	3.579	2	19	6.00	8.00	10.00
Infundibulo-pelvic angle	80	62.33	17.100	31	134	53.25	58.00	69.75
No. of procedures	80	1.35	.576	1	3	1.00	1.00	2.00

Table 2. Statistic Correlations (Spearman)

			Infundibular length	Infundibular width	Infundibulo-pelvic angle	Infundibulo-transverse angle	No. of procedures
Spearman's rho	Infundibular length	Correlation Coefficient	1.000	.174	-.341**	.054	.169
		Sig. (2-tailed)	.	.122	.002	.636	.134
		N	80	80	80	80	80

Spearman's rho	Infundibular width	Correlation Coefficient	.174	1.000	.150	-.043	-.226*
		Sig. (2-tailed)	.122	.	.185	.707	.044
		N	80	80	80	80	80
	Infundibulo-pelvic angle	Correlation Coefficient	-.341**	.150	1.000	-.344**	-.015
		Sig. (2-tailed)	.002	.185	.	.002	.895
		N	80	80	80	80	80
	Infundibulo-transverse angle	Correlation Coefficient	.054	-.043	-.344**	1.000	-.035
		Sig. (2-tailed)	.636	.707	.002	.	.755
		N	80	80	80	80	80
	No. of procedures	Correlation Coefficient	.169	-.226*	-.015	-.035	1.000
		Sig. (2-tailed)	.134	.044	.895	.755	.
		N	80	80	80	80	80

Table 3. Statistic Correlations (Pearson)

		Infundibular length	Infundibular width	Infundibulo-pelvic angle	Infundibulo-transverse angle	No. of procedures
Infundibular length	Pearson Correlation	1	.325**	-.401**	.054	.113
	Sig. (2-tailed)		.003	.000	.637	.320
	N	80	80	80	80	80
Infundibular width	Pearson Correlation	.325**	1	.075	-.032	-.186
	Sig. (2-tailed)	.003		.508	.776	.099
	N	80	80	80	80	80
Infundibulo-pelvic angle	Pearson Correlation	-.401**	.075	1	-.310**	.035
	Sig. (2-tailed)	.000	.508		.005	.761
	N	80	80	80	80	80
Infundibulo-transverse angle	Pearson Correlation	.054	-.032	-.310**	1	-.053
	Sig. (2-tailed)	.637	.776	.005		.640
	N	80	80	80	80	80
No. of procedures	Pearson Correlation	.113	-.186	.035	-.053	1
	Sig. (2-tailed)	.320	.099	.761	.640	
	N	80	80	80	80	80

Discussions

In our opinion, the principle of the least invasive method should be used, but not with the detriment of associated morbidity. In some cases it is wiser to choose a solution which is faster and has a higher stone-free rate (PCNL) but with a higher complication rate, than choose ESWL, which could mean more procedures, possibly lower stone-free rates, longer treatment. Although some authors would recommend choosing PCNL over ESWL in the case of lower pole infundibulo-pelvic angles lower than 70° [5,6], in our study, we observed good fragmentation and clearance for lower angles, requiring only one procedure. Although there is the case of asymptomatic ureteral stones, which could be overseen with KUB and US, we think that the two combined have a good diagnostic rate regarding residual fragments. The clearance of fragments after ESWL can be encouraged by inversion therapy, diuresis, mechanical percussion of the lumbar area and medical expulsive therapy (antiinflamatories and alfa-blockers). [2,15]

Conclusions

There was no statistically significant correlation between the number of procedures needed to achieve stone-free status and either of the anatomical measurements made in our study population.

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