



A retrospective study to compare Extracorporeal shock wave lithotripsy in or upper urinary tract stones in paediatric and adults patients

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Abstract

Objective: The main objective of the study was to compare and evaluate efficiency and safety of extracorporeal shock wave lithotripsy (ESWL) for upper urinary tract stones by using an electromagnetic lithotripter in children and adults.

Methods: Patients who had renal, solitary, and upper ureteric stones measuring <2 cm were retrospectively analysed over a period of 5 years where treatment method was used by ESWL done by Dornier Compact Delta (Dornier Medical Systems, Inc., Marietta, Ga, USA). 56 paediatric patients (age 5.7±3.8 years) was consider as Group A and 435 adults (age 44.3±14.2 years) was consider as Group B. Until adequate fragmentation was achieved, energy as well as number of SWs used was tailored and was not predetermined. Reassessment of initial stone was conducted at 48 hour and monthly thereafter. In each group the number of stone-free rate, auxiliary procedure rate, SWs, intensity of SWs, retreatment rate, effectiveness quotient and complication rate were assessed.

Results: It was observed that 85% was the stone-free rate with ESWL in paediatric patients and the same was 87% in adults with a p value of 0.69. Among the paediatric and adults the EQ was 78% and 77% respectively. Energy and number of SWs required per session was 948±334 and 11.64±0.72 kV in paediatric and 1348±431 and 12.81±0.29 in adults with a statistically significant differences (P< 0.001). It was found to be similar among both the groups as per as complication rates and re-treatment, auxiliary procedure is concern.

Conclusion: For patients having renal, solitary, and upper ureteric stones measuring <2 cm ESWL is as effective and safe in paediatric as well as in adults. To achieve equivalent results significantly fewer and lower energy SWs were required in paediatric patients as compare to adults.

Introduction

There was a paradigm shift or almost jumped an age since extra corporeal shock wave lithotripsy (ESWL) was introduced in non-invasive treatment

of urinary stone disease^[1]. Among the pediatric population, Newman et al reported successful results of ESWL, after these developments^[2]. In 1986 mentioned first report was published on

Extracorporeal shock wave lithotripsy (ESWL) and upper tract stones treatment algorithm was completely changed thereafter. It was already confirmed in children by several studies across the globe that in children ESWL is safe and effective with good stone-free rates^[3,4,5]. In ESWL, shock waves are generated by a source (lithotripter) external to the patient's body and are then propagated into the body and focused on a renal stone with the goal of fracturing the stone and allowing passage of the stone fragments via the urinary tract. In the past two decades, lithotripters have become more widely available throughout the world, and ESWL is now considered a first-line treatment for minimally invasive management of stone disease of the upper urinary tract^[6-9].

The main objective of the study was to compare and evaluate efficiency and safety of extracorporeal shock wave lithotripsy (ESWL) for upper urinary tract stones by using an electromagnetic lithotripter in children and adults.

Methods

Patients who had renal, solitary, and upper ureteric stones measuring <2 cm were retrospectively analysed over a period of 5 years where treatment method was used by ESWL done by Dornier Compact Delta (Dornier Medical Systems, Inc., Marietta, Ga, USA). 56 paediatric patients (age 5.7±3.8 years) was consider as Group A and 435 adults (age 44.3±14.2 years) was consider as Group B. Until adequate fragmentation was achieved, energy as well as number of SWs used was tailored and was not predetermined. Reassessment of initial stone was conducted at 48 hour and monthly thereafter. In each group the number of stone-free rate, auxiliary procedure rate, SWs, intensity of SWs, retreatment rate, effectiveness quotient and complication rate were assessed.

ESWL contraindication include poorly functioning renal unit, distal obstruction, bleeding diathesis, febrile UTI and pregnancy in adult women. Before the procedure patients were evaluated by ultrasonography (US), serum

biochemistry, urine culture and coagulation tests. Ketamine and midazolam i.v. was used to anaesthetize paediatric subjects while sedoanalgesia i.v were used for adults. For real time monitoring towards fragmentation and localize the stone fluoroscopy and US were used. The SWs were started at level at a level of 10kV to 11.5 kV and it was increased up to 16kV gradually only if objective was not achieved. The pulse frequency was 60 shocks per minute.

A treatment failure were considered when major auxiliary procedure like ureterorenoscopy or percutaneous nephrolithotomy required after ESWL. Chi-square and student's t-test was performed for statistical analysis with differences considered statistically significant if P<0.05.

Results

Both groups' demographic details were given in table 1. It was noticed that SW characteristics required for fragmentation was different for both the groups as mentioned in table 2.

Table 1: Patients demographic Characteristic

Variable	Group A (N=56)	Group B (N=435)
Male	36	313
Age (Years)	5.7±3.8	44.3±14.2
Location (%)		
Pelvis	52.8	32.5
Lower calyx	14.9	24.2
Middle calyx	8.6	9.4
Upper calyx	15.3	5.6
Upper ureter	8.4	28.3
Left side, %	56.53	45.54
Right side, %	43.47	54.46
Stone size, cm	1.00±0.28	1.16±0.38

It was noticed that SW characteristics required for fragmentation was different for both the groups as mentioned in table 2.

Table 2: The SW characteristics and stone-free rates, auxiliary procedure rates, re-treatment rates, complication rates and EQs

Variable	Group A (N=56)	Group B (N=435)	p value
No. of SWs per session	948±334	1348±431	<0.001
Total no. of SWs per stone	998±502	1521±698	<0.001
SW energy, kV	11.64±0.72	12.81±0.29	<0.001
Number of sessions	1.05±0.24	1.14±0.39	0.24

Percentage (%)			
Stone-free rate	85.2	87.92	0.69
Re-treatment rate	3.6	12.27	0.21
Auxiliary procedure rate	4.1	4.59	0.83
Complication rate	0	3.14	0.62
EQ	78.24	76.93	0.74

It was observed that 85% was the stone-free rate with ESWL in paediatric patients and the same was 87% in adults with a p value of 0.69. Among the paediatric and adults the EQ was 78% and 77% respectively. Energy and number of SWs required per session was 948 ± 334 and 11.64 ± 0.72 kV in paediatric and 1348 ± 431 and 12.81 ± 0.29 in adults with a statistically significant differences ($P < 0.001$). It was found to be similar among both the groups as per as complication rates and re-treatment, auxiliary procedure is concern. Pain requiring re-admission steinstrasse, oliguria and fever were the few complications observed in adults whereas complication was absolutely absent in paediatric subjects.

Discussion

Despite numerous reports and growing experience, few prospective studies and guidelines for ESWL have been completed. Variation in the methods by which study parameters are measured and reported can make it difficult to compare individual studies or make definitive recommendations. Stone size has frequently been cited as the most important predictor of ESWL success in the pediatric population,^[13,14] but variation in the methods by which stone size is measured and reported can make it difficult to compare individual studies and make recommendations for ESWL treatment. For fragmentation of both ureteric and renal stone ESWL was extensively used in paediatric patients. Factors affecting stone-clearance rates after fragmentation for all type stone size and position are generally same in both adults and children^[10-11]. ESWL was recommended as first line therapy in paediatric subjects as recommended by several authors^[12] while others only for a stone burden of <2 cm²^[15,16,17].

In this retrospective analysis retreatment required and stone free rate was comparable in both the groups. The EQs of both paediatric and adult ESWL were comparable. However in the present study between the number of SWs required for stone clearance in the children and adult were significantly different. Paediatric group required a mean of only 998 SWs compared with 1521 in the adult group ($P < 0.001$). As compared to adults the intensity of SWs used to fragment the stones was also reduced significantly in paediatric group.

Conclusion

For patients having renal, solitary, and upper ureteric stones measuring <2 cm ESWL is as effective and safe in paediatric as well as in adults. To achieve equivalent results significantly fewer and lower energy SWs were required in paediatric patients as compare to adults.

Conflict of Interest:

The authors declare no conflicts of interest. No funding sources.

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