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Original Research Article

Evaluation the success rate of extra corporal shock wave lithotripsy (ESWL) in patients with urinary stones

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ABSTRACT

Background: Urinary stones are one of the most common and earliest known human diseases. Extracorporeal shock wave lithotripsy (ESWL) is known as the most common method for treating urinary stones less than 20-25 mm. The aim of this study was to evaluation the success rate of ESWL in patients with urinary stones.
Methods: In this cross-sectional descriptive study 200 patients with urinary stones between 7-25 mm which were candidates for lithotripsy, enrolled in the study. Patients with coagulation disorders, urinary or other organ transplantation, pregnant women, uncontrolled blood pressure patients, and those who are contraindicated for drug use have been excluded from the study. The process was carried out by an operator and by the Dornier Compact Delta II lithotriptor. Two weeks later, the patients were re-visited, and ultrasound was performed, and the success rate of stones was measured and recorded and classified in three groups complete response, partial response and failure in treatment. Collected data analysed by statistical methods in SPSS version 19.
Results: Efficacy of Arian 101 lithotriptor in removing of renal stones, were found to be 74% complete response, 25.5% partial response while 0.5% of subjects had no response. There was significant positive correlation between the size of stones before and after lithotripsy (r=0.49, p=0.001). In stones upper than 10 mm, the upper calices stones had 100% complete response. Also, in stones lower than 10 mm, the upper calices stones had 100% complete response.
Conclusions: The results showed that Dornier Compact Delta II lithotriptor has more efficacy in treatment of stones. In stones below 10 mm, the success rate of treatment was generally higher, especially in the upper calices stones and pelvic. In stones larger than 10 mm, the success rate was slightly lower, but in the case of upper calices stones, the complete response was 100%.

Keywords: Ardabil, Extracorporeal crushing, Success, Urinary tract stones

INTRODUCTION

Urinary stones (such as: kidney, urethra, bladder and urethra stones) are one of the most common and earliest known human diseases. After the urinary tract infection and prostate disease, it was the third most common problem of the urinary system. The prevalence of kidney stones during life is estimated about 1-15% which based on age, gender, race and geographical location it was differ. The prevalence of stones in men is 2-3 times more than women. The occurrence of stones before the age of 20 is almost rare and its peak is in the 4th to 6th decades of life. In women, in the sixth decade of life, due to the incidence of menopause, another peak occurs.[1] Urinary stones along with other risk factors such as diabetes mellitus and high blood pressure are the major causes of kidney damage and kidney failure which leading to dialysis and therefore its effective and timely treatment

will reduce the complications and finally deal to significant reduction in the costs of the treatment.[2] The most common urinary stones are calcium oxalate, calcium phosphate, magnesium ammonium phosphate, uric acid and cysteine stones.[3] Most of the urinary stones appear at the onset of acute pain due to acute obstruction and upper urinary tract dilatation. Calices stones are often small, and multiplex and they pass by themselves. These stones can cause obstruction and renal colic, or they can to have produced periodic pain due to intermittent occlusion. This deep or vague pain is felt on the side or back and its severity varies. Pelvic stones larger than 1 cm are commonly called UPJO (Ureteropelvic Junction Obstruction) which cause severe pain in CVA (Costovertebral Angle).[4]

In recent years, major revolutions have been taken in the treatment of urinary stones. We can refer to the laser application, using percutaneous nephrolithotomy (PCNL), transurethral ureterolithotripsy (TUL) and finally ESWL that used without any anesthesia and no small incisions which urinary stones can be crushed within minutes.[3] ESWL is known as the most common method for treating urinary stones (70%) and selective treatment for small urinary stones (7 to 25 mm).[3] ESWL contra indication included pregnancy, uncorrected coagulation disorders, using anti platelet medications, distal to stones obstruction, urinary tract infections and renal artery or aorta aneurysms.[4] The risks of ESWL included breaking the kidney vessels and staying scar, causing hypertension, producing brushite stones (a kind of stones that produce in the urinary epithelium damage) and perirenal hematoma are significantly less than invasive methods such as Percutaneous Nephrolithotomy (PCNL) and surgery. If all ESWLs were successful, these dangers were not significant but all of them not successful. So, with the right choice of patients with a high success rate for lithotripsy it is possible to reduce these risks without any impose extra costs and doing non-important process for the patient.[5] Over the past two decades, several types of lithotripsy have been marketed witch their success varies depending on the location and size of the stones. The success rate of these methods in stones smaller than 20-25 mm is about 70 to 97 percent.[4,6] Electrohydraulic crusher have advantages such as large focal area, maximum pressure is almost high and adjustable spindle t. Piezoelectric crusher have many advantages includes longer life spans, long-term performance and less irritation for the patient and allow shock waves to be given at different frequencies. Electromagnetic crusher have long lifetime, long lasting performance, large and continuing energy rating.[7-9] Several studies have been carried out on the efficacy of various ESWL such as sonolite, Litostear, Dornier and Arian 101 lithotriptor.[6-10] Because of non-study about the performance of the Component Delta II lithotripter on different stones, this study was aimed at investigating the evaluation the success rate of extra corporal shock wave lithotripsy (ESWL) in patients with urinary stones.

METHODS

This prospective cross sectional descriptive was conducted on 200 people with urinary stones between 7-25 mm who were candidate for lithotripsy in the first six months of 2017 enrolled the study, after taking informed consent.

Exclusion criteria

- Patients with coagulation disorders,
- Urinary tract infection or other organs,
- Pregnant women,
- Uncontrolled blood pressure patients and
- People who oppose drug use.

Designing process

The process was carried out by an operator and by the Dornier Compact Delta IIcrusher machine. After preparing the patient and performing the stone crushing process, the individual was under supervision for up to 2 hours. Patients in the absence of a specific problem, were discharged with a diuretic drug, analgesic and if necessary an antibiotic. Two weeks later the patients were revisited, and sonography was performed, and the success rate of lithotripsy based on change in the size of the stone was measured and recorded. The complete cleaning of the urinary system or the remaining 4 mm stone or less was considered as a complete success and the presence of a stone larger than 4 mm and smaller than the original stone was considered as a partial success and failure to break the stone as a failure.

Data collection and statistical analysis

Patients' information was collected in a checklist containing age, sex, weight, job, history of drug use, kidney stone history, history of urinary tract infection, family history of stones, smoking and collected data analyzed by statistical methods in SPSS version 19.

RESULTS

Of the 196 people, 128 (65.3%) were male and 68 (34.7%) were female (Table 1).

Table 1: Characteristics of study patients.

Variables		N (%)	Mean±SD
WBC	<7500	94 (51.6)	9945.7±150
	>7500	88 (48.4)	
HG	<14	86 (44)	14.3±2.3
	>14	110 (56)	
CR	<1.04	85 (43.5)	1.14±0.2
	>1.04	111 (56.5)	
Age		43.6±7.1	
Sex			
Female		68 (34.7)	
Male		128 (65.3)	

Table 2: Location of stone.

Location of stone	n	%	Location of stone	n	%
Left pelvic	19	9.7	Right middle and lower calices	3	1.5
right pelvic	29	14.8	Left lower calices	14	7.1
Right urethra	33	16.8	Right upper calices	4	2
Right UPJ	8	4.1	Pelvic and Left lower calices	1	0.5
Left urethra	25	12.8	Left pelvic and UPJ	1	0.5
Left renal sinus	7	3.6	Right lower calices and urethra	1	0.5
Left UPJ	15	7.7	left middle calices	3	1.5
Right middle calices	9	4.6	Right middle urethra	2	1
Right middle urethra	4	2	Right renal sinus	2	1
Left upper calices	4	2	Total	196	100
Right lower calices	12	6.1			

The right urethra with 16.8% and then right pelvic with 14.8% was in first and second most location for stones (Table 2). The average primary stone size is 12.98 mm. Of the primary stones, 32.7% had a size less than 10 mm (Figure 1).

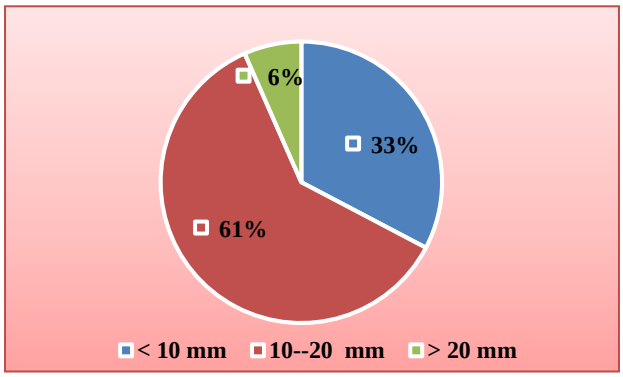

Figure 1: The first size of stones in study patients.

Of all patients, 31.4% had mild hydronephrosis and 30.9% moderate hydronephrosis. 33.5% had no hydronephrosis and 4.1% had severe hydronephrosis. 41.3% of patients had kidney stones on the other side. 34 (17.3%) of all patients, had kidney cysts. The average size of the stone after the crushing was 2.90 mm.74% of the stone after the lithotripsy had a size less than 4 mm and 26% had size more than 4 mm. Of the 45 people who needed to the second lithotripsy, 29 (64.4%) attempted to the second lithotripsy and 16 (35.6%) not participated in the second crusher. Of all patients, 19.9% had pain after the last lithotripsy. The average size of the primary stone before the lithotripsy was 12.98±4.62 and after the lithotripsy this average reach to 2.9±4.3 mm which was statistically significant (Table 3).

Of all patients, 74% (145 people) had complete success of ESWL that of them, 113 (80%) had complete response and 32 people (20%) had partial response with the remaining stone smaller than 4 mm (Figure 2). In other words aging increases the size of the urinary system stones.

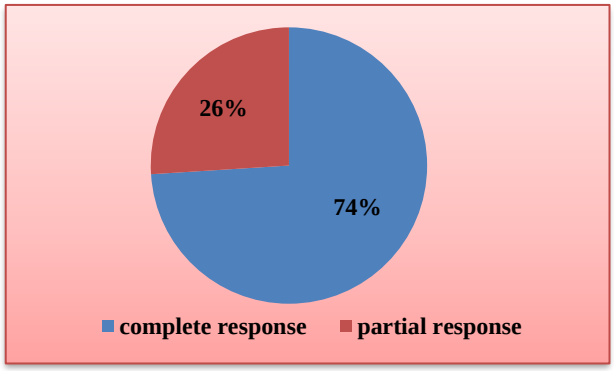

Figure 2: The success rate of lithotripsy in patients.

The results showed that the size of stone before lithotripsy was significantly different between men and women and the gender is effective in the size of the stone. Also, authors could say that the size of the stone before lithotripsy increases the size of the stone after the lithotripsy (Figure 3).

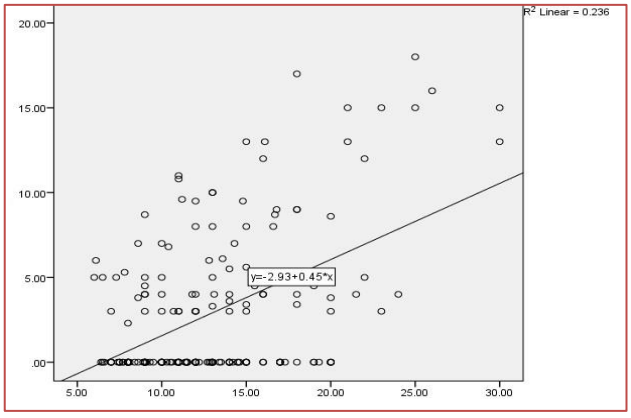

Figure 3: The correlation between two sized after and before lithotripsy.

Table 3: The changes in the size of stones (mm) before and after lithotripsy.

Tone size	n	mean±SD	p-value
Before lithotripsy	196	12.98±4.62	0.001
After lithotripsy	196	2.9±4.3	

Family history of stones, blood creatinine, white blood cells, number of shocks and the existence of stones on the other side hadn't affect on the size of the formed stones and the rate of successful in patients with urinary system stones. The results showed that blood hemoglobin and the presence of cyst can affect the size of the stone before and after the lithotripsy. In fact, an increase in blood hemoglobin and the presence of a cyst causes an increase in the size of the stone before lithotripsy.

DISCUSSION

The average age of patients was 43.7 years compared to other studies conducted in this field that the difference could be related to the lifestyle and residence place of the patients. Also, the relationship between age and treatment results wasn't statistically significant.[11-14]

In the present study, 65% of patients were men and 35% were women and the gender of the patients was not related to the success rate of the lithotripsy. These results are in line with other studies.[15-19] In the present study, 31% had stone in proximal urethra and 27% in the pelvic and 18% in lower calices which in terms of distribution of stone formation was in line with other studies.[20-22] In the present study, the average shock exposure was 3900 and in stones below 10 mm the stones in the upper calices were 100% successful while 66 % of the middle calices stones were completed and 16% had partial response and 16% had failure in treatment. 92% of lower calices stones had complete treatment and 8% had partial treatment. 78% of the stones in primary renter had complete and 11% had partial and 11% were unsuccessfully treated. In the pelvic region, 82% of the stones were completely treated and 18% partially. In the UPJ stones, 85% had complete treatment and 15% had partial treatment and the difference was statistically significant (P=0.001). The results of this study were in line with other studies.[20-23]

In stones over 10 mm, the upper calices stones had 100% complete treatment. In the case of middle calices stones, 66% of stones were fully treated and 33% were treated partially. In the lower calices region, 60% of the stones were treated as complete treatments and 34% were treated partially and 6% were defective treatment. In primary urethra stones, 68% had complete treatment while 29.5% were partially treated and 2.5% treated defectively. 72% of pelvic stones were fully treated and 28% were treated partially. Of UPJ stones, 73% complete, 20% partial and 7% also had a treatment failure. The difference between the success rate of ESWL in stones over 10 mm based on the stone formation location was statistically significant (P=0.008).

CONCLUSION

The results showed that, the rate of success in the free from the stone of the urinary system is as dependent on the size and the formation location of the stone. In stones below 10 mm, the success rate of treatment was generally higher especially in the upper calices and pelvis. In stones above 10 mm, the success rate was slightly lower but in the case of upper calices stones in both groups stones were fully treated with 100%. The results showed that the gender and age of the patients did not correlate with the success rate of the treatment. It is suggested that similar studies be carried out in this area with larger sample size in the future. From the limitations of this study authors can mention the limitations of similar studies sources in relation to the association between the success rate of lithotripsy with the cyst rate, hydronephrosis and pain in patients after lithotripsy and limiting access to patients in the second visit.

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