SJIF Impact Factor: 3.458

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

ISSN: 2457-0400
Volume: 2.
Issue: 5.
Page N. 50-54
Year: 2018

Original Article www.wjahr.com

# RESULTS USE OF EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY (ESWL) IN TREATMENT HIGHER URETERAL STONES

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**Received date:** 25 June 2018 **Revised date:** 15 July 2018 **Accepted date:** 05 August 2018

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## ABSTRACT

**Background:** The higher ureteral stones (HUS) are the stones formed in the kidney and migrated to the ureter. These stones cause severe pain and recurrent renal colic episodes, In addition to the occurrence of expansion and ascites in the renal pelvis. It is therefore necessary to find the best treatment methods to get rid of these stones quickly to avoid the occurrence of these complications. Extracorporeal shock wave lithotripsy (ESWL) is one of the most important methods of treatment. The aim of this study was to examine the effectiveness of the treatment of break-up of extracellular shock waves in patients with higher stones of ureteral. **Methods and materials**: The study included 420 patients with high ureter stones who visited Tishreen University Hospital in Lattakia, Syria, from 1/2/2016 to 28/2/2018. And who had a Shaded stones on the rays. Where ESWL were conducted for all patients (from 3 to 3 sessions maximum), the patients were given in each session of 3000-4000 shots and severely 4 joule. Patients were divided by diameter of the stones into two groups (less than 10 mm, greater than 10 mm). The pathological story, necessary laboratory analysis, imaging, echography of the urinary tract were recorded for all patients, and an intravenous pyelogram (IVP) was done if necessary. **Results**: The number of patients in the study was 420 patients (315 males and 105 females) and men to women 1/3. Age of Patients was between 19-78 years and their average age was 39.4 years. We found that the complete response to ESWL in the first session in patients with a diameter of pebble between 0.7-1 mm occurred in 146 patients (49.49%), While the incomplete response occurred in 101 patients (34.23%), and There was no response in 43 patients with 14.57%. **Conclusion**: The success rate of fragmentation after the first session in patients with pebble diameter up to 1 cm was 49.49%, and after three sessions it reached 89.83%. While the success rate of fragmentation after the first session in patients with pebble diameter of 1-1.5 cm was 20.8%, and after three sessions it reached 50.4%. We found that all patients with stones in the upper ureter, the stones was broken in 328 patients with a success rate of 78.09%. We can said that ESWL is a successful, effective and safe option to treat higher ureteral stones.

**KEYWORDS:** Higher ureteral stones, extracorporeal shock wave lithotripsy.

## INTRODUCTION

The higher ureteral stones are the stones that are located at the top of the ureter, which extends from the pelvis to the upper edge of the sacral bone. A total of stones formed in the kidney and migrated to the ureter and settled in it. These stones cause severe pain and recurrent renal colic episodes, also the expansion and ascites of the upper emptying urinary system, and It can also lead to serious urinary infections. It is therefore necessary to find the best treatment methods to get rid of these stones quickly to avoid the occurrence of these complications. Extracorporeal shock wave lithotripsy (ESWL) is one of these therapeutic methods.[1]

ESWL consist of ultrasonic waves which when focused on a specific point (e.g. stone), can fragment and dissipate the material at this point. This was the beginning to use this property to break up urinary stones by generating these waves outside the body and focus on the stone with a safe passage of the ultrasound through the tissues in a non-invasive or satisfied, and It can be used by patient hypnotism or general anesthesia in rare cases.[2] The waves are directed to the stone by X-RAY or the ultrasound (US), and the two methods can be used together.[3]

**The ESWL device consists of**[3,4]

1) Shock wave generator (electric - water, electric - pressure, electric - magnetic and it is the most recent form).
2) Focus System: Directs shock waves centrally and in a consistent manner.
3) A mechanism to compare the transfer of waves from outside the body to the inside to reduce the loss of energy wave when crossing the skin (half balloon filled with distilled water and a silicone membrane).
4) Unit of imaging: to locate the pebble and guide the shock wave and then observe the process of fragmentation (radiosurgery or ultrasound).

**Mechanism of ESWL**[5,6]

1- The shock wave energy is released when it passes between two types of physical circles. Have a different speed of passage in them clearly (such as the solid stone and surrounding fluid such as the urine). This energy causes the fragmentation of the stone circumference.
2- A difference in the structure of the stone parts results in differences in the speed of the passage of the waves of these parts with multiple changes to the pressure caused by these waves, which causes the crumbling of the stone.
3- The rapid and significant change in the positive and negative pressures of the waves, which is the change in temperature with the effect of absorbent is similar to a bubble with a negative pressure rapid formation and disappearance at the circumference of the stone which causing its fragmentation.

For the dissection of the higher ureter stones in ESWL, the patient is placed in the dorsal position. ESWL is an effective means of breaking up urinary stones, where it is effective in breaking up the ureteral stones from 62-90%. Therefore this is the first option to treat high ureteral stones as a non-invasive pathway.

Contraindications of ESWL: Pregnancy, acute and effective urinary tract infection, abdominal aortic aneurysm, irreparable coagulation disorders, patients with cardiac arrhythmias, large spinal deformities, excess obesity, and severe tightness.[7,8]

The importance of research is the presence of a large number of patients with higher ureteral tumors, and serious complications that may occur to patients in the event of delay in treatment, and that the treatment of ESWL is effective and non-invasive compared to surgical treatment.[9] The aim of this study was to study the effectiveness of the treatment of the break-up of ESWL in patients with higher Uterus stones which treated at Tishreen University Hospital in Lattakia between 2016- 2018.

## METHODS AND MATERIALS

The study included 420 patients with high ureter stones who visited Tishreen University Hospital in Lattakia, Syria, from 1/2/2016 to 28/2/2018. And who had a Shaded stones on the rays. Where ESWL were conducted for all patients (from 3 to 3 sessions maximum), the patients were given in each session of 3000-4000 shots and severely 4 joule.

Patients were divided by diameter of the stones into two groups. The first group included patients with pebble diameter between 7-10 mm, the second group included patients with pebble diameter between 11-15m. A clinical story was taken and a clinical examination was conducted for all patients. Cell Blood Count, clotting time, bleeding time, blood clotting, calcium, uric acid, and urine analysis were performed. Take a simple image of the urinary system (KUB) and ultrasound of the urinary system for all patients. The intravenous pyelogram (IVP) is also done when necessary. The shape of the stones was determined by their dispersion results and their shadow over the simple picture, either smooth or irregularly shaped.

The lithotripsy was performed for all patients using Germany 2013 SIEMENS LITHOSKOP, and the most important feature of this device is high-power and low-density waves that achieve higher efficiency and more security. Results of fragmentation were monitored during the dissection session by performing a simple image of the urinary system 5-7 days after the session. And Results were broken down into:

1- Complete response: absence of stone shadow on the KUB carried out after 5-7 days of the first fragmentation session.
2- Incomplete response: Small size of the stone or a change in shape on the KUB performed 5-7 days after the first session and requiring another session.
3- Non-response: Patients who did not respond to fracture and did not have any change in the shape and size of the stone on the KUB after 5-7 days of the first fracture session.

**Statistical analysis**

The SPSS-25 program was used, where the Shapiro Law was used for natural distribution, the T-student law was used for independent samples, and the Chi square test was used for class samples. The statistical significance of P-VALUE was found to be less than 0.05 with 95% confidence.

## RESULTS

The number of patients in the study was 420 patients (315 males and 105 females) and men to women 1/3. Age of Patients was between 19-78 years and their average age was 39.4 years. We found that the most frequent clinical symptoms in patients was pain in most patients and then the hematuria. We found that the diameter of the pebble was between 7-10 mm in most patients. The majority of the stones were smooth (Table 1,2).

**Table 1: The average laboratory results of the study patients.**

| | |
|---|---|
| Leukocyte | 6400 cells |
| Hemoglobin | 13.2 g/dl |
| Protorombin time | 87% |
| Bleeding time | 145 sec |
| Coagulation time | 13 sec |
| Creatinine | 0.9 mg/dl |
| urea | 33 mg/dl |
| Uric acid | 5.8 mg/dl |
| Calcium | 9.1 mg/dl |

**Table 2: Clinical and radiological characteristics of patients with higher ureteral stones.**

| | | |
|---|---|---|
| Total number of patients | 420 | 100% |
| **Clinical symptoms** | | |
| the pain | 412 | %98.09 |
| Hematuria | 335 | %79.76 |
| Associated digestive symptoms | 288 | %68.57 |
| **Diameter of the stones** | | |
| (A) from 0.7-10 mm | 412 | %98.09 |
| (B) of 10-15mm | 335 | %79.76 |
| **The state of the pelvis and ureteral** | | |
| There is no expansion | 16 | % 3.80 |
| Light expansion without ascites | 75 | % 17.85 |
| There is a 1-2 degree ascites | 105 | % 25 |
| There is a 3-4 degree ascites | 20 | % 4.76 |
| There is a DJ croup | 204 | % 48.57 |
| **The shape of the stone** | | |
| Smooth | 230 | % 54.76 |
| harsh | 190 | % 45.23 |

We found that the complete response to fragmentation in the first session in patients with stone diameter ranged from 7-10 mm was in 146 patients (49.49%). While incomplete response was in 101 patients (34.23%), and 43 patients did not respond (14.57%). Patients who did not respond to fragmentation at the first session or had an incomplete response were given a second break-up session. We found that patients who had stone diameter was between 7-10 mm responded to them for fragmentation in the second session fully 88 patients (61.11%), And that 31 patients had an incomplete response (21.52%). Patients who did not respond to fragmentation accounted for 25 patients (17.36%). Patients who did not respond to fragmentation in the second session or incomplete response were subjected to a third fragmentation session, where we found that patients who responded to fragmentation in the third session were 19 patients (23.45%), while patients who did not respond to fragmentation were 62 patients (76.54%) (Table 3).

**Table 3: Response to ESWL processing by session number.**

| | **Session1 (N=420 )** | | **Session2 (N=243 )** | | **Session3 (N=137 )** | | **P-value** |
|---|---|---|---|---|---|---|---|
| Diameter of the stone | 7-10 mm | 11-15mm | 7-10 mm | 11-15mm | 7-10 mm | 11-15mm | |
| Number of patients | 295 | 125 | 144 | 99 | 56 | 81 | |
| | 70.23% | 29.76% | 59.26% | 40.74% | 40.88% | 59.12% | |
| Complete | 147 | 26 | 88 | 18 | 26 | 19 | |
| | 49.49% | 20.80% | 61.11% | 18.18% | 46.42% | 23.45% | 0.01 |
| Incomplete | 103 | 36 | 31 | 25 | | | |
| | 34.23% | 28.80% | 21.52% | 25.25% | | | |
| No response | 45 | 63 | 25 | 56 | 30 | 62 | |
| | 14.57% | 50.40% | 17.36% | 56.56% | 53.57% | 76.54% | 0.008 |

After studying the results of the three fragmentation sessions, We found that patients with stone diameter ranged from 7-10 mm was completely fragmented of The stone in 265 patients out of 295 patients (89.83%). While the stone was not fragmented in 30 patients (10.16%) and P-value was 0.005. Patients with a stone diameter between 10-15 mm were successful fragmentation with 63 patients (50.4%), and failure to break up in 62 patients (49.6%) and P-value was 0.07 (Table 4).

**Table 4: Relationship between diameter of stone and success rate of fragmentation.**

| **Diameter of stone** | **Success** | | **Failed** | | **P-value** |
|---|---|---|---|---|---|
| | **number** | **%** | **number** | **%** | |
| 7-10 mm | 265 | % 89.83 | 30 | %10.16 | 0.005 |
| 11-15 mm | 63 | % 50.4 | 62 | % 49.6 | 0.07 |

## DISCUSSION

Technological advances in medical treatment have led to numerous treatment methods for ureteral stones, Such as ESWL and intravenous urinary therapy. And Remediation of ESWL still achieves a cure rate of 79-82%.[10] ESWL is a very effective treatment for urinary stones. And the choice of the best treatment method for each patient is a dialectical point of Urology.[11] The size of the remaining parts of the stone after fragmentation as well as the time of fragmentation is also a point of contrast between the studies. The main part of the stone is an insignificant residual part of a size smaller than 3 mm after 3 months of intervention. However, recent studies have shown that fragments up to 4 mm in diameter, which are considered clinically insignificant, caused 44% of the related complications after follow-up during the first year following the end of ESWL sessions.[12] Most previous studies have used the Clavien-Dindo scale for surgical complications and comparison of therapeutic alternatives.[13] There are imaging techniques that make it possible to accurately measure the focal length, intensity and size of the stone. These three factors are inversely related to the fragmentation of kidney stones. If the distance between the skin and the pebble is large (> 10 cm), the effectiveness of ESWL decreases. In such cases, direct urinary techniques may be the best choice. Some authors have shown that through ESWL can be obtained similar or even better results from techniques within the other urinary tract.[14,15] ESWL technology must be implemented by a specialist, Where it or it achieves optimal control over the key things that determine the success rate of the technology.

It is necessary to properly manage energy application to break down kidney stones, And The placement of the patient and monitoring the location of the hard stone of the renal tissue by radiological ultrasound, also, As well as the correct management of anal drugs to reduce the movement of the bowel of the patient. Increasing the energy used in this method is an important method in the effectiveness of this technique.[16,17] ESWL plays an important role in the treatment of kidney stones in the urinary tract. When selected as a treatment method, the selection of appropriate technical factors for this patient will be highly effective in fragmenting the stones.[18,19]

## CONCLUSION

The success rate of fragmentation after the first session in patients with pebble diameter up to 1 cm was 49.49%, and after three sessions it reached 89.83%. While the success rate of fragmentation after the first session in patients with pebble diameter of 1-1.5 cm was 20.8%, and after three sessions it reached 50.4%. We found that all patients with stones in the upper ureter, the stones was broken in 328 patients with a success rate of 78.09%.

We could said that ESWL is a successful, effective and safe option to treat higher ureteral stones.

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