ABSTRACT

Aim of the study: To assess the efficacy of emergancy extracorporeal shockwave lithotripsy (ESWL) in treatment of ureteric calculi during first 24hours of uretric colic .

Patient and Methods:60 patients (45) male & (15) female ,median age (37.5 yrs.) Range (12-60 yrs.) admitted in the emergancy department of AL- Imamain AL-Kadhimiain Medical city from January 2013 to June 2014 .presented with acute uretric colic due to uretric stone treated by ESWL within first 24 hours from the onset of colicWere enrolled in this study.

Results: 60 patients were enrolled in this study with median age (37.5 years) Range from (12-60 years). Male 45 patients (75%)/ female 15patients (25%) .and Right side stone in (28) patients(46.6%) and Left side (32) patients(53.4%) . Mean stone size was 9.15 mm Range from (6-20 mm). They were located in the Upperureter(n =40)(66.6%)(≤10 mm= 27 (67.5%),>10 mm=13 (32.5%) and lower ureter(n = 20) (33.4%). (≤10 mm=10 (50%), >10 mm=10 (50%).

Fragmentation after Three sessions of ESWL was succesfull in(47) patients(78.3%). in the Upper ureter(35)patients(87.5%). of them(≤10 mm= 25 (71.43 %) and (>10 mm=10 (28.57%),and failed in (5) patients (12.5 %).of them (≤10 mm=2 (40%),>10 mm=3 (60%). and lower ureterwassuccesful in12 (60%)patients,of them (≤10 mm=7 (58.33 %) and(>10 mm=5 (41.67%).and failed in(8) patients (40%) , of them(≤10 mm=3 (37.5%)and>10 mm=5 (62.5%).Of those13 patients (21.7%), in whom ESWL had no impact on the stone(failed).8 underwent ureteroscopy, spontaneous passage occurred in 5 patients 4of them in lower ureter.

Conclusion: Emergency ESWL in first 24hours from the onset of colic for treatment of ureteric stone has a satisfactory success free rate and very low morbidity. The stone-free rate and fragmentation of ureteral calculi with ESWL decreases significantly after failed initial treatment. Stone size may be the main predictive factor for retreatment. We suggest that no more than 3 treatments should be given for a particular stone due to minimal improvement in the subsequent cumulative treatment success rate.

INTRODUCTION

Definition of ESWL:

Technique that use high pressure waves (sound waves create outside the body) that can focused on a very small area there by fragment solid object such such as kidney stone,gall stone,etc.. the small fragment can pass more easily and harmlessly.

History of ESWL:

Engineers at Dornier Medical Systems in West Germany, during research on the effects of shockwaves on military hardware, demonstrated that these shockwaves are reflectable and therefore focusable. The possibility of applying shockwave energy to human tissue was discovered when, by chance, a test engineer touched a target body at the very moment of impact of ahigh-velocity projectile. The engineer felt a sensation similar to an electric shock, although the contact point at theskin showed no damage at all (Hepp, 1984). This observation and its potential military applications led Dornier to pursue a method of generating a reproducible shockwave.Beginning in 1969 and funded by the German Ministry of Defense, Dornier began a study of the effects of shockwaves on tissue. Specifically, the study was to determine if the shockwaves generated by a projectile striking the wall of a military tank would damage the lungs of a crew member leaning against the same wall.During the study, Dornier engineers developed techniques to reproducibly generate shockwaves. 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.At some point a possible medical application of shockwaves became apparent: if shockwaves could safely pass through tissue but fragment brittle materials, perhaps they could be used to breakup kidney stones. Dornier engineers found that lower-energy shockwaves, which would be appropriate for medical applications,could be generated in a predictable and reproducible manner byan underwater electrical spark discharge.In 1972, on the basis of preliminary studies performed byDornier Medical Systems, an agreement was reached with EgbertSchmiedt, 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 culminatingin February 1980 with the first treatment of a human byESWL. The production and distribution of the Dornier HM3 lithotripter began in late 1983, and ESWL was approved by the U.S. Food&Drug Administration in 1984. Since Dornier's pioneering work, numerous other companies have demonstrated that shockwaves capable of stone fragmentation may be generated by electromagnetic induction, microexplosions, focused lasers, andpiezoelectric crystals. To date, more than 3000 lithotripters of alltypes have been placed worldwide.

Urinary lithiasis can cause a greater or lesser degree of obstruction , depending on the size of the calculus, urothelial edema and the degree of impaction, requiring instrumental treatment, sometimes as an urgent procedure. Optimal treatment for ureteral calculi remains controversial. Treatment options vary and include expectant management, passage of ureteral stent, extracorporeal shockwave lithotripsy (ESWL), ureteroscopy with basket extraction or intracorporeal lithotripsy and open ureterolithotomy. Open surgery is rarely used[(1)]. However, a conservative approach is often complicated by recurrent flank pain, multiple visits to the emergency room (ER), absence from work and an increased risk of serious complications, such as obstruction, infection and silent loss of renal function[(2)]. There is a significant risk of long-term renal impairment if patients have unrelieved obstruction for more than 4 weeks regardless of symptoms and stone size[(2)]. ESWL is the treatment of choice for moderately sized, uncomplicated ureteric stones[(3,4)]. It is a simple, robust and safe procedure and is usually recommended for stones resistant to medical treatment in absence of absolute indication of ureteral drainage [(5)]. Interestingly, the role of ESWL as a first line therapy, applied rapidly after the onset of renal colic, has deserved very limited attention. Few studies have suggested that emergency ESWL is an appealing treatment strategy for symptomatic ureteral stones[(6-9)]. The success rate of ESWL in the treatment of ureteral stones is about 80%[(2]). It can be successfully used, without anesthesia, in patients with early recurrence of renal colic[(6]). Others have used ESWL within 14 days of the onset of acute renal colic but under anesthesia[10].Or even during acute renal colic [7] or acute renal failure[11]. Moreover, a comparative retrospective analysis has shown that, in emergency situations, ESWL is more effective than nephrostomy or a double J stent and has very low morbidity[12].

Physics of Shock Waves

The shock wave represents a short duration(<10 m s) acoustic pressure wave consisting of acompressive phase (peak pressure 30–100 MPa)followed by a tensile phase (negative pressure).From the pressure form, physical parameters canbe calculated such as acoustic energy and energyflux density (Chaussy et al. 1980)[11].. Effective energy(E eff) contributes to fragmentation except for theportion not hitting the calculus. At present, thereis a debate on the fragmentation process and thetissue injury process, and no clear metric indicateshow well a stone will break, respectively howmuch damage surrounding tissue will suffer.

Table (1)

Mechanisms of Stone Fragmentation

Hypothesis	Mechanism	Prerequisites	Type of action	Comments
Tear and shear forces (Chaussy et al. 1980	Pressure gradients due to impedance changes at stonefront&distal surfacewith pressure inversion	Shock wave smaller in spaceextension than stone	Hammer-like action Resulting to a crater-likefragmentation at both endsof stone	Only relevant for small focus
Spallation (Rassweiler et al. 2010	Re flected tensile wave at distal surface of with	Shock wave smaller in space extension than stone	Breaking of stone from inside like freezing of water in brittle material	Only relevant for small focus No explanation for stone breakage at front side
Quasi-static squeezing (Lokhandwalla and Sturtevant 2000	Pressure gradient between circumferential and longitudinal waves result to squeezing of stone	Shock wave is broader than the stone SW velocity is lower in water than in stone	Nutcracker-like action requiring large focal diameters	Only relevant for large focal zone
Cavitation (Rassweiler et al. 2011	Negative pressure waves induce collapsing cavitation bubble at stone surface	Low viscosity of surrounding medium	Microexplosive erosion at proximal and distal end of stone	More important during stone comminution Useful to improve ef fi ciency of shock waves (i.e. EHL)
Dynamic Squeezing (Zhong et al. 1999	Shear wave initiated at the corner of stone are reinforced by squeezing waves along the calculus	Parallel travelling of longitudinal waves SW velocity is lower in water than in stone	Nutcracker-like action in combination with spalling	Best theory to explain results of numerical model

Technical Aspects

All lithotripsy machines share 4 basic components: (1) a shockwave generator, (2) a focusing system, (3) a coupling mechanism, and (4) an imaging/localization unit.

Shockwave generator

Shockwaves can be generated in 1 of 3 ways, as follows:

Electrohydraulic: The original method of shockwave generation (used in the Dornier HM3) was electrohydraulic, meaning that the shockwave is produced via spark-gap technology. In an electrohydraulic generator, a high-voltage electrical current15000 to 25000Volts lasting one second passes across a spark-gap electrode located within a water-filled container. The discharge of energy produces a vaporization bubble, which expands and immediately collapses, thus generating a high-energy pressure wave.

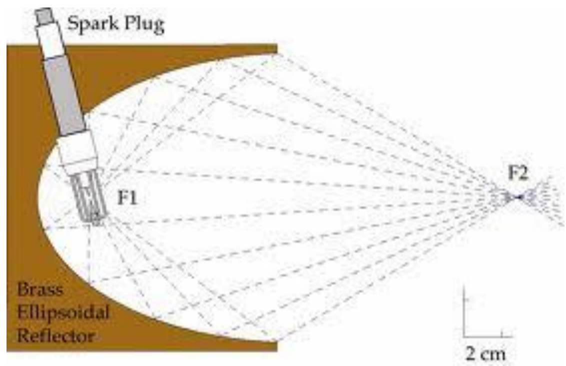
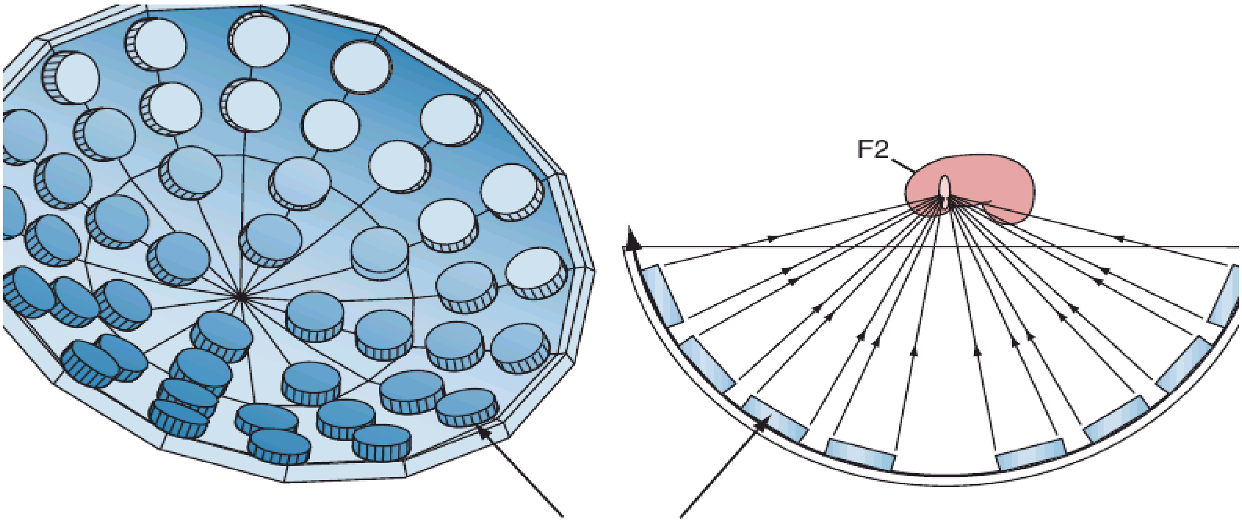


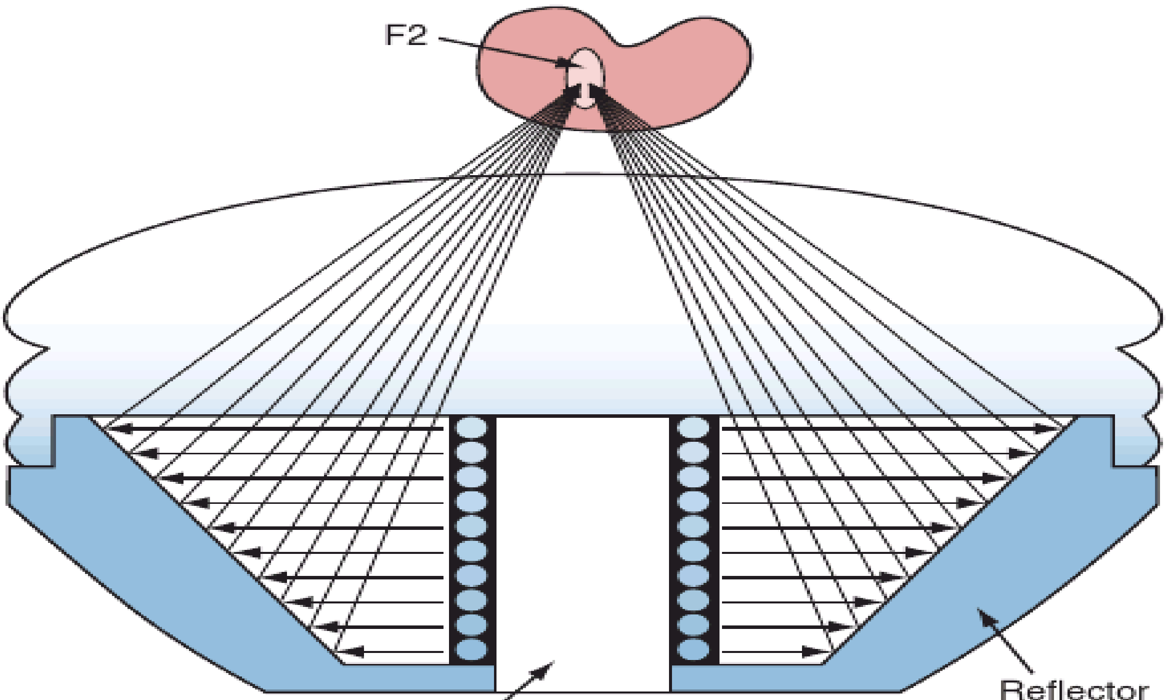
Figure (1)

Piezoelectric: The piezoelectric effect produces electricity via application of mechanical stress. The Curie brothers first demonstrated this in 1880. The following year, Gabriel Lippman theorized the reversibility of this effect, which was later confirmed by the Curie brothers. The piezoelectric generator takes advantage of this effect. Piezoelectric ceramics or crystals, set in a water-filled container, are stimulated via high-frequency electrical pulses. The alternating stress/strain changes in the material create ultrasonic vibrations, resulting in the production of a shockwave.



Figure(2)

Electromagnetic: In an electromagnetic generator (as seen below), a high voltage is applied to an electromagnetic coil, similar to the effect in a stereo loudspeaker. This coil, either directly or via a secondary coil, induces high-frequency vibration in an adjacent metallic membrane. This vibration is then transferred to a wave-propagating medium (ie, water) to produce shockwaves.



Figure(3)

Focusing systems

The focusing system is used to direct the generator-produced shockwaves at a focal volume in a synchronous fashion. The basic geometric principle used in most lithotriptors is that of an ellipse. Shockwaves are created at one focal point (F1) and converge at the second focal point (F2). The target zone, or blast path, is the 3-dimensional area at F2, where the shockwaves are concentrated and fragmentation occurs.Focusing systems differ, depending on the shockwave generator used. Electrohydraulic systems used the principle of the ellipse; a metal ellipsoid directs the energy created from the spark-gap electrode. In piezoelectric systems, ceramic crystals arranged within a hemispherical dish direct the produced energy toward a focal point. In electromagnetic systems, the shockwaves are focused with either an acoustic lens (Siemens system) or a cylindrical reflector (Storz system).

Coupling mechanisms

In the propagation and transmission of a wave, energy is lost at interfaces with differing densities. As such, a coupling system is needed to minimize the dissipation of energy of a shockwave as it traverses the skin surface. The usual medium used is water, as this has a density similar to that of soft tissue and is readily available. In first-generation lithotriptors (Dornier HM3), the patient was placed in a water bath. However, with second- and third-generation lithotriptors, small water-filled drums or cushions with a silicone membrane are used instead of large water baths to provide air-free contact with the patient's skin. This innovation facilitates the treatment of calculi in the kidney or the ureter, often with less anesthesia than that required with the first-generation devices.

Localization systems

Imaging systems are used to localize the stone and to direct the shockwaves onto the calculus, as well as to track the progress of treatment and to make alterations as the stone fragments. The 2 methods commonly used to localize stones include fluoroscopy and ultrasonography.

Fluoroscopy: which is familiar to most urologists, involves ionizing radiation to visualize calculi. As such, fluoroscopy is excellent for detecting and tracking calcified and otherwise radio-opaque stones, both in the kidney and the ureter. Conversely, it is usually poor for localizing radiolucent stones (eg, uric acid stones). To compensate for this shortcoming, intravenous contrast can be introduced or (more commonly) cannulation of the ureter with a catheter and retrograde instillation of contrast (ie retrograde pyelography) can be performed.

Ultrasonographiclocalization:whichallows for visualization of both radiopaque and radiolucent renal stones and the real-time monitoring of lithotripsy. Most second-generation lithotriptors can use this imaging modality, which is much less expensive to use than radiographic systems. Although ultrasonography has the advantage of preventing exposure to ionizing radiation, it is technically limited by its ability to visualize ureteral calculi, typically due to interposed air-filled intestinal loops. In particular, smaller stones may be difficult to localize accurately

AbsoluteContraindications

- Bleeding diathesis including anticoagulation
- Pregnancy
- Distal obstruction
- Active infection.
- Aortic enurysm
- Obesity (BMI)>40

Complications

- Haematuria– common
- Incomplete fragmentation of stone
- Renal colic
- Steinstrasse

PATIENTS AND METHODS

60 patients (45) male & (15) female ,median age (37.5 yrs.) Range (12-60 yrs.) admitted to emergancy department of AL- Imamain AL-Kadhimiain Medical city from January 2013 to June 2014 .presented with acute uretric colic due to uretric stone treated by ESWL within first 24 hours from the onset of colic Were enrolled in this study.Admission work-up included: monitoring of vital parameters; temperature; physical examination; blood test for leucocytes, urea, creatinine; urine analysis and culture.. Primary imaging of the patient was performed by helical unenhanced computed tomography of the abdomen, according to current recommendations (13). Initial characterization of the stone was based on imaging.and included stone size and stone location .

Patients underwent emergency ESWL using the (Lithoskop,siemens CO, Germany) within 24 hr of admission and the calculi were localized with fluoroscopic guidance. All patients were given analgesia and the level of shockwave energy was progressively stepped up until satisfactory stone fragmentation within the limits of patient comfort.

Patients for whom the therapeutic modality is contraindicated because of pregnancy, urinary tract infection, coagulation disorders or previous uretericreimplantation, presence of a perirenalurinoma, temperature > 38 C, blood leukocytes > 20,000/dL, solitarykidney, radiolucent stones, or prior history of ureteric stricture or tumor were excluded from the study. stone located in the renal pelvis or the pyelo-ureteral junction, or if there was any contraindication to ESWL were also excluded.

After defining the indications of treatment, the patients were informed of all the treatment modalities and their probable complications. The need for anesthesia, stent, uretral manipulation, possible complications, need for repeated follow-up especially after ESWL, and the cost factor involved, were explained to the patients.and informed consent was taken from the patient and next of kin.

Upperuretric(above iliac crest), and lower ureteric(below iliac crest) stones were fragmented with the patient in the supine position(over under table) mean the patient fixed and the energy source movable, this is aspecial characteristicfor 4th generation lithoskopunlike other generation we put patient in prone position in lower uretric stone. Follow-up during three months comprised evaluation of pain, temperature and fragment elimination, and radiological check-ups (abdominal X-ray and/or ultrasound) but the final assessment after three month byhelical unenhanced computed tomography. Interventional procedures (double J stent ± ureteroscopy) were performed within 48-72 hours only in cases of worsening symptoms and impossibility to manage patients medically, appearance of fever or modification in laboratory findings. and these cases was excluded from the study.

- Results were compared by the Chi-square test.
- A 0.05 significance level was used.
- A mean efficiency quotient (EQ) of lithoskope was calculated according tothe formula of Denstedt and co-workers (14):

Stone free (%) X 100/ (100 + retreatment rate (%) + rate of auxiliary procedures (%)).

RESULTS

A total of 60 patients 45 patients Male (75%)/ 15 patients female (25%) ,The mean age of the patients was 37.5 years (12-60 years). Overall, (44 patients) were treated as outpatients and (16 patients) were kept in hospital overnight. All the stones were radiopaque. Their mean size was 9.15 mm (6-20mm). A total of 60 patients required 150 sessions of lithotripsy by(Lithoskop,Siemens) The mean number of sessions per patient was 2.5 (1-3) and with interval every two days between each session and other with average number of(3500-4000) shock waves at frequency (90-120 sw/minute)and voltage of (10-20 kV) and energy(4-8J/impulse) . The procedure was completed successfully in 60 patients. After ESWL treatment, pain resolved in 40 patients (66.6%), persisted in 12 patients (20%), and required administration of supplementary anti-inflammatory agents or opioids in 8 patients (13.4%). Fragmentation after Three sessions of ESWL was succesfulin(47) patients (78.3%).They were located in Upper ureter(n =40)(66.6%)(≤10 mm= 27 (67.5%),>10 mm=13 (32.5%),with Fragmentation rate after Three sessions of ESWL was succesful in(35patients)(87.5%). of them(≤10 mm= 25 (71.43 %) and (>10 mm=10 (28.57%) ,and failed in (5 patients)(12.5 %).of them (≤10 mm=2 (40%),>10 mm=3 (60%). Andlower ureter(n = 20) (33.4%) (≤10 mm=10 (50%), >10 mm=10 (50%) .withFragmentation rate after Three sessions of ESWL was succes in 12 (60%)patients. of them (≤10 mm=7 (58.33 %) and(>10 mm= 5 (41.67%).and failed in(8 patients (40%). of them(≤10 mm=3 (37.5%)and>10 mm=5 (62.5%).

Of those 13 patients (21.7%), in whom ESWL had no impact on the stone(failed) .8 underwent ureteroscopy, spontaneous passage occurred in 5 patients 4 of them in lower ureter.Distribution of fragmentation according to site and size in relasion to ESWL sessionsillusterated in table.(2),(3).and figure (4),(5).

Table (2)

Distribution of stone fragmentation according to size and number of ESWL sessions in upper ureter

No.ofESWL sessions	No. of stone fragmented	No. of stone ≤10 mm	No. of stone >10 mm
1st Session (40)	20 (50 %)	15 (75 %)	5 (25%)
2nd Session (20)	10 (50 %)	6 (60 %)	4 (40%)
3rd Session (10)	5 (50%)	4 (80%)	1 (20 %)

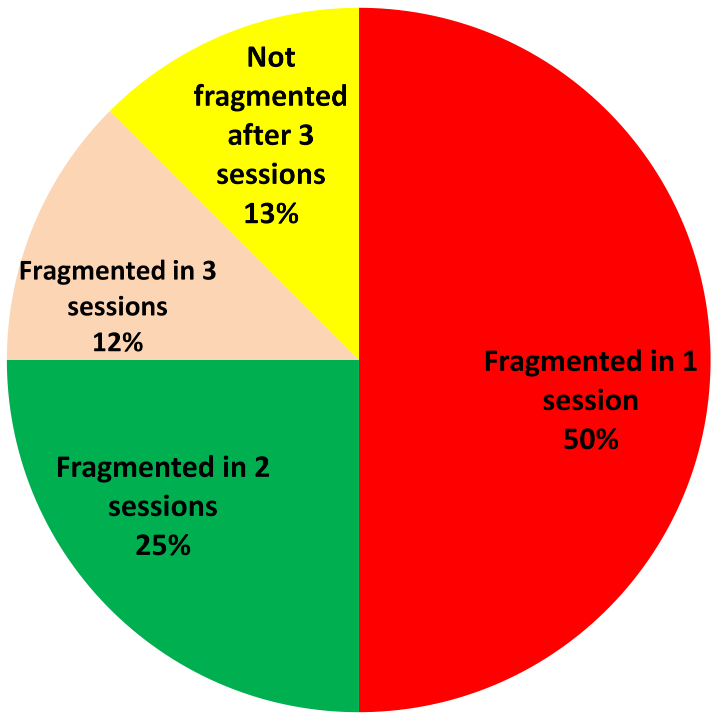


Figure (4): Percentage of stone fragmentation in upper ureter in relation to ESWL sessions

Table(3)

Distribution of stone fragmentation according to size and no. of ESWL sessions in lower ureter

No. of ESWL session	No. of stone fragmented	No.ofstone ≤10 mm	No. of stone >10 mm
1st Session (20)	5 (25%)	3 (60%)	2 (40%)
2nd Session (15)	4 (26.6%)	2 (50%)	2 (50%)
3rd Session (11)	3 (27.2%)	2 (66.67%)	1 (33.33%)

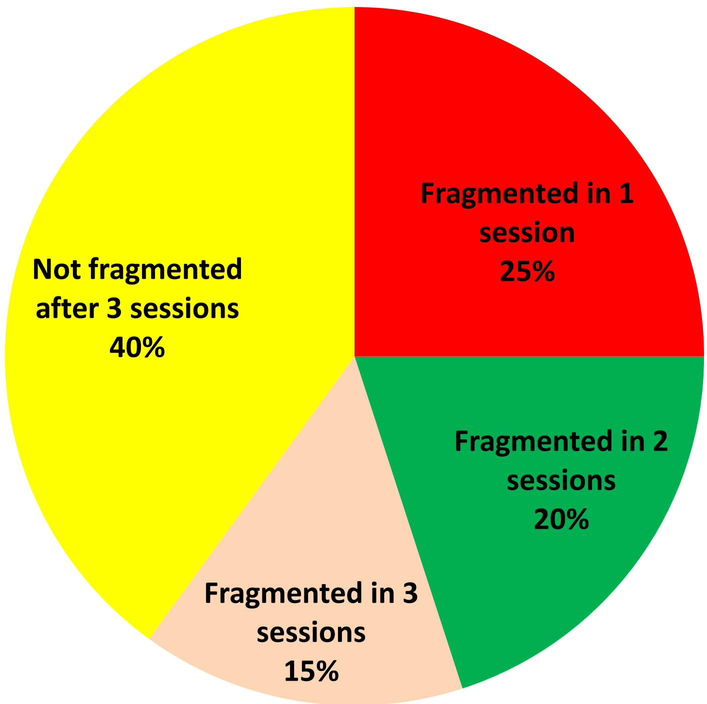


Figure (5): Percentage of stone fragmentation in lower ureter in relation to ESWL sessions

Table(4)
Distribution of success and failure in stone fragmentation according to size and no. of ESWL sessions in upper ureter

	No. of stone fragmented	No. of stone ≤10 mm	No. of stone >10 mm	P value*
No. of patient with successful fragmentation after 3 session	35 (87.5%)	25 (71.43 %)	10 (28.57%)	0.3065
No. of patient with failure fragmentation after 3 sessions	5 (12.5 %)	2 (40%)	3 (60%)	
TOTAL NO.	40	27 (67.5%)	13 (32.5%)	

* Fischer exact test

Table(5)
Distribution of success and failure in stone fragmentation according to size and no. of ESWL sessions in lower ureter

		No. of stone ≤10 mm	No. of stone >10 mm	P value*
No. of patient with successful fragmentation after 3 session	12 (60%)	7 (58.33 %)	5 (41.67%)	0.6499
No. of patient with failure fragmentation after 3 sessions	8 (40%)	3 (37.5%)	5 (62.5%)	
TOTAL NO.	20	10 (50%)	10 (50%)	

* Fischer exact test

Table(6)

Distribution of stone fragmentation in stone size ≤ 10 mm and no. of ESWL sessions in upper and lower ureter

No. of ESWL sessions	No. of stone fragmented	Upper ureter	lower ureter
1st Session	18 (56.25 %)	15 (83.33 %)	3 (16.67%)
2nd Session	8 (25 %)	6 (75%)	2 (25%)
3rd Session	6 (18.75%)	4 (66.67%)	2 (33.33%)
Total	32 (100%)	25 (78.12%)	7(21.88%)

P value = 0.6729

Table(7)

Distribution of stone fragmentation in stone size > 10 mm and no. of ESWL sessions in upper and lower ureter

No.ofESWL sessions	No. of stone fragmented	Upper ureter	lower ureter
1st Session	7 (46.67%)	5 (71.43%)	2 (28.57%)
2nd Session	6 (40 %)	4 (66.67%)	2 (33.33%)
3rd Session	2 (13.33%)	1 (50.0 %)	1 (50.0%)
Total	15 (100%)	10 (66.7%)	5 (33.3%)

P value =0.8515

The stone-free success rate for ESWL (fragmentation + elimination) was 47 patient(78.3%) of them (35case/40 (87.5%) in upper ureter and 12case/20(60%) in lower ureter as showing in Table(3,4)and figure (6).and sequence of passage is 38 % (n = 18) on day 2, 51% (n = 24) on day 15, 87% (n = 41) on day 30, and 100% (n = 47) on day 90.

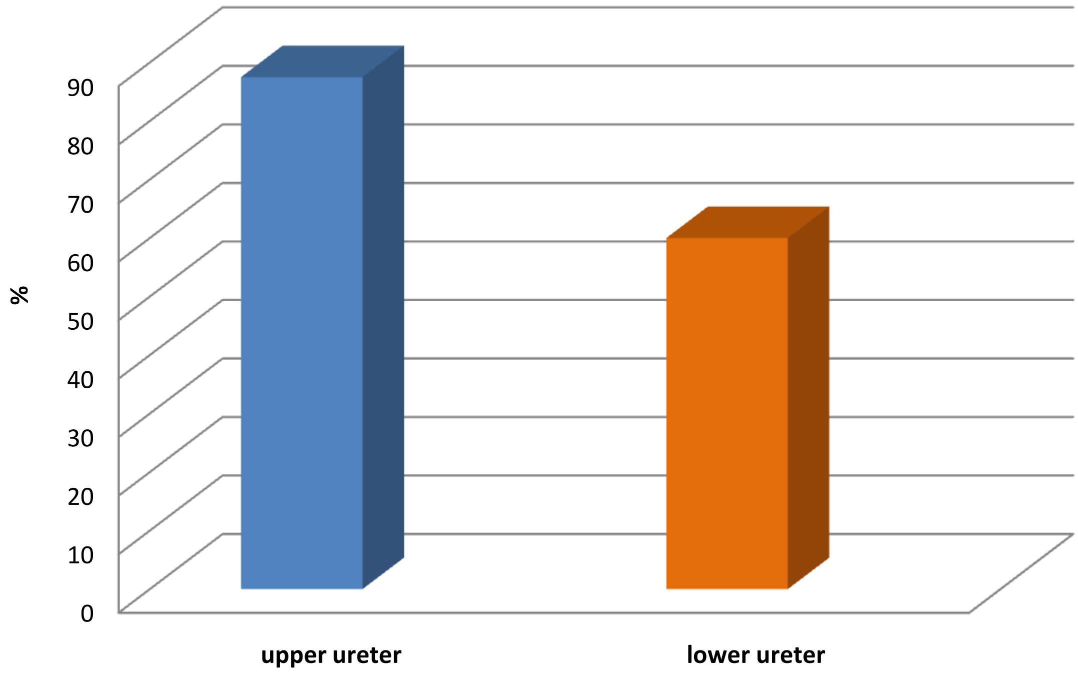


Figure (6): percentage of stone free rate after three months in upper and lower ureter

both location and size were considered prognostic factors. Group analysis were performed by combining stone location (uppervs. lower) ureter. and size (**≤ 10 mm and> 10 mm**). The amplitude of the benefit, however, was more stringent for stones located **proximally and with a size≤ 10 mm**.Median and average hospital stay were 2.0 and 2.4 days. This effect depended on the rate of fragmentation after the first session as well as the size and location of the stone.

Discussion

In the last 20 years, the development and constant improvement of minimally invasive techniques such as ureteroscopy with in situ lithotripsy or laser fragmentation and ESWL has prompted urologists toward a more aggressive attitude. Although observation is still recommended for stones measuring less than 4 mm in diameter, most international guidelines today recommend active removal of all stones exceeding 5-7 mm, when proven that they have resisted medical therapy (9). The spontaneous rate of elimination of the stones depends on the stone size and position in the ureter (2). In a recent prospective study using unenhanced helical CT, Coll et al. have demonstrated that the spontaneous passage rate for stones ranged from 87% to 25% according to the size of stones (1 mm in diameter to more than 9 mm) [(15)]. In the same series, spontaneous passage rate was also dependent on stone location (48% for stones in the proximalureter, 60% for mid ureteral stones, 75% for distal stones, and 79% for ureterovesical junction stones). In addition to size and location, there are also other interfering factors such as obesity, level of renal obstruction and type of medical therapy[(16)].

In our study, most of the stones and fragments that passed spontaneously were 7 mm or less and located in the lower ureter like other studies and support our opinion about intervention in larger size stone . Active removal is also strongly indicated in patient with persistent pain despite adequate medical treatment, acute obstruction with impaired renal function or solitary functional kidney, urinary tract infection, risk or suspicion of urosepsis[(2,17)]. In cases where removal of ureteral stone is warranted, the main debate centers currently around the choice of ESWL or endoscopic management combined with laser or mechanical fragmentation [(4,18,19)].

Traditionally, the imaging study used for evaluating patients presenting with ureteral colic believed secondary to an acute episode was IVU. Although the examination was often diagnostic, limitations included inability to obtain proper bowel preparation to aid in imaging because of the acute nature of the study, risk of allergy to contrast agents, potential nephrotoxicity, need to assess renal function before contrast injection, inability of conventional radiography to visualize some stones (e.g., uric acid), and the time-consuming nature of the study. Though renal ultrasonography is sometimes useful in detecting the presence of hydronephrosis secondary to an obstructing ureteral stone, the evaluation is very operator dependent. Furthermore, the study is unable to accurately measure the size of the stone and locate ureteral stones in many instances. Computer tomography (CT) scan is able to address many of these issues and, with the introduction of spiral CT, nonenhanced studies are rapidly becoming the standard means of evaluating patients presenting to emergency departments with acute flank pain [13].

In institutions equipped with ESWL the question arises whether applying ESWL shortly after the onset of renal colic could help resolving this issue. Interestingly enough, although ESWL is widely considered as one of the treatments of choice of ureteral stones, its use as an immediate therapeutic tool in an ER setting has not yet deserved much attention.

To our knowledge, only reports by Gonzalez Enguita et al. [8], Doublet et al. [6], Tligui et al. [7], and Tombal et al. [9] have addressed its potential interest.

Tligui et al. reported in 2003 their experience of 200 patients suffering from acute renal colic and treated with emergency ESWL (EDAP LT-02) within 24 h. Stone-free rate ranged from 79% to 83% according to the location of the stone, and from 75% to 86% according to the size of the stone. Two or three ESWL sessions were required in 79 patients. The 36 patients, in whom ESWL failed, underwent ureteroscopy (n = 23) or lithotripsy with a Dornier® machine (n = 13). Based on this observation, they advocated a more widespread use of the technique based on a high stone free rates after three months and a low morbidity. These are consistent with our findings. The study however was not randomized. We could not do a randomization of our patients in order to collect a representative number of patients to undergo statistical workup.

Tombal et al. in 2005 reported the results of the first randomized trial addressing the role of emergency ESWL in 100 patients requiring hospitalization for the management of renal colic [9]. These authors have prospectively compared standard medical treatment with NSAID and antispasmodic to medical treatment plus emergency ESWL, performed without analgesia on a Siemens Lithostar lithotripter (Siemens Medical Systems, AG, Munich, Germany) within 6 h. following admission to the ER. On average, this study showed that ESWL increased the proportion of patients stone-free (SF) after 48 hours (SF-48) by 13% while it increased the median duration of hospitalization by one day. Emergency ESWL increased both SF-48 and proportion of patients discharged from the hospital at 72 hours by respectively 40% and 25% when the stone was located proximally and > 5 mm, and they advocated that it should be strongly recommended in these cases. In contrast, when the stone is located distally from the crossing of the iliac artery, ESWL only slightly increased stone free rate by 5% while decreasing the proportion of

patients released from hospitalization at 48 h and 72 h. Their study demonstrated that emergency ESWL is a valuable therapeutic option to improve elimination of ureteral stones and shorten duration of hospital stay, when proven that the stone is located proximally to the iliac vessels.
A better outcome of ESWL has been reported for kidney stones compared to ureter stones, others could not demonstrate such differences [20,21].
Pace et al. investigated a large number of ESWL cases and demonstrated a superior success rate for upper and mid ureter stones compared to distal calculi [22]. The AUA meta-analysis revealed best stone clearance for small stones < 10 mm, with 74% compared to 46% for stones between 11-20 mm [2]. For complete stone disintegration, many patients have to undergo 2 or more shockwave sessions [2]. There isno reported consensus on the number of shock wave lithotripsy treatments for ureteral calculi that should be administered for a single stone before alternate modalities are used. Pace et al. [22] have reported a low success rate of repeated shock wave lithotripsy for ureteral stones after failed initial treatment.
Kim et al. suggested that no more than 3 treatments should be given for a particular stone due to minimal improvement in the subsequent cumulative treatment success rate [23].

In a series of 1588 patients they had treated 1593 ureteral calculi with the Dornier MFL 5000 lithotripter (Dornier Medical Systems Inc., Kennesaw, GA) over a period from January 1994 to September 1999 [22]. The stone free rate after initial treatment was 68% (1086 of 1593 stones), which decreased to 46% for first re-treatment and 31% for second re-treatment. Overall the success rate increased to 77% after 3 treatments compared with 76% after two treatments. Upper and mid ureter stone free rates were significantly higher than those in the lower ureter after initial treatment. Success rate was also greater for smaller stones (10 mm or less versus 11 to 20 mm was 74% versus 43% (p < 0:001).

In our series, patients with no fragmentation after the initial treatment were offered anthor sessions of ESWL and the majority of them were stone free by 3 months. We found that the stone free rate was higher for upper uretric stone(**87.5%),**than lower ureter(**60%**).
As showing in fiqure (6).And stones ≤10mm(upper ureter=**(78.12%),**lower ureter(**21.88%**).andforstones>10mm(upper ureter=**(66.7%),**lowerureter**(33.3%).**as in table (5,6)
Although the difference was not stasticaly significant(**P value = 0.6729**)for stones ≤10mm present in upper ureter and for stones ≤10mm present in lower ureter but the stone sucsses free rate is more for upper ureter and for stone ≤10mm.

With the widespread use of ESWL, fewer stones are being analyzed because of difficulties in collecting stone samples. We were able to analyze stones from 12 patients and calcium oxalate stones were the most common type.
More commonly, hospitalization is required to manage intractable pain resistant to oral or intra-rectal therapy. While the main goal of therapy should then still be oriented toward fast pain relief and safe stone removal, it is also critical to achieve rapid discharge from the hospital.

We compared the success rate of initial shock wave lithotripsy for ureteral calculi with that of subsequent treatments to determine whether more than 1 treatment is justified for any single ureteral stone. In this respect our results are in agreement with other reported series .our patients responded to repeat sessions after the initial treatment. But in declining responsedepanding on stone location and size as showing in figure (4,5) .and table(2,3)

In our series the majority of the patients had treatments as an outpatient procedure and inpatient procedure resevedmainly for 'social' reasons, i.e. ,difficulty in transport, lack of follow-up, health care facility and less commonly for complications. And also for those who needed intravenous opioid and antibiotic treatment.

Inpatient stay.Ureteral pre-stenting is only necessary for patients with persistent pain, fever or renal insufficiency due to obstruction. Some authors reported a decreased stone free rate after introduction of an indwelling stent, most probably due to problems in stone detection and interference with the shock waves [4,22]. Especially with older lithotripters, focusing on ureter stones was difficult. For this reason pre-stenting was not part of our treatment. If practical, in situ shockwave lithotripsy in acute obstructive ureteric lithiasis seems to be advantageous compared to later shockwave application in the non-obstructive phase 28.Arrabal-Martın et al. recently demonstrated, that in situ ESWL for both obstructive and non-obstructive lumbar ureter stones reached 95.5% and 93.15% stone free rate respectively [4].

As kidney stones were thought to show a better response to ESWL, push-back manipulation into the kidney was recommended for proximal ureter stones. We do not recommend this as with improved lithotripsy and stone detection technology, this procedure is now considered being out-dated. Some investigators [21] have reported a better outcome of ESWL after stone manipulation, while others [20] have not found a statistical difference. However it can prove difficult to manipulate an impacted stone, and the possibility of post-treatment obstruction by a large fragment in an edematous ureter remains. This risk can be minimized by stent placement at the time of stone manipulation. Advances in ureteroscopic technology with the introduction of small caliber semi-rigid and flexible ureteroscopes combined with the introduction of the holmium YAG laser have improved stone free rates following ureteroscopy while decreasing the risk of complications [24,25].

Success rates for shock wave lithotripsy may differ according to the lithotripter used. Average stone-free rate for cumulative shock wave lithotripsy series reported in the literature using an HM3 lithotripter is slightly but consistently higher than that achieved with many second and third generation lithotripters and may influence the choice of treatment [26]. It is important to stress that the results with shock wave lithotripsy are truly machine specific and cannot be translated to use with other lithotripters [19]. The LithoskopeSiemens Lithotripter that we use proved in different series to be very effective in the treatment of renal and ureteral calculi [14].

Conclusion

- Rapidly performed ESWL is a valuable therapeutic option to improve elimination of ureteral stones. We agree with the other authors that it could be more widespread in acute uretric colic. .It has medical advantages.i.e. no need for prolonged anti-inflammatory treatment,.and also economic advantages.i.e. no need for anesthesia and routine hospitalization with fewer absences from work.

- It requires appropriate endourological facilitiesfor emergency use and a follow-up period of up to three months. Ultimately, the chosen treatment option (medical treatment, ESWL, or ureteroscopy) is a matter of a joint decision between the physician and the informed patient.

- SFR. and fragmentation ismore in proximal ureter and for stone ≤ 10 mm.

- stoneSusceptibility for fragmentationin subsequent sessions will decline if the stone was not completely fragmented initially.

Recommendation

We recommend to use ESWL as a safe and effective procedure to treat uretric stone during first 24 hours from the onset of uretriccolic ,specially for upper uretric stone ,And it issize≤10mm.

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