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Original Research Article

Efficacy and Safety of Ultrasound Guided Extracorporeal Shock Wave Lithotripsy (SONO ESWL) In Patients with Radiopaque Renal Stone

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Abstract

To assess the advantages and disadvantages of using ultrasound to guide ESWL in patients with radiopaque renal stone. This study included 80 patients with radiopaque renal stone who visited the ESWL unit in urology department at Hillah teaching hospital. Thirty-eight of those patients underwent US guided ESWL while in the other 42 patients the procedure done under fluoroscopy control. The results, complications and operative time were compared between both groups.

Both groups were comparable regarding stone size, site and body mass index. Operative time was significantly longer in group 2, there was no significant difference regarding passage of gravels, stone free rate, postoperative hematuria and loin pain between both groups. Therefore, we conclude that even in patients with radiopaque stones, ultrasound can be used to guide ESWL as effectively as fluoroscopy, without any risk of radiation.

Key Words: ESWL: Extracorporeal shock wave lithotripsy, KUB: Kidney, Ureter, and Bladder X-ray, CT: Computed tomography.

سلامة وفعالية استخدام جهاز الموجات فوق الصوتية (السونار) لمتابعة عملية تفتيت الحصى بواسطة الموجات الصادمة في المرضى الذين يعانون من حصى الكلية الضليل الاشعة

الخلاصة

ان الهدف من الدراسة هو لتقييممدى سلامة وفعالية استخدام الموجات فوق الصوتية لمتابعة عمليات تفتيت الحصى في المرضى الذين يعانون من حصى الكلية ظليل الأشعة. اشتملت هذه الدراسة على ٨٠ مريضا يعانون من حصى الكلية ظليل الأشعة والذين زاروا وحدة تفتيت الحصى في قسم المسالك البولية في مستشفى الحلة التعليمي.

تمت متابعة عملية التفتيت في المجموعة الاولى والتي ضمت ٤٢ مريض بواسطة جهاز الاشعة فيما تمت المتابعة في المجموعة الثانية والتي ضمت ٣٨ مريض عن طريق جهاز السونار.

تمت مقارنة نتائج التفتيت، المضاعفات الحاصلة من عملية التفتيت والوقت المستغرق لكل جلسة تفتيت بين المجموعتين.

كلا المجموعتين كانتا متقاربتان فيما يتعلق بحجم الحصى وموقع الحصى بالنسبة للكلية ومؤشر كتلة الجسم ،فيما كان الوقت المستغرق في الجلسة أطول بكثير في المجموعة ٢،لم يكن هناك فرق كبير فيما يتعلق بنزول الحصى، معدل خلو الكلية من الحصى، التبول الدموي وآلام الخاصرة بعد العملية بين المجموعتين.

نستنتج من الدراسة أنه حتى في المرضى الذين يعانون من حصى الكلية ظليل للأشعة ،يمكن استخدام جهاز السونار لمتابعة عملية التفتيت على نحو فعال (كما هو الحال في استخدام الاشعة)، دون أي خطر من الإشعاع.

الكلمات المفتاحية: تفتيت الحصى بالموجات الصادمة من خارج الجسم، اشعة الكلية والحالب والمثانة، المفراس الحلزوني.

Introduction

Renal stones is one of the common diseases that affect the urinary system and it is estimated that it affect more than 10 % of the general population [1].

There are many options for treatment of renal stones and the choice of one of theme is depends on many factors including patient age and comorbidity, stone size, type, site, anatomy of the kidney, and some time patient preference [2]. These options include oral chemical dissolution, extracorporeal shock wave lithotripsy, percutaneous nephrolithotripsy, retrograde intrarenal lithotripsy, or open surgery [3].

The year 1980 saw the first use of extracorporeal shock wave lithotripsy for treatment of renal stone, and since that time the use of (ESWL) expand greatly in treatment of many urological and non-urological diseases [4].

Because of its efficacy and relative safety, ESWL is now the most commonly used treatment modality for renal stone, although ESWL is not without side effect as perirenal hematoma can occur in about 0.6 % of cases, steinstrasse, cardiac dysrhythmia, is also a possible complications [5, 6].

To visualize the stone and monitor its fragmentation an imaging system is required, either fluoroscopy, ultra-sonography or combination of bothis commonly used to achieve this purpose [7].

The main disadvantages of fluoroscopy imaging are the high maintenance cost and the risk of patients and staff radiation exposure. Ultrasonographic localization eliminate the risk of radiation exposure to both patients and staff, in addition small or radiolucent calculi can be localized with ultrasound rather than fluoroscopy. The main disadvantages of ultrasonography are the difficulty of localizing ureteral stone and the longer learning curve [8].

Materials and Methods

Our study was conducted at the extracorporeal shock wave lithotripsy unit of urology center at Hillah teaching hospital, 80 patients with radiopaque renal stones were included in the study, 38patients underwent a single session of an ultrasound guided ESWL while in the other42 patients the procedure done under fluoroscopic guidance.

All patients underwent full evaluation including history, examination and the following investigation; urinalysis, renal function tests, bleeding profile test, an ultrasound, a KUB X-ray film, and native abdominal CT scan.

All patients advised to remain fasting over the preoperative night, all patients received a single intramuscular injection of ketorolac 30 mg as a form of analgesia 60 minute preoperatively.

Lithotripsy system description:

Our lithotripsy system is (MODULITH® SLX-F2) made by STORZ MEDICAL company in Germany.

Operative Procedure

The patient takes off his cloths and placed in supine position on the ESWL table, we used tab water as a conducting media

For patients in whom the lithotripsy is done under fluoroscopy guidance, localization of the stone is done by mobilizing the fluoroscopy C-arm between 0 degree and then 30 degree laterally. When the stone appears in the center of the mark in both (0 and 30) degree the lithotripsy started.

For patients in whom the lithotripsy is done under ultrasound guidance, localization of stone is done by removing the C-arm and inserting the US probe, then the table is moved in medio-lateral, cephalo-cudal and up-down directions, first we localize the kidney shadow then the stone with its hypo echoic shadow is appears, then we move the probe up and down until the stone become in the center of the cross mark to start the lithotripsy.

The lithotripsy is started with low power, increasing gradually until reaching the maximum allowed power (6 to 7) Jules, the frequency used was 1.5 shock / second for all patients, all patients received a total of 2500 shocks for each session.

When the patient completed the session he remained in a side room for 30 to 60 minute for checking of his vital signs giving information and advisement regarding the post lithotripsy course and time of next visit, then all patients discharged on (oral analgesia and alpha-blocker). All patients were re-evaluated by an US and KUB film six weeks later.

Results

The total number of patients was 80, divided in to 2 groups, in group 1 which involved 42 patients, the procedure done under fluoroscopic control, group 2 involved 38 patients underwent the procedure under ultrasonic control.

The mean age of patients in group 1 was 37.19 years while it was 36.68 years for group 2 patients, 28 and 14 patients in group 1 was male and female respectively, while in group 2 there was 20 male and 18 female, and as shown in tale number 1 there was no statistical difference between both groups regarding age and sex of the patients.

Table 1: age and sex distribution of the patients

Group	No.	Mean age	Sex			
			Male		female	
			NO.	%	NO.	%
1	42	37.19	28	66.6	14	33.3
2	38	36.68	20	52.6	18	47.3
P value		0.8	0.2		0.4	

Table number 2 showed the characteristics of stones, there was no significant statistical difference between both groups regarding stone size and site.

Table 2: Stone characteristics

Group	No.	Mean Stone size	Stone site					
			Upper calyx		Lower calyx		Mid calyx & pelvis	
			NO	%	NO.	%	NO.	%
1	42	13.17	9	21.4	8	19	25	59.5
2	38	12.58	7	18.4	9	23.6	22	57.8
Pvalue		0.4	0.3		0.1		0.4	

The mean of body mass index for group 1 patients was 24.07, which was not significantly differ from the second group 22.9. Fig. number 1

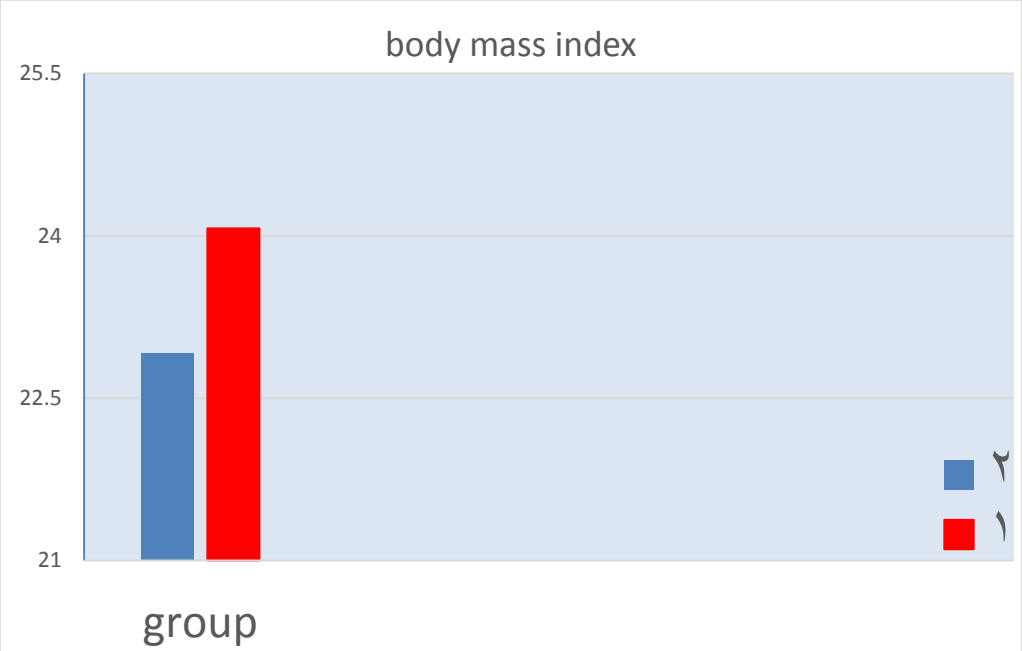

Figure 1:BMI.

The overall successful litrhoclast (defined as post ESWL passage of gravels with urine) was 88.75 %, while about 80 % of all patients become stone free as documented by an ultrasound and KUB study after 6 weeks of the first session. Fig number 2

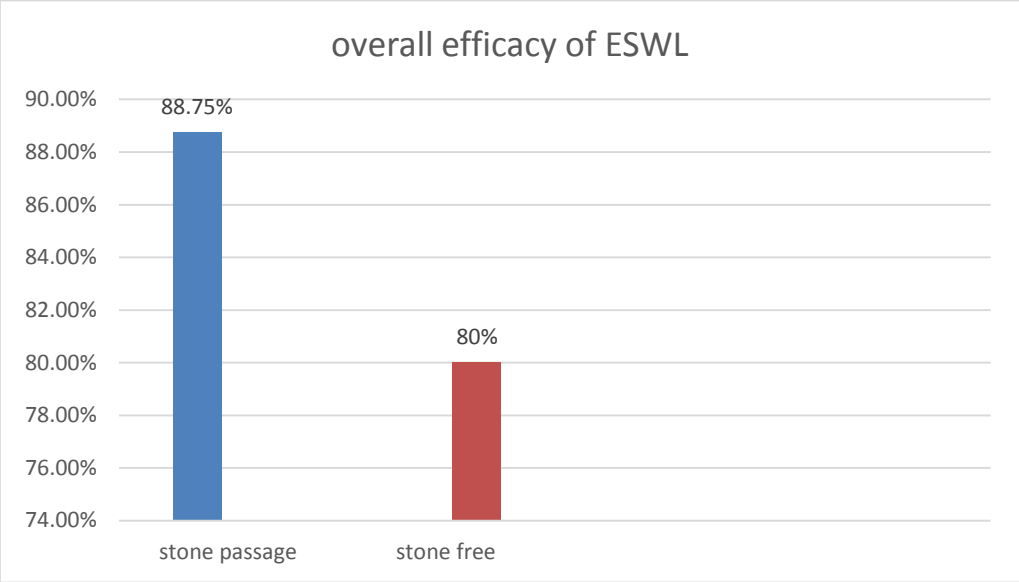

Figure 2: overall efficacy of ESWL.

From table number 3 we observed that there is no statistically significant difference between both groups regarding successful litrhoclast (stone passage) and stone free rate, however the operative time (calculated from the beginning of stone localization until the last shock in the session) was significantly longer in group 2. Table number 3

Table 3: Results

Group	No.	Stone passage		Stone free		Operative time
		NO	%	NO	%	
1	42	38	90.4	34	80.95	33.6
2	38	33	86.8	30	78.9	41.58
P value		0.6		0.8		0.000

The most common complication observed in our study were post lithotripsy loin pain and hematuria that occurred in an approximate rate in both groups. Table number 4.

Table 4: Complications

Group	No.	hematuria		Renal colic	
		NO	%	NO	%
1	42	39	92.8	5	11.9
2	38	36	94.7	4	10.5
P value		0.7		0.8	

Discussion

Although ultrasound is mostly used to guide ESWL for radiolucent stone, however the fact that all renal stones are echogenic makes ultrasound useful to guide ESWL for all stones regardless of its radiological appearance [9].

Advantages of ultrasound guided ESWL (SONO ESWL) are elimination the risk of radiation exposure, real time monitoring of lithotripsy, ability to identify other pathology of the kidney (hydronephrosis, cyst, tumor, etc), ability to differentiate between stone and stent, identify the exact site of the stone within the kidney and lastly making the operator (urologist) more familial with this fundamental imaging method [9].

The overall (SONO and FLURO ESWL) stone free rate in our study was 80 %,this is slightly lower than the study of Kumar A, et al who reported 88.75 % stone free rate at 3 months follow-up, the lower stone free rate in our study may be due to shorter follow up duration [10].

The stone free rate for ultrasound guided ESWL was 78.9 % at 6 weeks post ESWL, Xi-Zhao S. reported stone free rate for ultrasound guided ESWL of about 63.6 % and 86.4 % at 3 weeks and 3 months respectively [11].

Complications of ultrasound guided ESWL in our study were macroscopic hematuria 94.4 % and sustained renal colic 10.5 %, moderate hematuria occur in about 45.7 % and renal colic 30.4 % according to Xi-Zhao S. study [11].

The operative time was significantly longer in ultrasound guided ESWL 41.58 minute, in fact most of this time elapsed in stone localization, the time decreased gradually with increase our experience in using ultrasonography for ESWL guidance.

Conclusions

Even in patients with radiopaque renal stones, ultrasound can be used to guide extracorporeal shock wave lithotripsy as effectively as fluoroscopy, without any risk of radiation.

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