

STUDY OF RENAL MORPHOLOGICAL CHANGES AFTER EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY (ESWL)

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Abstract

Background: To find out the renal morphological changes after Extracorporeal Shock Wave Lithotripsy (ESWL) both in short and long term. **Materials and methods:** This prospective study was carried out in the Department of Urology, Chittagong Medical College Hospital, Chittagong from January 2009 to January 2010. Patients with symptom, radiologically proved renal stone(s) measuring less than 2 cm in diameter and who are normotensive were enrolled in this study. **Results:** All 50 patients were divided into four age groups. The age ranged from 38 to 68 years and the maximum number was found in the age group of 51-60 years. The mean age was 50.9 years with Standard Deviation (SD)±11.2 years. Out of which 58.0% were male and rest 42.0% were female patients. All patients had normal morphological kidney ESWL but after ESWL 4(8.0%) had peri renal hematoma hydronephrosis / increased size of the kidney. The difference was not statistically significant ($p>0.05$) before and after ESWL. Sub capsular hematoma or peri renal hematoma, hydronephrosis of kidney

and increased size of the kidney diagnosed by USG of KUB region and CT scan. All patients had normal kidney before ESWL but after ESWL 6(12.0%) had parenchymal scarring / decreased size of the kidney. The difference was statistically significant ($p<0.05$) before and after ESWL. Morphological changes of the kidney like parenchymal scarring and decreased size of the kidney diagnosed by USG of KUB region. All patients had normal kidney before ESWL but after ESWL 3(6.0%) had hydronephrosis, obstruction in pelviureteric junction and ureter, Stein strasse formation. The difference was not statistically significant ($p>0.05$) before and after ESWL. **Conclusion:** ESWL is a good option for the management of renal stone less than 2cm. ESWL is considered a safe and well-tolerated procedure. Serious complications are rare, but need to be considered in certain number of patients with complications at short and long term after ESWL. Transient renal morphological changes occurs within short time and at variable period after ESWL. Post ESWL complication's like renal morphological changes are rare, which become normal within variable period.

Key words : Extracorporeal Shock Wave Lithotripsy (ESWL); Renal stone; Perirenal hematoma; Hydronephrosis.

Introduction

Urolithiasis is one of the most common problem of modern society. Stone disease typically affects adult man more commonly than adult women¹. Since Extracorporeal Shock Wave Lithotripsy (ESWL) was first applied for the treatment of urolithiasis in 1980, it has been widely used as an effective and safe treatment modality². Complications of ESWL occur in 3.0–7.0% of patients; they are usually mild. Life threatening kidney injury or retroperitoneal hemorrhage is extremely rare³.

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ESWL has gained a world wide acceptance in the last 10 years and success rates in the management of symptomatic urinary calculi less than 2 cm reached as high as 98%⁴. Now-a-days, as a highly effective treatment modality ESWL became the treatment of choice for most of the urinary calculi and has gained a great approval with its already known non invasive nature. Both the extensive experimental studies and the clinical data have shown some local, regional and systemic effects of ESWL. In addition to transient renal functional, morphological alteration, local adverse effects such as perirenal or sub capsular hematomas have commonly been observed. The most important systemic effect well-known is the new onset of hypertension due to the damage and fibrosis of renal parenchyma⁵.

In the clinical setting morphological changes in the kidneys have been reported in up to 74.0% of post-ESWL ultrasonography of KUB region, Intravenous Urography (IVU) and Computed Tomography (CT) scan studies as well as a transient elevation of several urinary enzyme levels, such as N-acetyl- β -glucosaminidase, β -galactosidase and γ -glutamyl transferase (Assimos et al 1989)⁶. Controversy continues about whether this observed structural renal damage is of significance in the long term. Currently, there are only a few studies reporting that ESWL may be complicated by hypertension⁶.

Assessment of the resistive index by color Doppler ultrasonography is a novel noninvasive diagnostic modality for studying changes in the arterial system. The intrarenal resistive index, which is measured in the interlobar arteries, is elevated in renal parenchymal disease, such as renovascular sclerosis, diabetic nephropathy, pyelonephritis and acute tubular necrosis, as well as in acute and chronic renal obstruction. In a previous study some investigators able to demonstrate elevated resistive index levels in 30% of patients immediately after ESWL, which suggests damage to the renal parenchyma. Elevated resistive index levels were found exclusively in patients older than 60 years. At that time it was not possible to predict whether the resistive index levels would remain elevated and whether the patients would have hypertension.

ESWL is now widely practiced in Bangladesh in different cities. But its impact on renal morphological changes has not yet been studied in

Bangladesh. So it is worthwhile to perform a study to evaluate the post ESWL complication like renal morphological changes and effect on blood pressure in our population.

Materials and method

It was a cross sectional analytical study conducted in the Department of Urology, Chittagong Medical College Hospital, (CMCH) Chittagong from January 2009 to January 2010. Patients were received ESWL for renal stones up to 2cm size. All the patients were given an explanation of the study and informed written consent has taken from each patients as per instruction of ethical committee. The patients were selected as per inclusion criteria like patients with symptomatic who were radiologically proved renal stone(s) measuring less than 2 cm in diameter and are normotensive was enrolled in this study, no distal obstruction and well excreting kidney in IVU and with exclusion criteria like acute urinary tract infection, evidence of obstruction due to the stone on radiographic imaging, pregnancy, untreated blood dyscrasias, renal failure, radiolucent stones, stone in solitary kidney, stone more than 2cm and extreme scoliosis or kyphosis. Patients were recruit on convenience sampling.

It was observed that 22 to 24 cases are available monthly in CMCH. The total duration of the study was 12 months and the population size was roughly estimated 240. Therefore estimated sample size was 50. Patients assigned to treatment and those assigned to observation who subsequently became symptomatic underwent routine ESWL using a Modulits storz. Mean number of shocks for all treatments were recorded. Stone-free status was evaluated at 3 months with abdominal X-ray, USG of KUB region and plain renal tomography. Residual stones were characterized by size and location. The number and type of necessary ancillary procedures were documented. To assess morphological changes following data are obtained at (1,3,6) month and one year interval. To assess Morphological changes of kidney ultrasonogram KUB region, CT scan and IVU were done. Patient data were enter and statistical analyses was performed using software Statistical Package for Social Science (SPSS) a statistical analysis package program version-15. Chi-square and 't' tests were performed to compare proportions and means respectively between treatment and observation groups. A 'p' value <0.05 were taken as level of significance.

Results

Table I : Distribution of age of the patients (n=50)

Age in Years	Number	Percentage (%)
31-40	14	28.0
41-50	7	14.0
51-60	15	30.0
61-70	14	28.0
Mean±SD	50.9±11.2	
Range	(32-68)	

Table II : Study of the patients as per sex (n=50)

Gender	Number of patients	Percentage
Male	29	58.0
Female	21	42.0

Table III : Morphological changes of the kidney evaluated by USG of KUB region and CT scan in short term (1-3 months) followup (n=50)

USG findings	Before ESWL (n=50)		After ESWL (n=50)		p value
	n	%	n	%	
NAD	50	100.0	46	92.0	
Subcapsular/ Peri renal hematoma					0.058 ^{NS}
hydronephrosis/increased size of the kidney	0	0.0	4	8.0	

NS= not significant

p value reached from fisher exact test

Table IV : Morphological changes of the kidney evaluated by USG of KUB region in long term (6 months- 1 year) followup (n=50)

	Before ESWL (n=50)		After ESWL (n=50)		P value
	N	%	n	%	
NAD	50	100.0	44	88.0	0.013 ^S
Parenchymal scarring/ decreased size of the kidney	0	0.0	6	12.0	

S= Significant

p value reached from fisher exact test

Table V : Morphological changes of the kidney evaluated by intravenous urography (IVU) (n=50)

	Before ESWL (n=50)		After ESWL (n=50)		p value
	n	%	n	%	
NAD	50	100.0	47	94.0	0.124 ^{NS}
Hydronephrosis, obstruction in pelviuretic junction and ureter, steinstrasse formation	0	0.0	3	6.0	

NS= Not significant

p value reached from fisher exact test

The age ranged from 38 to 68 years and the maximum number was found in the age group of 51-60 years. The mean age was 50.9 years with standard deviation (SD)±11.2 years. The age distribution is shown in table I.

In this study 58.0% were male and rest 42.0% were female patients. The results are shown in the table II .

All patients had normal morphology of the kidney of KUB region before ESWL but after ESWL 4(8.0%) had peri renal hematoma, hydronephrosis/ increased size of the kidney. The difference was not statistically significant (p>0.05) before and after ESWL (Table III).

All patients had normal kidney before ESWL but after ESWL 6(12.0%) had parenchymal scarring/ decreased size of the kidney at 6 months to 1 year followup. The difference was statistically significant (p<0.05) before and after ESWL (Table IV).

All patients had normal kidney before ESWL but after ESWL 3(6.0%) had hydronephrosis, obstruction in pelviuretic junction and ureter, steinstrasse formation. The difference was not statistically significant (p>0.05) before and after ESWL (Table V).

Discussion

This prospective study was carried out with an aim to find out the morphological changes after ESWL for a variable period.

In this current study it was observed after 1-3 months of ESWL 8.0%, after 6 months 6.0% and after 1 year 2.0% patients had peri renal hematoma, hydronephrosis or increased size of the kidney evaluated by USG and IVU, which were not statistically significant (p>0.05) after ESWL.

The present study findings were discussed and compared with previously published relevant studies. Lingeman et al⁷. have shown in their similar series, the mean age of the patients was 52.4±13.1 years which was comparable with the current study, where the present study observed the mean age was 50.9 ±11.2 years with ranged from 38 to 68 years and the maximum number was found in the age group of 51-60 years. On the other hand, Yokoyama et al (1992) observed the mean age of the patients was 47.8 years, Jewett et al (1998) found 47.5±12.47 years, Coptcoat et al observed 46.5 years, Madbouly et al found 42.1±11.2 years which are lower the current study, which indicate that the early detection of renal stones in the western country^{8,9}.

Madbouly et al and Coptcoat et al found male female ratio was almost 3:1 in their studies. Similarly Claro et al observed male female ratio 3:2. Lingeman et al male female ratio 2:1, which are closely resembled with the present study⁷⁻¹⁰. The current study observed male female ratio was 1.4:1, which indicates that the incidence was higher in male subject.

Sarica et al evaluated the morphology of the treated kidneys before and after ESWL and they did not find any hematoma formation just after ESWL nor any pathological changes in the length, width and especially in the parenchymal thickness of the treated kidneys ($p>0.05$)¹¹. Another study reported that the pressure wave can also cause more significant morphological renal tissue damage from contusions to haemorrhage requiring transfusion. Kaude et al mentioned in their study that on MRI, 29.0% of patients will have subcapsular, perirenal or intraparenchymal haemorrhage⁶. Jeon et al mentioned the incidence of hematoma due to kidney injury occurred in 0.2–0.7% of cases when examined by ultrasonography¹². Hematoma should be suspected in cases where the flank pain persists despite administration of analgesics or in cases with findings suspicious for hypovolemic shock, such as syncope, orthostatic hypotension and a decrease in hemoglobin¹³. The values obtained in the present study strongly support these investigators.

In this present series it was observed that 12.0% patients had parenchymal scarring / decreased size of the kidney after ESWL evaluated by USG, which was statistically significant ($p<0.05$). On the other hand 6.0% patients had hydronephrosis, obstruction in pelvive uretuic junction and ureter, stein strasse formation and after ESWL evaluated by intravenous urography. In the current study found 6.0% and 14.0% had abnormal ECG and echocardiography but after ESWL.

Conclusion

In conclusion we can say that ESWL is a good option for the management of renal stone less than 2cm. ESWL is considered a safe and well-tolerated procedure. Serious complications are rare, but need to be considered in certain number of patients with complications at short and long term after ESWL. Transient renal morphological changes occurs within short time and at variable period after ESWL. Post ESWL complication's like renal morphological changes are rare, which become normal with in variable period. So ESWL can safely done renal stones less than 2 cm.

Disclosure

All authors declare no competing interest.

References

1. Assimios DG, Boyce WH, Furr EG, Espeland MA, Holmes RP, Harrison LH, Kroovand RL and McCullough. DL: Selective elevation of urinary enzyme levels aRer extracorporeal shock wave lithotripsy. *J Urol*:1989;142:687.
2. Moon YT, Oh CH, Moon WC, Kim KD, Kim YS, Kim SC: An experience with piezoelectric extracorporeal shock wave lithotripsy: 2000 cases. *Korean J Nephrol* 1991;10:166 –174.
3. Maziak DE, Ralph-Edwards A, Deitel M, Wait J, Watt HJ, Marcuzzi A: Massive perirenal and intra-abdominal bleeding after shock wave lithotripsy: Case report. *Can J Surg.* 1994;37:329 –332.
4. Chaussy CG and Schmiedt E: Extracorporeal Shock Wave Lithotripsy (ESWL) for kidney stones: An alternative to surgery? *Urol Radiol.* 1984;6:80-87.
5. Lingeman JE, McAteer JA, Kempson SA et al. Bioeffects of extracorporeal shock wave lithotripsy. *Urol Clin North Am.* 1988;15:507-514.

6. Kaude JV, Williams CM, Millner MR, Scott KN and Finlayson B: Renal morphology and function immediately after extracorporeal shock-wave lithotripsy. *AJR*. 1985;145:305-113.
7. Lingeman JE, McAteer JA, Kempson SA, et al. The bioeffects of extracorporeal shock wave lithotripsy. *J Endourol*. 1987;1:89-98.
8. Coptcoat M, Webb D, Kellet M. Incidence of hypertension in the Framingham study. *Am J Public Health*. 1988;78:676.
9. Madbouly K, Moneim EL-Tiraifi A, Seida M, El-Faqih Sr, Atassi R AND Talic RF: Slow versus fast shock wave lithotripsy rate for Urolithiasis: A prospective randomized study. *The Journal Of Urology*. 2005;173:127–130.
10. Claro JA, Lima ML, Ferreira U and Netto RN: Blood pressure changes after extracorporeal shock wave lithotripsy in normotensive patients. *J Urol*. 1993;150:1765.
11. Sarica K, Kopeli S, Kopeli B, Arikian N, Erbay G, Atasever T: Multi-parametric evaluation of renal function and morphology after extracorporeal shock wave lithotripsy. *Turk J Med Rees*. 1994;12(3): 131-135.
12. Jeon BH, Jang JH, Seung YO, Sang JL, Sung EK et al. Kidney Rupture After Extracorporeal Shock wave Lithotripsy: Report of A Case. *The Journal of Emergency Medicine*. 2009; 37(1):13–14.
13. Collado SA, Huguet PJ, Monreal GVF, Rousaud BA, Torre F, Vicente RJ. Renal hematoma as a complication of extracorporeal shock wave lithotripsy. *Scand J Urol Nephrol*. 1999;33(3):171-175.