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Success Rate of Stone Recurrence after Extracorporeal Shockwave Lithotripsy and Factors affecting Success of Treatment among Egyptian Patients

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Abstract

Objectives: To evaluate the factors that affect the success rate of ESWL for treatment of renal stones and to estimate the prevalence of stone recurrence during a 1-year period.

Materials and Methods: During the period of January, 2010 and December, 2010, prospective study of 142 subjects with single or multiple renal stones (<30 mm, largest diameter) undergone ESWL monotherapyby Siemens-LITHOSKOP lithotriptor. The results of treatment were assessedafter a follow-up period of 3 months. Treatment success was a complete clearance of the stones or presence of insignificantresidual fragments<4 millimeters. Correlation of the success rate with the characteristics of the subjects, conditionsof the urinary tract and features of the stone was done.

Results: During the 3-months follow-up period, the success rate was 111/142 (78%). Re- treatment was needed in 75 patients (52.8%). Post-treatment procedures were done in 12 subjects (8.4%). Post-ESWL complications were observed in 5 subjects (3.5%). Out of 10 prognosticfactors studied, 5 had a powerful influence on the success rate, which are: renal morphology, presence of congenital anomalies, size of stone, site of stone and treated stones number. Other factors including age, sex, nationality, stonenature (de novo or recurrent) and ureteric stenting had no significant impact on the success rate.

Conclusions: Prediction of success of treatment with ESWL and the recurrence depends and may be predicted by renal morphology, presence of congenital anomalies, size of stone, site of stone and treated stones number.

Keywords: Hepatocellular carcinoma; Gd-EOB-DTPA; Early hepatocellular carcinoma; Borderline lesion; Angiography.

Introduction

The only expulsive treatment for urinary stones was the open surgery, until the 1980. Afterwards, extracorporeal shock wave lithotripsy (ESWL) was introduced as novel and alternative treatment method to conventional surgical method. Ever since, it has become the most preferred treatment modality for the renal, proximal and mid ureteral stones. What favors the ESWL over both the open and endoscopic techniques is that it is minimally invasive, requiring less anesthesia and provides a successful stone-free rate when used in the appropriately selected subjects [1].

With the advantage of high efficiency and low morbidity rates, ESWL has become the therapy of choice for small renal stones due to the less invasive procedure as compared to open nephrolithotomy. This therapy provides good results, associated with few complications, but it does not change the underlying metabolic abnormality. Stone recurrence usually occurs after treatment, even in those with a stone-free status after treatment. In addition, retained stone fragments following this therapy may reform or compose a nucleus for another stone formation, hence causes a high rate of stone growth [2-5]. The patient's chances of first episode recurrent stone formation range between 27% and 50% [6,7].

Medical treatment must be considered after this intervention, to prevent further auxiliary treatments and hospitalizations.

The aim of the study was to evaluate the factors that affect the success rate of ESWL for treatment of renal stones and to estimate the prevalence of stone recurrence during a 1-year period.

Materials and Methods

From January, 2010 and December, 2010, prospective study of 142 patients were subjected to ESWL monotherapy for renal stones at Al-Zahraa University Hospital, Cairo, Egypt. Residual stones after percutaneous nephrolithotomy (PCNL) or open surgery were excluded. Follow-up data for 142 of them were available at 3 months. The series included 126 males (88.7%) and 16 Females (11.3%). Their mean age was 58.5 years (ranging from 19 to 79 years). There were no limitations as regards to body size or weight.

All patients except 8 (5.6%) were treated as outpatients. Those treated as inpatients were admitted as an emergency due to anuria or persistent severe renal colic were subjected to pre-ESWL management by other methods. All patients were subjected to pre-treatment urinalysis, culture and sensitivity test, coagulation profile, serum creatinine, blood picture, kidney ureter and bladder study (KUB X-ray) and ultrasonography (US).

Exclusion criteria were the presence of ureteric strictures, coagulopathies and non-functioning kidney. Among the entire group of treated patients, 4 (2.8%) had congenital anomalies including one horseshoe kidney, one ectopic iliac or pelvic kidney and two duplex ureter (diagnosed before).

All the treated stones were <30 mm in largest diameter.

All patients were treated with the same lithotriptor (Siemens-LITHOSKOP). This lithotriptor uses electromagnetic waves for shock wave generation, water cushion for coupling, membrane for shock wave focusing and fluoroscopy for stone localization.

Ureteric double-J stents were placed in 93 patients (21.8%) before ESWL. Indications for ureteral stenting were solitary kidney, calculus anuria and large stone burden (>20 mm, largest diameter). Percutaneous nephrostomy (PCN) was required in 2 patients of anuria and in 2 patients with obstructed infected kidneys.

Adequate sedoanalgesia was given to the patients in the form of fentanyl (1.5 μg/kg). ESWL therapy is usually started at a low voltage of 5 kv until the patient becomes accustomed to the shocks, and the voltage is then gradually increased to 9 kv. The average shocks per session were 2500-3000. All the patients were treated in the supine position.

Patients were reviewed 1 week after the first ESWL session using a KUB film and renal US to assess fragmentation and the presence of renal obstruction. Repeat treatment was carried out if there was inadequate fragmentation of the stone. If there was no response after three sessions, the case was considered ESWL failure. Follow-up using KUB film and renal US was continued every 2 weeks until there was complete stone clearance. All the follow-up data were analyzed after the 3-month visit. Treatment success was defined as complete stone clearance or presence of clinically insignificant residual fragments (CIRFs) (<4 mm), peripheral, not causing renal colic, with no infection or gross hematuria). Failure was defined as no gross response to ESWL or presence of significant residual fragments after the third session.

The success rate was correlated with the characteristics of the patients, urinary tract, and stones using the chi square test. A p value <0.05 was considered significant.

Results

After 3-month follow-up, a success rate of 78% (111/142) was obtained by ESWL therapy. The stone clearance rate is in Table 1.

	No. of patients	%
Success	111	78
Stone-free	87	61
CIRFs	24	17
CIRFs, clinically insignificant residual fragments		

Table 1: Stone clearance rate.

Re-treatment was needed in 75 patients (52.8%). Among the re-treatment group, 43 patients (30.2%) needed more than two sessions to confirm complete disintegration. The mean sessions per stone were (2.2 ± 1.43). The mean shocks per stone in total was (3400 ± 625), the mean voltage was (5.95 ± 1.22 kV). Post-ESWL procedures were done in twelve subjects (8.4%) and (Table 2).

Procedure	No. of patients	%
Double-J Stent	7	5
PCN	1	1
Uerteroscopy	4	3
Total	12	9

Table 2: Post-ESWL auxillary procedures.

Post-ESWL complications were noted in 5 subjects (3.7%) (Table 3).

A correlation was done between the characteristics of the patients, urinary tract condition, features of the stone and the success of the procedure.

Complication	No.	%
Hematoma	2	1.4
Massive hematuria	3	2.1
Steinstrasse	9	6.3
Septicemia	2	1.4
Anuria	3	2.1
Total	19	13.4

Table 3: Post-ESWL complications.

Several factors were studied to determine their influence on the success rate, however, the following factors proven to implicate on the success rate significantly:

1. Congenital anomalies: the success rate decreased from 79% for stones located in kidneys without congenital anomalies to 54% in those with congenital anomalies (p<0.03).

2. Size of stone: for stones ≤ 10 mm, the success rate was 90%, against 70% for stone>10 mm (p<0.05).

3. Number of stones: single stones had a success rate of 78.3% and 62.8% for multiple ones (p<0.01).

4. Site of stone: regarding stones in the renal pelvis and upper calyx, the success rate decreased from 87.3% to 88.5% respectively, to 69.5% for lower calyceal stones (p<0.05).

5. Radiological renal morphology: the success rate for patients with normal renal structures was 83% and 76% for obstructed structures(p<0.05).

Other factors (e.g., age, sex, nature of the stone nature and ureteric stenting had no significant influence on the success rate (Table 4).

Discussion

In consistent with previously published studies [8-11], our study proved that size of the stone is a powerful factor affecting the ESWL outcome. Lalak et al. [10] conducted a study in order to evaluate the short-term results of patients undergoing SWL with the Dornier Compact Delta lithotripter for all renal calculi. 500 renal calculi treated in 166 female and 334 male patients with a mean age of (53 ± 15) years.

Parameter	Subjects		Success rate		P
	No	%	No	%	
Age (years) ≤40 >40	75 67	53 47	55 53	39 37	NS
Gender Male Female	127 16	89 11	96 11	68 8	NS
Radiological renal morphology Intact Obstructed	106 36	75 25	88 27	62 19	<0.05
Congenital anomalies Present Absent	4 138	3 97	2 109	2 77	<0.03
Stone size (mm) ≤10 >10	83 59	58 42	75 42	53 29	<0.05
Stone site Renal pelvis Upper calyx Middle calyx Lower calyx Multiple site	24 17 19 58 25	17 12 13 41 17	21 15 14 40 18	15 11 10 28 13	<0.05
Stone nature De-novo Recurrent	109 33	77 23	81 25	57 18	NS
Stone number Single Multiple	114 29	80 20	89 18	63 13	<0.01
Ureteric stenting Done Not done	31 111	22 78	23 87	16 61	NS
NS; Non-significant, Chi-Square test.					

Table 4: Correlation between success rate, the subject's.

The stone-free rate for stonesless than 10 mm was 76% at 3 months, 66%, for stones 10-20 mm, while forstones >20 mm in size was 47%. The authors recommended ESWL as primary therapy for stones<20 mm [10].

In another study [11], 246 cases with stones less than 20 mm in lower pole renal calculi were treated with the Doli 50 lithotriptor. The stone-free rate was 78%, 73%, 43% and 30% for stones<5, 6-10, 11-15 and 16-20 mm insize, respectively. The authors concluded that stone size is more predictive of ESWL outcome than lower pole calyceal anatomy [12].

In a third study, Abdel-Khalek et al., [9] defined the prognostic factors influencing the success rate post-ESWL in 2954 subjects. Authors showed that stone size affected success rate significantly, the stone free was 89.7% for stones<15 mm and 78% for stones>15 mm (p<0.001) [9,13,14].

The current study shows that success rate had ahigher range regarding upper calyceal and pelvic stones (70%-90%) compared to 50%-70% success rate for the lower calyceal stones, this finding is similar to data of some previously published studies [2,5-7].

In our study, number of stones was a significant predictor of success. Ackermann et al., [15] studied prognostic factors influencing treatment outcome post-ESWL. They stated that BMI and number of stones were the only significantfactors. The authors concluded that number of stones appeared to be more important than the stone burden in subjects with small to medium burden [15].

We found that obstructed kidneys had a significantly lower stone-free rate compared with normal kidneys. This finding is in consistent with previous studies [9,16]. This may be explained byfaint peristalsis, which leads to decreased clearance of fragments. In a study of 680 patients with lower pole calculi, Poulakis et al. [16] reported that the pattern of dynamic urinary transport was the most important predictor of stone clearance.

Lingeman et al. [17] stated that the type of device used in treatmentaffects the outcome, as the original HM3 machine is more effective than the newer lithotriptors. Logarakis et al., [18] in a study, which included 5769 renal and ureteral stones treated with Dornier MFL 5000, compared operator-specific success rates of ESWL performed by 12 urologists at one centre. They found both, clinically and statistically significant intra-institutional differences in success rate; the best results being obtained by the urologists who treated the greatest number of patients, used the highest number of shocks and had the longest fluoroscopy time [18].

In an experimental study, Pateson et al., [19] showed that slowing the shock wave rate significantlyenhances stone fragmentation.

Joseph et al., [20] evaluated the CT attenuation value of renal calculi as a predictor of successful fragmentation using ESWL in 30 patients. The success rate for stones with an attenuation value>1000 HF units was significantly lower than that for stones with a value of <1000 HF units. The mean attenuation value and the number of shocks required for calculus fragmentation correlated significantly [20].

Conclusions

The overall success rate of ESWL for treatment of renal stones at Al-Zahraa University Hospital was 78%. Post-ESWL procedures were required in 8.4%. The re-treatment rate was 53% and the complication rate was 3.7%. Factors that significantly influenced the success rate included radiological renal morphology, congenital anomalies, size of the stone, site of the stone and number of stones treated.

References

1. Grasso M III, Paik LJ, Green DA, Alexander BS (2014) Extracorporeal Shockwave Lithotripsy. Medscape.
2. El-Nahas AR, El-Assmy AM, Madbouly K, Sheir KZ (2006) Predictors of clinical significance of residual fragments after extracorporeal shockwave lithotripsy for renal stones. J Endourol 20: 870-874.
3. Soygur T, Akbay A, Kupeli S (2004) Effect of potassium citrate therapy on stone recurrence and residual fragments after shockwave lithotripsy in lower caliceal calcium oxalate urolithiasis: A randomized controlled trial. J Endourol 16: 149-152.
4. Kang DE, Maloney MM, Haleblian GE, Springhart WP, Honeycutt EF, et al. (2007) Effect of medical management on recurrent stone formation following percutaneous nephrolithotomy. J Urol 177: 1785-1788.
5. Mattle D, Hess B (2005) Preventive treatment of nephrolithiasis with alkali citrate--A critical review. Urol Res 33: 73-79.
6. Trinchieri A, Ostini F, Nespoli R, Rovera F, Montanari E, et al. (1999) A prospective study of recurrence rate and risk factors for recurrence after a first renal stone. J Urol 162: 27-30.
7. Ljunghall S, Danielson BG (1984) A prospective study of renal stone recurrences. Br J Urol 56: 122-124.
8. Cohen TD, Preminger GM (1997) Management of calyceal calculi. Urol Clin North Am 24: 81-96.
9. Abdel-Khalek M, Sheir KZ, Mokhtar AA, Eraky I, Kenawy M, et al. (2004) Prediction of success rate after extracorporeal shock-wave lithotripsy of renal stones--A multivariate analysis model. Scand J Urol Nephrol 38: 161-167.
10. Lalak NJ, Moussa SA, Smith G, Tolley DA (2004) The Dornier compact Delta lithotriptor: the first 500 renal calculi. J Endourol 16: 3-7.
11. Sorensen CM, Chandhoke PS (2002) Is lower pole calyceal anatomy predictive of extracorporeal shock wave lithotripsy success for primary lower pole kidney stones? J Urol 168: 2377-2382.
12. Zanetti G, Montanari E, Mandressi A (2009) Long-term results of extracorporeal shock wave lithotripsy in renal stone treatment. J Endourol 5: 61-64.
13. Rassweiller J, Kohrmann KU, Alken P (1992) ESWL, including imaging. Curr Opin Urol 2: 291-299.
14. Tolon M, Miroglu C, Erol H, Tolon J, Acar D, et al. (1991) A report on extracorporeal shock wave lithotripsy results on 1,569 renal units in an outpatient clinic. J Urol 145: 695-698.
15. Ackermann DK, Fuhrimann R, Pfluger D, Studer UE, Zingg EJ (1994) Prognosis after extracorporeal shock wave lithotripsy of radiopaque renal calculi: a multivariate analysis. EurUrol 25: 105-109.
16. Poulakis V, Dahm P, Witzsch U, de Vries R, Remplik J, et al. (2003) Prediction of lower pole stone clearance after shock wave lithotripsy using an artificial neural network. See comment in PubMed Commons below J Urol 169: 1250-1256.
17. Lingeman JE, Siegel YI, Steele B, Nyhuis AW, Woods JR (1994) Management of lower pole nephrolithiasis: a critical analysis. J Urol 151: 663-667.
18. Logarakis NF, Jewett MA, Luymes J, Honey RJ (2000) Variation in clinical outcome following shock wave lithotripsy. J Urol 163: 721-725.
19. Paterson RF, Lifshitz DA, Lingeman JE, Evan AP, Connors BA, et al. (2002) Stone fragmentation during shock wave lithotripsy is improved by slowing the shock wave rate: studies with a new animal model. J Urol 168: 2211-2215.
20. Joseph P, Mandal AK, Singh SK, Mandal P, Sankhwar SN, et al. (2002) Computerized tomography attenuation value of renal calculus: can it predict successful fragmentation of the calculus by extra-corporeal shock wave lithotripsy? A preliminary study. J Urol 167: 1968-1971.