Outcome of Extracorporeal Shock Wave Lithotripsy at B and B Hospital

Shrestha B, Baidya JL
B & B Kathmandu University Hospital, Nepal

ABSTRACT

Introduction: Extracorporeal Shock Wave Lithotripsy is an effective noninvasive method to treat urolithiasis. This study aims to evaluate its outcome and determine appropriate management strategies for urolithiasis.

Methods: It was a prospective study which included one hundred patients who underwent ESWL for the management of solitary urolithiasis during a period of eight months (December 2007- August 2008). Status of stone and complications were observed and managed accordingly within a period of six postoperative weeks.

Results: Out of 100 patients, 93% had complete clearance of stone by the end of six postoperative weeks. Seven percent of the patients required adjunct invasive intervention including open surgery in 3%. Number of sessions of ESWL was found to increase as the size of stone increased. However, in three patients stones were completely refractory to ESWL even after two consecutive sessions.

Conclusions: ESWL is highly effective noninvasive modality in the management of urolithiasis in appropriately selected patients.

Key Words: *double J stent, extracorporal shockwave lithotripsy , steinstrasse, ultrasonography, ureterorenoscopy*

INTRODUCTION

Extracorporeal shock wave lithotripsy (ESWL) has considerably modified the management of upper urinary tract lithiasis and has become the therapeutic option in most cases, since its introduction by Chaussy et al in 1980.[1]

With follow-up studies for nearly 20 years, this technique is considered to be efficient, noninvasive and safe for both adults and children.[2] The purpose of the present study was to evaluate prospectively the efficacy of ESWL, factors which might influence the outcome and

Correspondence:
Dr. Binod Shrestha
Department of Urology
B&B Hospital, Satdobato, Kathmandu, Nepal.
Email: drbinshrestha@yahoo.com
Phone: 9841211859

potential adverse effects of ESWL in both children and adults in our institute set-up using Stonelith Electrohydraulic Lithotripter.

The fragments of stone produced after ESWL are usually expected to pass spontaneously down the ureter into the bladder and ultimately cleared with the passage of urine. However, their passage can be blocked, resulting in an accumulation of these fragments within the ureter, known as steinstrasse (stone street).[3]

METHODS

This is a prospective observational study conducted at B&B Hospital in between may 2008 and november 2008. Observations were made for 100 patients with solitary urinary calculi, who were treated with ESWL. Patients with multiple calculi and stone in the middle third of the ureter were excluded from the study. The evaluation before treatment comprised of an abdominal X-ray, Intravenous pyelogram (IVP), renal ultrasound and computerized tomography (CT) scanning in a few cases.

All patients were treated using Stonelith V5 electrohydraulic lithotripter, under intravenous Pethidine (10-30 mg) and Midazolam (0.2-0.3 mg/kg), in all cases. Diclofenac 75mg intramuscular injection was given in all cases half an hour prior to ESWL. All patients received intravenous antibiotic prophylaxis (Gentamycin 3-5mg/Kg), injected half an hour before the session.

All the 100 stones treated with Stonelith V5 were targeted under fluoroscopic guidance. The number of impacts per session and the total number of sessions were recorded for each patient. Therapy was usually started at a low power (10Kv), until the patient became familiar with the sound and sensation of the shocks; the power was then increased stepwise up to 22 KV. A maximum of 4000 shocks were delivered per session and there was a minimum interval of 2 weeks (2-4 weeks) between sessions. All patients received good hydration, antibiotics for 5 days, and analgesics for 3 days at the end of each session, to provide optimal conditions for the elimination of stone fragments.

Patients were reviewed 7 days after the first session using a plain X-ray KUB (Kidney, Ureter and Bladder) and renal USG in few cases to assess fragmentation, presence of obstruction and the need for further sessions. Follow up was continued until there was complete stone clearance or failure to disintegrate the stone. All follow-up data were collected and analyzed after 6 weeks visit, together with the findings from X-ray KUB and renal USG in some cases.

Factors influencing for successful outcome after ESWL were observed. Informed consent was taken from the study participants and SPSS version 11.5 was used for the statistical analysis.

RESULTS

Over the period of eight months, we had 100 patients who underwent ESWL therapy for the management of solitary urolithiasis using stonelith V5 lithotripter. Of the 100 cases, 57 had stone on the left side and the rest had on the right.

The mean age was 37.11 years ranging from 12 to 70. Sixty six patients were male and the rest were female. Most of the patients presented with dull aching pain while few with colicky abdominal pain and haematuria.

Table 1. Age distribution

Age interval (years)	Number of patients
10-20	3
21-30	34
31-40	28
41-50	19
51-60	10
61-70	6
Total	100

Table 2. Imaging studies

Imaging studies	Number of patients
USG/KUB	35
IVU	26
USG/IVU	25
KUB	3
USG	5
CT	6
Total	100

The most commonly performed imaging modalities for patients with urinary stones in our centre were a combination of Ultrasonogram and Plain X-ray (35%). Intravenous urography was the sole imaging study in 26% and CT was done for the diagnosis of urolithiasis in only six patients.

Majority of patients who underwent ESWL had stone in the kidney (46%). Likewise, 23% had stone in the pelvis and 31% in the ureter, 27% in upper ureter and 4% in lower ureter. Fifty seven percent of patients had stone on the right side.

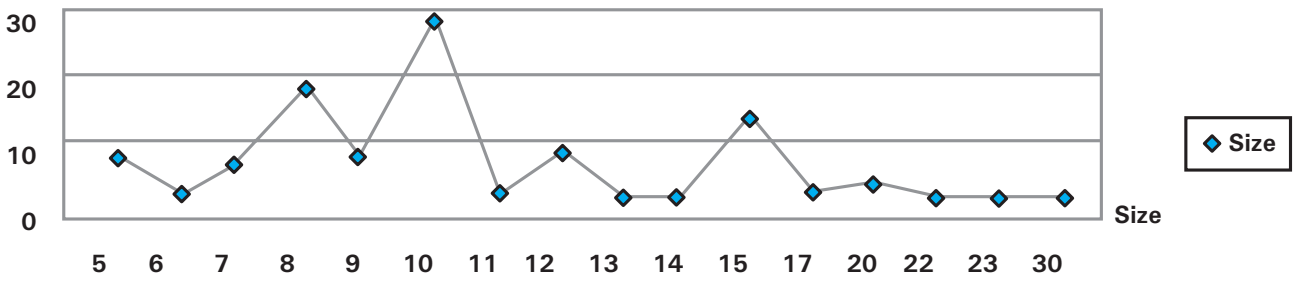

Figure 1. Size of the stones

The mean size of the stones was 10.70mm. However, the size varied widely from 5mm to 30mm.

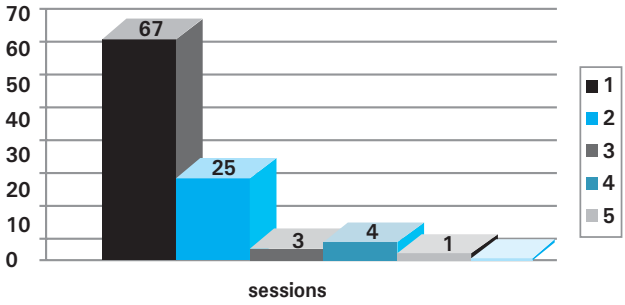

Figure 2. Sessions required

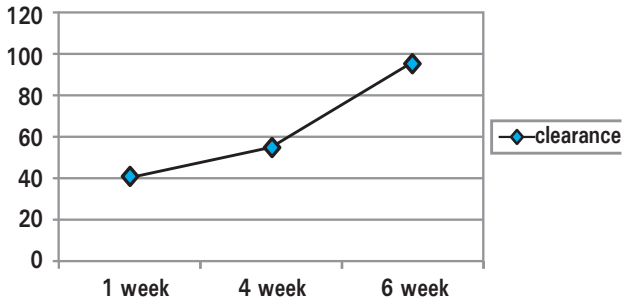

Figure 3. Stone clearance

The number of sessions required varied from a single session to five sessions. The majority (67%) required just a single session for complete fragmentation of stone. Twenty five percent of the patients required two sessions for complete fragmentation. DJ (double J) stent was placed in 15% of patients in whom the stone was larger and more sessions were anticipated.

Table 3. Complications associated with ESWL

Complications	Percentage (%)
None	73
Ureteric colic	21
Urosepsis	6
	100

Twenty seven percent of the patients developed some form of complications but the rest had uneventful post ESWL period; least number of them required interventions. Forty seven percent developed steinstrasse, majority (44%) of which were in the lower ureter. Only 7% required some ancillary procedures while the rest settled on conservative treatment. Three percent of the patients with stones inside the kidney were completely refractory to ESWL. In such cases, ESWL was abandoned after two sessions of trial and were advised for open surgery.

Complete clearance of stone was achieved in 96% of the patients (excluding cases that were refractory to the lithotripsy) in six weeks time. However, in 4% of patients there was still radiological evidence of residual stone.

Ten patients required some form of ancillary procedure apart from ESWL to make them stone free. DJ stent was required in three patients and formal URS was required in four patients. Three patients, whose stones were refractory to ESWL, underwent open surgery.

Table 4. Size of the stones requiring more than two sessions of ESWL

Sessions	Stone size in mm	Total Patients
3	23	3
	15	
	15	
4	8	4
	5	
	15	
	15	
5	30	1
	Mean size -	8
	15.75mm	

Ninety percent of the patients had successful stone fragmentation and satisfactory outcome at the end of six post operative weeks; however 10 percent required some form of ancillary procedure for making the patient stone free. Out of 90 percent, eight patients (8.88%) required three or more sessions for the successful outcome. Maximum five sessions were required in one patient in order to make him stone free by the end of six post- ESWL weeks.

DISCUSSION

The introduction of shockwave lithotripsy into clinical practice revolutionized the management of urinary tract stone disease.[4] Since the first report of its efficacy and safety by Chaussy et al in the early 1980s, ESWL has become the treatment of choice for most renal stones in both adults and children. The stone clearance rate after ESWL is 75-97% in adults and 62-86% in children, although clearance rates are lower for calyceal than for pelvic stones.[5] Kraft et al[6] reported a stone free rate of 62%, with 8% retreatment rate, in a series of 184 cases using Dornier HM 3 and HM 4 model. The significant factors associated with success were stone size, stone burden (number), site of the stone and radiological abnormalities.

In the series by Lingeman et al, stone size was the most significant factor affecting success rate.[7] Newman D et al[8] studied 1910 stones. They showed that stone free rate after ESWL dropped from 80% in up to 10mm size stones to about 60% in stones greater than 30mm size. Drash et al (1986) reported, when four or more stones were present, the resulting stone free rate was only about 30%.[9] In the present study, 96% of the solitary stones were stone-free after six weeks of follow-up.

In various studies, the stone free rate after 3000 shocks or one session ranged from 55-95% and retreatment rate was 15-30%.[10,11] In the present study, 67% of patients were stone-free with less than 4000 shocks or single sitting. Twenty five percent were stone- free by two sittings or less than 8000 shocks. Eight percent of the patients required three or more sessions and their mean stone size was 10.75 mm. Besides size of the stone, fragmentation of the stone also depends upon the composition of the stone. Stones containing calcium monohydrate and cysteine are usually refractory to the ESWL. Stone analysis is a must in order to determine the actual composition of the stone, which is not readily available in our centres.

In situ ESWL for ureteric stones, being the least invasive procedure and which can be carried out with no need for anesthesia, is an attractive proposition. In association with stone disintegration, it can simultaneously relieve obstruction. Even when disintegration is partial after ESWL session, the obstruction is often relieved. In situ ESWL has been shown to be effective for up to 81% for stones in all parts of the ureter.[12,13] In the present study, the overall stone- free rate using in situ ESWL for upper and lower ureteric stones was 93.5 % (29 out of 31 ureteric calculi) while the stone failed to fragment in 6.5% who ultimately underwent open ureterolithotomy. Joshi et al showed 81% success rate after in situ ESWL with no complications. It was just a bit less than with the present study which may be because ureteric calculi in the middle third of the ureter have been excluded in the present one.[14]

Various complications have been reported after ESWL, including flank pain, urosepsis, slight hematuria and steinstrasse. These complications are less common after treatment using new generation lithotripters.[2] In the present study, complications rate was 27%, including urosepsis (6%) and ureteric colic (21%). Forty seven patients developed steinstrasse. Most of these patients were managed conservatively except three patients who underwent DJ stenting and four who underwent URS.

Generally when the larger stones are treated with ESWL, the risk of developing steinstrasse increases proportionately with size and so do the complications like pain, infection and even impairment in the renal function. The optimum selection of cases (aiming to pulverize the stones rather than fragment them) and accurate stone targeting are essential to minimize the development of steinstrasse. A meticulous follow-up of patients with steinstrasse should prevent any loss of renal function. When there is obstruction and/or infection or renal damage, active treatment is indicated, of which ESWL and Percutaneous nephrostomy (PCN) are most effective; with ureteroscopy and open surgery being reserved for difficult cases.

Conservative treatment of uncomplicated steinstrasse was effective in about half of the cases as reported by Kim et al.[3] In our study 47% had steinstrasse and most of them were successfully managed conservatively. Failure of steinstrasse to resolve within three to four weeks may necessitate intervention.[15] Percutaneous nephrostomy alone has a success rate of more than 70% where as ureteroscopic intervention is definitive and predictable with an immediate success rate approaching 100%.[15]

Besides post ESWL high fluid intake, active mobilization should be stressed for effective passage of fragments. We have also experienced that in obese, elderly or mobility restricted patients and in some cases with stone in the lower pole, liberal usage of intra-procedure diuretics does help in smooth passage of fragments and may even help to prevent steinstrasse. We have also observed that

over-treatment of the stone with higher shockwave per session with the intention to break the stone more efficiently or to reduce subsequent sessions, also promotes formation of steinstrasse by showering the fragments.

CONCLUSIONS

ESWL is a safe option for treating both adults and children urinary tract stones of optimum size. Irrespective of the make of lithotripter, the clearance rate was 75-97%. The stone free rate is influenced significantly by stone size, site of the stone, number of stones and radiological features. DJ stent is not required routinely at the time of ESWL but if complications arise in form of infection, it may be required. Steinstrasse usually responds to conservative therapy but occasionally may require URS or ESWL itself for big obstructing fragments. We recommend a thorough radiological evaluation before management of urinary stones and in situ ESWL for ureteric stones.

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