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The Outcome of Shock Wave Lithotripsy (SWL) in the Treatment of Urinary Stone Disease: 115 Cases in SOMCH

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Abstract

Purpose: *Urinary stone disease is a systemic metabolic and recurrent disease. It is the third most common disease of the urinary tract. Urolithiasis affects 4%-15% of the world population and this is increasing. Treatment of urinary stone disease moved dramatically from open operative procedures to endoscopic, minimally invasive, and noninvasive methods. The introduction of shock wave lithotripsy (SWL) has revolutionized the treatment of urinary stones with the concept of disintegration of stones. The present study aims to evaluate the outcome of SWL in the treatment of urinary stone disease.*

Methods and Materials: *This retrospective observational study was conducted in the department of urology, SOMCH from June 2019- to March 2021. Renal stone <2.0 cm & upper Ureteric stone <1.5 cm were included and radiolucent stones, patients having ureteral obstruction with grossly impaired renal function, UTI, uncontrolled bleeding disorder, pregnancy & BMI >30kg/m^2 were excluded. A total of 115 patients was enrolled. SWL with Siemens Lithoskope (3rd generation) lithotripter was used with a standard number of shock waves 2500-3500 per session & an energy setting of 3.0-3.5 KV. NSAID was given in suppository form and intravenous pethidine just before starting shock for analgesia and all were under antibiotic prophylaxis. Patients were discharged the day after the SWL procedure with the advice of follow-up every 2 weeks for 3 months. All patients were followed up with history, urine R/M/E & C/S to detect UTI, plain X-ray KUB region to see stone clearance or any other complications.*

Results: *Total 179 sessions of SWL procedure done for 115 patients (1.55/patient) with the urinary stone of both gender between 19 to 70 years. Of them, 82(71.3%) were male and 33(28.7%) female and 94(81.5%) were in the 20-60 years age group. Renal stones 78(67.9%), upper ureteric stones 37(32.1%), and 70(60.8%) were on the left side. Pre-procedure stenting was done in 35(30.4%) patients due to obstruction & residual stones. 70(60.9%) have achieved stone clearance after the first session of SWL. After a maximum of 3 sessions of SWL and 3 months follow up found that 99(86%) patients were stone-free. Only 16(14%) found treatment failure and needed auxiliary procedures like URS, RIRS, etc because of hard stone, steinstrasse, and patients' non-compliance due to pain & fearlessness. 13(11.3%) patients complain of moderate pain after SWL and needed a maximum of 2 days of hospitalization with an injectable pain killer. UTI was found in 9(7.8%) patients, of the 7(6.1%) were pre-stenting. Gross hematuria was found in 2(1.7%) patients due to HDN & UTI.*

Conclusion: *As the stone clearance rate is high with fewer complications however multiple sessions are required, SWL, a noninvasive procedure, is a good option for the treatment of urinary stone disease.*

Keywords: ESWL, Urinary stone

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Introduction

Urinary stone disease is a systemic metabolic and recurrent disease. It is the third most common disease of the urinary tract (Stoller et al. 2012). Urolithiasis affects 4%-15% of the world population and this is increasing (Trinchieri, A., 2008). The introduction of extracorporeal shock wave lithotripsy (ESWL) in the 1980s heralded the paradigm shift to non-invasive management of urinary stone disease (Chaussy C et al. 1982). This technological advance has replaced the need for open surgery in the majority of patients, thereby reducing morbidity, hospital stay, and cost of treatment. More recently, improvements have centered on lithotripsy design with refinements in shock wave generation, delivery, and stone imaging to allow for treatment of all types of renal and ureteric calculi (Wickham, J.E., 1993). ESWL is also effective for ureteral stone and for a proximal ureteric stone it is recommended as first-line treatment by both the American Urological Association (AUA) and the European Association of Urology (EAU). Regarding URS for stones in the proximal ureter, success rates were low until recently when flexible ureteroscopes and holmium/YAG lasers were introduced, with which success rates of 100% have been achieved but high cost and nonavailability make it non-accessible to general people (Tawûek ER and Bagley DH, 1999). Open surgery may still be indicated in cases involving complicated anatomy or large stones or where there is a failure of first- or second-line therapy.

We have evaluated the role of ESWL for renal and proximal ureteric stones in recent years in our institute.

Methods and Materials

This retrospective observational study was conducted in the department of urology, SOMCH from January 2018- to June 2020. Renal stones <2.0 cm & upper Ureteric stones <1.5 cm, stone density < 1000HU were included and radiolucent stones, patients having ureteral obstruction with grossly impaired renal function, UTI, uncontrolled bleeding disorder, pregnancy & BMI >30kg/m^2 were excluded. A total of 125 patients were enrolled. SWL with Siemens Lithoskope (3rd generation) lithotripter was used with a standard number of shock waves 2500-3500 per session & an energy setting of 3.0-3.5 KV. Patients were instructed to take a laxative with carbon tablets for 2 days before SWL to help reduce intestinal gases and facilitate stone localization. A half-hour before SWL, NSAID was given in suppository form and intravenous pethidine just before starting shock for analgesia, and all were under antibiotic prophylaxis. Patients were discharged the day after SWL procedure with the advice of follow up every 2 weeks for 1 month, monthly for the next 3 months then annually. All patients were followed up with history, urinalysis & culture, plain X-ray KUB region, and USG on special occasions to see stone clearance or any other complications. For renal stone, a stone-free status or the presence of fragments of less than 4 mm in diameter were both regarded as successful treatment. As for ureteric stones, only stone-free status after ESWL was regarded as a success.

Results

Total 179 sessions of SWL procedure were done for 115 patients (1.55/ patient) with a urinary stone of both genders between 19 to 70 years. Of them, 82(71.3%) were male and 33(28.7%) female and 94(81.7%) were in the 20-60 years age group. Renal stones 78(67.9%), upper ureteric stones 37(32.1%). Pre-procedure stenting was done in 35(30.4%) patients due to obstruction & residual stones. 70(60.9%) patients needed one session, 24(53.33%) needed two sessions, 05(23.8%) patients needed three sessions for complete stone clearance. After a maximum of 3 sessions of SWL and 3 months follow up found that 99(86%) patients were stone-free. Only 16(14%) found treatment failure and needed auxiliary procedures like URS, push back PCNL, etc because of hard stone, steinstrasse, and patients' non-compliance due to pain & fearlessness. 13(11.3%) patients complain of moderate pain after SWL and needed a maximum of 2 days hospitalization with injectable pain killer. UTI was found in 9(7.8%) patients, of them 7 were pre-stenting. Gross hematuria found in 2 patients due to HDN & UTI,

Table 1: *Age & Gender Distribution*

Age/ Gender	Male- N(%)	Female- N(%)	Total- N(%)
< 20 yrs	02(1.7%)	01(0.9%)	3(2.6%)
20 -60 yrs	67(58.2%)	27(23.5%)	94(81.7%)
> 60 yrs	13(11.3%)	05(4.4%)	18(15.7%)
Total	82(71.2%)	33(28.8%)	115(100%)

Table- II: *Location of Stones*

Location of stone	Right N(%)	Left N(%)	Total N(%)
Kidney	30(26.2%)	48(41.7%)	78(67.9%)
Upper Ureter	15(13.0%)	22(19.1%)	37(32.1%)
Total	45(39.2%)	70(60.8%)	115(100%)

Table- III: *Stone clearance according to location*

	Kidney n(%)	Upper ureter n(%)	Total
Stone cleared	70(89.7%)	29(78.4%)	99(86%)
Treatment failure	8(10.3%)	8(21.6%)	16(14%)
Total	78	37	115

Tabla- IV: *Stone clearance according to SWL session*

Session	Stone clearance	Frequency
After 1 session	Complete	70(60.9%)
	Incomplete	45(39.1%)
After 2 session	Complete	24(53.33%)
	Incomplete	21(46.67%)
After 3 session	Complete	05(23.8%)
	Incomplete	16(76.2)

Discussion

Since first clinical experience with extracorporeally induced destruction of kidney stones by shock waves in 1980, it is playing a great role in the treatment of urinary stone disease (Chaussey et al. 1982). Since its introduction, open surgical techniques for urinary calculus disease have been relegated to play a less important role in our contemporary urological practice (Obaid et al. 2019). ESWL was started in SOMCH in 2009 and is doing successfully for renal and ureteric stones with 3rd generation Siemens Lithoskope lithotripter. The majority of patients were treated on a day-case basis with minimal analgesics. We find that satisfactory analgesic requirement could be achieved with a single bolus dose of intravenous pethidine before treatment and this reduces the need for full anesthetic monitoring and possible complication of anesthesia. In this series majority of the patients were male 82(71.3%), and 94(81.7%) of patients were between 20 to 60 years old. We achieved an overall success rate of 89.7% for renal stone, and 82% for ureteric stone. Among renal stones, lower caliceal stone clearance was lower and was 76% but non lower polar stone clearance was higher 92%. Many factors reduce the stone clearance rate in a lower polar stone-like dependent position and unfavorable anatomy (Snicorius et al. 2021).

We treated upper ureteric stones with ESWL which are 1.5cm or less and achieved a satisfactory stone clearance rate of about 78.4% without any major complication. Since the improvements in the mechanics of lithotriptors and a better understanding of shock wave physics and increasing availability of equipment and trained personnel have made this modality more effective. Stones can be successfully fragmented by the application of shock waves, but the ability of the kidney and ureter to clear the resulting fragments is by far more important in terms of the successful treatment outcome (Batra et al.2018). Increasing experience shows some advantages, cost reduction, permanent monitoring of therapy improves stone-free rate. With the advent of small caliber and ûexible ureteroscopes, the paradigm of treatment of upper ureteric stones has shifted towards ureteroscopy with success rates approaching 95% but not without its share of complications and it is not available everywhere. ESWL on the other hand is noninvasive and less morbid with a low complication rate. Various authors like Lingeman et al., Gnanapragasam et al., Gafoor and Halim, Padhye et al. have in their studies found clearance rates ranging from 82.4% to 94% for upper ureteric stones less than 2 cm when ESWL was used as the treatment modality. Routine use of internal stents before SWL does not improve stone-free rates (SFRs), nor lowers the number of auxiliary treatments and EAU 2021 guideline does not recommend it routinely. We did not use stents routinely. Overall 16(14%) found treatment failure including 2 steinstrasse and needed auxiliary procedures like URS, PCNL, and internal stenting. 13(11.3%) patients complain of moderate pain after SWL and needed a maximum 2 days hospitalization with injectable pain killer. UTI was found in 9(7.8%) patients, of the 7(6.1%) who were pre stenting for hydronephrosis, Gross hematuria was found in 2(1.7%) patients all of them resolve with conservative treatment. The success rate for SWL will depend on the efficacy of the lithotripter and size, location (ureteral, pelvic, or calyceal), and composition (hardness) of the stones and patient's habitus(Hung et al.2009).

Conclusion

As the stone clearance rate is high with fewer complications however multiple sessions are required. SWL is a non-invasive procedure, is a good option for the treatment of both renal and ureteric stones. It can be used as a treatment of choice for properly selected patients with the acceptable outcome, patient compliance, and cost-benefit.

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