# In Situ Extracorporeal Shock Wave Lithotripsy in the Management of Ureteric Calculi

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**It was to determine the efficacy of ESWL in ureteric calculi, with reference to site, size and radiodensity of the stone. Prospective study of patients undergoing in situ ESWL of ureteric calculi with lithostar plus by Seimens. Consecutive 35 patients with ureteric calculi of 7mm size to 15mm size and irrespective of site were included in the study. Pre ESWL evaluation done routinely in which patients had IVU when required to observe the site of stone and level of ureteric obstruction. We looked at success of ESWL for stones at various location in the ureter, along with number of session, also of analgesia and need of any ancillary procedure. There were 29(83%) male and 6(17%) female patients. 34% presented with upper ureteric stones, 17% with middle ureteric and 49% with lower ureteric stones. In upper and middle ureter size range was 13-15mm. Lower ureter had larger sizes of stones. 48.57% patients had only one session for stone clearance while 37.50% had to go for second session for stone clearance. Whereas 11.4% patients had to go for three or more session and 5.7% patients had their stones not cleaned so they needed some other procedure for stone clearance. In our setup where too much expertise and instrumental facilities for ureteroscopy are not ideal, ESWL is a favourable choice for ureteric stones. Most patients preferred anaesthesia free, out patient based treatment provided that is available, effective and without comorbidity. The enthusiasm for ureteroscopy should not be the main determinant for selection of a treatment modality.**

**Key words: ESWL, ureteric calculi**

Stone disease is a major urological problem worldwide. Its prevalence is second only to malaria and schistosomiasis[1]. It has a morbidity rate of 2 to 4% of total population, which is similar to that of diabetes[2]. It is more prevalent in temperate and humid area. Pakistan lies in stone belt. Urolithiasis is the commonest ailment encountered by the urologist in this region[3].

ESWL and ureteroscopy are the mainstay of treatment for ureteric stones, when the stones are associated with sepsis, the obstruction should be relieved first and the infection dealt with before treating the stone. However in cases not associated with sepsis, if facilities are available, urgent in situ ESWL appears to be superior to other forms of treatment for obstructing ureteric stones[4].

## Aims and objectives

To determine the efficacy of ESWL in ureteric calculi for stone breakage and clearance with reference to their site, size and radiodensity.

## Material and methods

This was a prospective study of patients undergoing in situ ESWL of ureteric calculi on lithostar plus lithotriptor, SIEMEN Germany. It was being carried out at the Department of Urology, Mayo Hospital, Lahore. Thirty five consecutive patients with ureteric calculi with size 7mm to 15mm irrespective of site were included in the study. All patients had pre ESWL evaluation. No anaesthesia was used.

We looked at the success of ESWL in treating stones of varying size in different locations (Stone free status and time needed to achieve it), use of analgesia, number of treatment sessions, need of any ancillary procedure following treatment and cost. The number of sessions required to achieve stone free status was noted. The number of shock waves and intensity of shock waves was documented.

The patients with: Bleeding diathesis ,Renal failure (serum creatinine >1.5mg%),,Marked obesity (weight >300lbs), Pregnant ladies, Impacted stones with hydronephrosis and Patients having radiolucent stones (fluoroscopic head only) were excluded.

After treatment complications of ESWL were noted e.g local skin changes haematoma, haematuria, fever, nausea, vomiting and local pain. An impression of fragmentation was noted after completion of first session of ESWL. Follow-up was done with X-rays, KUB 1/52, 3/52, 1/12 and 3/12. Further ESWL was not done for 1/12 unless these was any complication (pain or obstruction).

## Results

Total number of patients was thirty five. (Fig.1) gives the distribution of stones in the ureter in various age groups of patients reporting to us for ESWL treatment. According to the analysis 34% patients presented with upper ureteric stones, 17% patients presented with middle ureteric stones and 49% of the patients presented with lower ureteric stones (Fig.2).

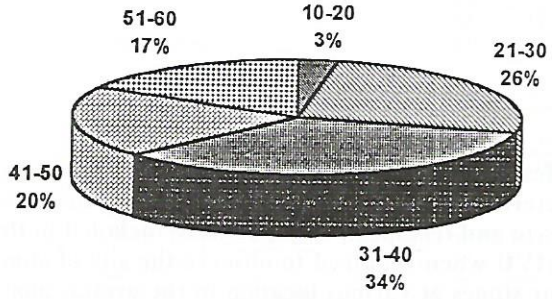


**Fig.1** Distribution of stones according to the age.

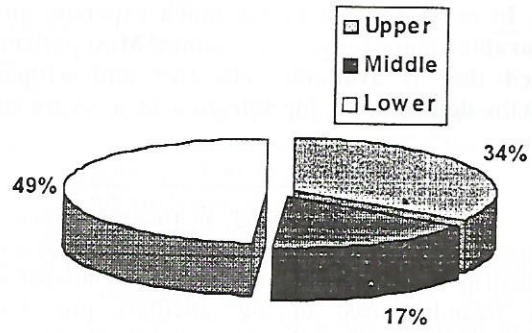


**Fig.2**

Fig. 2 Distribution of stones aAccording to the site.

Size range of the stones were made as 7-9 mm, 10-12 mm and 13-15mm and incidence of various sizes of stones evaluated for different parts of ureter in (Table-1). Out of 12 patients with upper ureteric stones 50% stones in size range of 13 to 15 mm. Similarly for middle ureter 50% had stone size range of 13-15 mm. For lower ureter size distribution was nearly the same for all the three categories of stone size 35.2%, 35.2% and 29.4% respectively.

Table –1 Percentage of stones of various sizes in different parts of ureter

| Site | 7-9 mm | 10-12 mm | 13-15 mm |
|---|---|---|---|
| Upper (n=12) | 33.33 | 16.66 | 50 |
| Middle (n=6) | 16.66 | 33.33 | 50 |
| Lower (n=17) | 35.2 | 35.2 | 41.66 |

Mean shock wave range was 2300, 2500 or 2750 for upper middle and lower parts of ureter respectively. Similarly mean intensity of shock wave range was 15.1KV, 16.3KV and 15.9KV in upper, middle and lower parts of the ureter respectively

Stones has been categorized by comparing their density to bones into 3 groups. Those having radiodensity less than bone, those having radiodensity equal to bone and those having radiodensity more than bone. Keeping in mind that stones having radiodensity less than bone are softer as compared to the stones having their radiodensity more than bone, which are thought to be harder. Distribution of stones with regard to their radiodensity was analyzed for different parts of the ureter in Fig.3.

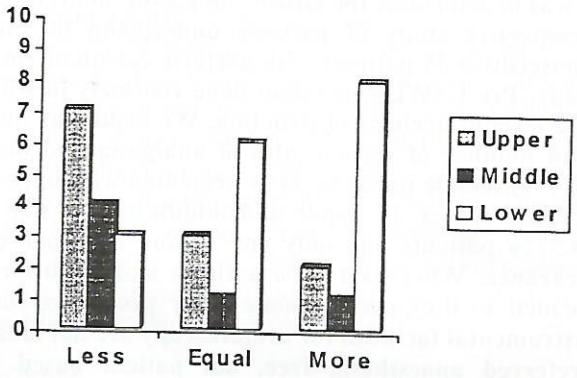


Fig. 3

Fig. 3. Distribution of stones according to their density for different part of ureter.

In all patients of ureteric calculi 17 (48.57%) patients had got their stones cleared in one session and 13 (37.50%) patients had to go for second session for stone clearance and 3 (8.57%) patients had to go for third or more sessions. While 2 (5.7%) patients had their stones not cleared inspite of multiple sessions and they have to go for ancillary procedures (Fig.4). Both these patients had their stones in lower ureter and both had radiodensity more than bone.

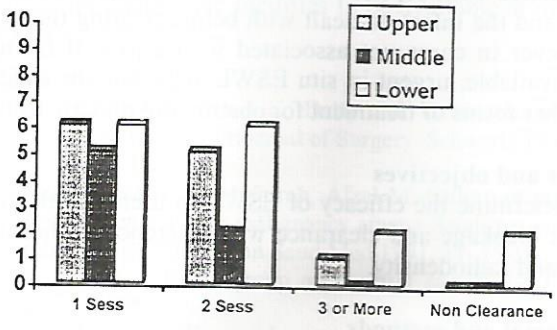


Fig. 4 No. of session and stones clearance for different parts of Ureter.

Radiodensity of stones was evaluated for number of sessions for their clearance. Patients having less dense stones had 64.28% clearance rate after 1st session, patients having stones of density equal to bone had clearance rate of 60% after 2nd session. Non clearance 18.18% of stones even with more than 6 sessions was only seen in cases of stones having density more than bone (Table-2). Stone size had been found no significant impact upon clearance with

regard to sessions. Only two patients who were in treatment failure group had stone size of 9-12 mm and 13-15 mm 8.3% and 9.09% respectively in their groups (Table-3).

Table - 2 Stone clearance % in relation to their density to bone and number of sessions

| Density | 1 Session | 2 Sessions | 3 or more | Non Clear |
|---|---|---|---|---|
| Less (n =14) | 64.28% | 35.71% | 0% | 0% |
| Equal (n =10) | 30% | 60% | 10% | 0% |
| More (n =11) | 36.6% | 27.27% | 18.18% | 18.18% |

Table - 3 Relation of stone size of stone clearance and number of sessions

| Size | 1 Session | 2 Sessions | 3 or more | Non Clearance |
|---|---|---|---|---|
| 7-9 (n =12) | 50% | 41.66% | 8.30% | 0% |
| 9-12 (n =12) | 41.6% | 33.33% | 8.31% | 8.31% |
| 13-15 (n =11) | 45.45% | 36.36% | 9.09% | 9.09% |

In various parts of the ureter, stone clearance when analyzed according to their size and radiodensity. It has been found that stones in larger size range, having high radiodensity (hard stones) and lying in lower ureter had poor clearance 88.2% and 75% according to size and density respectively, when compared with 100% clearance rate of smaller and less dense stones. Overall results according to the size, location, mean shock wave and mean KV had been summarized in (Table-4).

Table - 4 Results according to size and location of ureteric stones

| Variable | Upper (n=12) | Middle (n=6) | Lower (n=17) |
|---|---|---|---|
| No. of stone with size mm | | | |
| 7-9 mm | 4 | 2 | 6 |
| 10-12 mm | 2 | 1 | 6 |
| 13-15 mm | 6 | 3 | 5 |
| Mean size mm | 11.5 | 12 | 11 |
| Stone free rate % | 100 | 100 | 88.2 |
| Mean no of treatment | 2 | 1.5 | 1.5 |
| Mean Kv | 15.1 | 16.3 | 15.9 |
| Shocks mean | 2300 | 2500 | 2750s |

**Discussion**

The results in this series of ureteric stones treated by ESWL compared favourably with various previously published series and is found that good stone-free rates can be achieved without the use of ureteroscopy. In this group, 94.3% patients were rendered stone free with receiving ESWL. Previous studies using the Dornier MFL 5000 in the treatment of ureteric calculi have also reported stone-free rates of 80-90%[5]. Results with both the HMZ and lithostar are in the same range.[6,7] Results are better when compared with EDAP LT02 lithotriptor in local study[8] of those having lithotripsy 17 (48.57%) achieved stone free status after only one session which is quite less comparing with international data (94%).[9]

Patients who needed two or more treatments had stone-free rates of 76-78%[9] whereas in our study, patients who needed two or more treatments had stone-free rates of 45.71%. It is important not to judge the results of ESWL too soon after treatment, as patients may continue to pass fragments for weeks afterwards. Unless there is an indication to expedite an auxiliary procedure, e.g. ureteric obstruction or severe pain, ureteroscopy should be withheld for 8 weeks to allow time for the spontaneous passage of fragments. Fragmentation can be difficult to assess on X-ray and in many cases stones are found to be fragmented at the time of ureteroscopy.

Because ureteroscopy is technically more difficult in the upper ureter, ESWL remains the recommended treatment for upper ureteric stones.[10] The success rate in our study was 100% with no failure, even with larger stone (10-15 mm) and with high density stone as well. Whereas the success rate in other studies is 90.4%[9].

In this study the stone-free rate for the middle third was also higher (100%) than 88.6% in other studies. Stone in this segment of the ureter can be difficult to locate as they overlay the sacrum but in this series this was not a problem. Patients were treated and stones located by fluoroscopic control successfully.

In the lower third of the ureter, stone-free rate was 88.2% which again compare favourably with other ESWL series which show success rate of 85%[9].

Stones in the lower third are the easiest to treat by ureteroscopy and several authors have advocated a cost-benefit argument for an endourological approach. Most of the published results of stone series treated ureteroscopically are taken from dedicated endourological units and do not necessarily reflect the overall results nation wise, particularly in the upper ureter[9].

In this study no ureteric stent had been used at all for ureteric stones at any site and favourable results have been achieved, although there is experimental evidence that presence of ureteric stent may improve the results of ESWL in vitro[10]. This has not proved to be the case in vivo. In a large review of 18825 cases, Mobley et al. found that the presence of an indwelling ureteric stent did not influence the outcome at any treatment location[11]. Only two patients with treatment failure required auxiliary procedure. Both patients had open ureterolithotomies while one has ureterorenoscopic failure before having open surgery. No analgesia or anaesthesia had been used in any patient as per routine in our department during the treatment but the patients had been recommended regular NSAIDS following ESWL session for 5-7 days. No significant complication had been observed in this study.

Anderson et al., compared two groups of patients with ureteric stone, managed by ESWL or ureteroscopy and recommended ESWL as first line therapy[12].

The cost benefit analysis was found in favour of ureteroscopy. In addition they found the convalescence period to be twice as long in the ureteroscopy group, so that indirect cost to the patient may be greater with ureteroscopy. Thus in situ ESWL using lithostar plus remains an effective treatment for ureteric calculi in all locations. Patients with stones of more than 10 mm in diameter, radiodensity equal or more than bone and lower ureteric stone in this series were more likely to require additional treatment. Despite ureteroscopy giving stone-free rates approaching 100%, particularly in the lower ureter, patients should be made aware of choices available so that they can make an informed decision about treatment.

## Conclusion

In our setup where too much expertise and instrumental facilities for ureteroscopy are not ideal, ESWL is a favourable choice for ureteric stones. Most patients preferred anaesthesia free, out patient based treatment provided that is available, effective and without comorbidity. The enthusiasm for ureteroscopy should not be the main determinant for selection of a treatment modality.

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