# PERCUTANEOUS ULTRASONIC LITHOTRIPSY — ITS ROLE IN THE MANAGEMENT OF RENAL AND UPPER URETERIC STONES

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## SYNOPSIS

**Percutaneous ultrasonic lithotripsy (PUL), a new technique used in the treatment of renal stones has been shown to be safe and effective with low morbidity. 54 of the 57 patients (95%) were successfully treated by this method and all were done as a single stage procedure. 39 patients (68%) in this series were either unsuitable or had failed extracorporeal shock wave lithotripsy (ESWL). No mortality occurred in this series and one patient with staghorn stone required a nephrectomy due to severe secondary haemorrhage.**

**Though PUL is technically more difficult to perform, it is a better alternative than open renal surgery and is complementary to ESWL especially in the treatment of the more complicated renal stones.**


**Key words:** Percutaneous surgery, Ultrasonic lithotripsy, Renal stone

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## INTRODUCTION

Percutaneous ultrasonic lithotripsy (PUL) is a new technique used in the treatment of renal stones. It was first popularized by Alken (1), Marberger (2), Wickham (3) and Segura (4) about 5 or 6 years ago and is now a well established procedure in most of the major urological centres. The advantages of PUL are its lower morbidity and a much shorter convalescence following treatment. With increasing experience of this endourological technique, larger stones can also be effectively treated with little increase in morbidity. While most of the simple renal stones now can effectively be treated by ESWL, the usefulness of this technique lies in the management of the difficult and complicated stones as well as those who have failed ESWL.

This paper presents our experience in selection of patients and the results following PUL.

## PATIENTS AND METHODS

Over a one-year period, from January to December 1986, 57 patients with renal and upper ureteric stones were treated by PUL at the Department of Surgery, National University Hospital. The age in this series ranged from 23 to 68 years (Fig 1) and the female to male ratio was 1:1.6.


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**AGE DISTRIBUTION OF PATIENTS TREATED BY PUL**

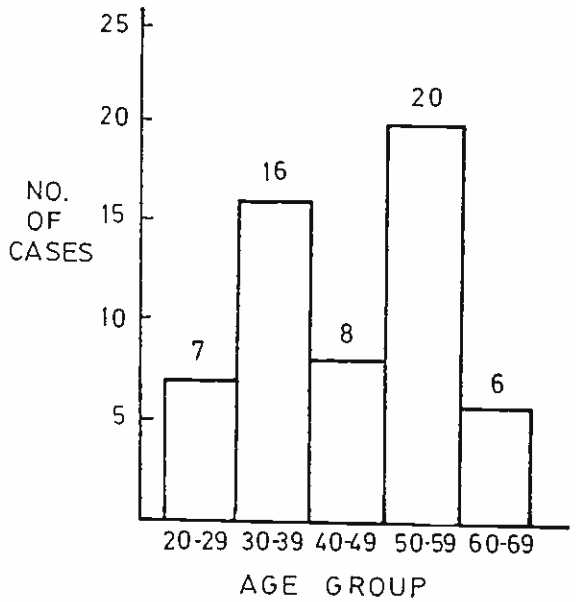


Figure 1

The size of stones ranged from 0.9 x 1.0cm to 3.5 x 7.5cm and all required ultrasonic fragmentation before removal. The indications for PUL in this series is shown in Table 1. The majority, 39 patients (68%) were either unsuitable or had failed ESWL treatment. Among the 12 patients with large stone mass, 6 were due to staghorn stones. The locations of stones in this series is shown in Table 2.

During the initial period of study, only simple renal stones of less than 3cm were treated, however, with increasing experiences, larger stones were also included. All patients had urine cultures, intravenous urograms, renal functions and coagulation profiles screened prior to

Table 1.
**INDICATIONS FOR PERCUTANEOUS ULTRASONIC LITHOTRIPSY**

| | | No |
|---|---|---|
| 1. Unsuitable for ESWL | | 33 |
| Large Stone (>3cm) | 12 | |
| Long standarding obstruction | 15 | |
| Stricture | 6 | |
| 2. Failed ESWL | | 6 |
| 3. Unable to afford ESWL | | 17 |
| 4. Residual stones after open surgery | | 1 |

Table 2.
**LOCATION OF STONES**

| | No |
|---|---|
| 1. Renal | 35 |
| 2. Pelvi-ureteric junction | 7 |
| 3. Upper ureter | 17 |

the treatment. PUL was carried out only when the urine cultured was shown to be sterile with normal coagulation profiles. Patients were given prophylactic gentamycin prior to the procedure and continued for 3 days. All patients in this series were done as a single stage procedure. A nephrostomy tube was inserted in the Radiology Department under local anaesthesia before going into the operating theatre. The nephrostomy tract was dilated under general anaesthesia to 28F with fascial dilators under fluoroscopy screening. Storz nephroscope and ultrasonic lithotriptor were used for stone disintegration. Stone forceps, Dormia basket and flexible nephroscope were used to remove residual stones from the collecting system. Retrograde catheterization was done only in selected cases when distension of collecting system was required to facilitate puncture.

Normal saline was used for irrigation and low pressure irrigation with continous suction were maintained throughout the procedure. The fluid deficits as well as the airway pressure were closely monitored in order to detect extravasation. 40 mg of Lasix was given at the end of the procedure. Size 18F Foley's catheter was placed in the renal pelvis and left to free drainage for 2 to 3 days. This was followed by antegrade nephrostogram before removal. Those who needed a second session PUL were usually done after an interval of 3 days. Patients were discharged from hospital 24 to 48 hours after removal of the nephrostomy tube. An intravenous urogram was done 6 weeks later at the follow up clinic.

## RESULTS

54 of the 57 patients (95%) were successfully treated by PUL. 1 nephrolithotomy and 2 ureterolithomies had to be carried out after failure to enter into the collecting system. 39 patients (72%) had their stones removed in one session; 13 patients (24%) required a second session and another 2 patients (4%) with staghorn stones needed a third session.

The duration taken for dilatation of nephrostomy tract and ultrasonic lithotripsy is shown in Table 3. The average duration for dilatation was 16 minutes and for ultrasonic lithotripsy was 30 minutes. The average total duration of the procedure in operating theatre was 75 minutes.

6 patients with stones and strictures at the pelviureteric junction and upper ureter (due to previous surgery) had their stones removed by PUL. Strictures were

Table 3.
**DURATION OF PERCUTANEOUS ULTRASONIC LITHOTRIPSY**

| | AVERAGE TIME (mins) | RANGE (mins) |
|---|---|---|
| Dilatation | 16 | 5-60 |
| Ultrasonic lithotripsy | 30 | 5-150 |
| Total duration in O.T. | 75 | 25-220 |

treated by endopyelotomy in 3 patients. Another 3 patients had dilatation by angioplastic balloon. All patients had double J stents left in situ for 4 to 6 weeks. The initial intraveous urograms after removal of stents showed satisfactory drainage.

11 patients (20%) were found to have residual stones and in 8 patients the stone fragments were less than 4mm and were treated conservatively. 3 patients had residual stones of 10mm in size in the calyx not accessible by the nephrostomy tract, these were treated by ESWL.

No mortality occurred in this series and the complications are listed in Table 4. Most of the complications

Table 4.
**COMPLICATIONS FOLLOWING PERCUTANEOUS ULTRASONIC LITHOTRIPSY**

| | No |
|---|---|
| 1. Perforation of pelvis and calyx | 5 |
| 2. Excessive extravasation (> 1½ ltres) | 5 |
| 3. Urinary tract infections | 6 |
| 4. Narrowing of pelvi ureteric junction | 1 |
| 5. Nephrectomy | 1 |

were minor except in one patient with staghorn stone. After two sessions of PUL he developed severe secondary haemorrhage and urosepsis, requiring a nephrectomy. 7 patients in this series required blood transfusion of an average of 2.5 units. The average duration of hospital stay was 7.5 days with a range from 4 to 21 days.

## DISCUSSION

The treatment of renal stones has changed tremendously over the past five to six years with the trend towards less invasive surgery. The establishment of PUL as a safe procedure represents an important development in endourology and is definitely superior to open renal surgery. Although the majority of simple renal stones are best treated by ESWL, the treatment of large and complicated stones still remain a difficult problem. ESWL monotherapy is unsatisfactory due to the risks of obstruction by large stone burden after fragmentation as well as septic complication following treatment. Several workers (5, 6 & 7) have shown lately that by combining percutaneous debulking, followed by ESWL for such complicated stones, satisfactory results can be obtained and yet open surgery can be avoided. Hence, it has been our policy to perform PUL for patients with renal stones larger than 3cm in diameter.

The presence of both stone and stricture is obviously unsuitable for ESWL but this can be effectively dealt with by PUL with either endopyelotomy (8) or angioplastic balloon dilatations as was done in 6 patients in this series. Impacted stones at pelvi-ureteric junction or upper ureter which fail to be pushed back into the kidney for ESWL is also preferably treated by PUL. By performing antegrade

ureteroscopy and ultrasonic lithotripsy, stones as low down as fourth or fifth lumbar vertebra levels can be removed. In such situation, it is mandatory to puncture the middle or upper pole calyx so as to facilitate introduction of ureteroscope into the upper ureter.

The salvage of failed ESWL cases by PUL clearly demonstrates the importance of acquiring both these modalities of treatment in the modern era of management of renal and ureteric stones.

Low pressure irrigation and continous suction are important to safe guard against excessive extravasation of irrigating fluid. In addition to measuring the fluid deficits, monitoring of the airway pressure, in our experience, is also useful in detecting significant extravasation.

The importance of having adequate nephrostomy drainage after the procedure cannot be over-emphasised as serious complications like urinoma, urosepsis and secondary haemorrhage are unlikely to occur when the neprhrostomy tube is functioning well.

The overall results in this series was comparable to those reported by Marberger (9) and Wickham (10) in their early series. The success rates quoted were 89.3% and 68.6% and the residual stone rates were 10.7% and 20% respectively.

PUL and ESWL should be regarded as complementary rather than competitive in patient management. Both are safe and effective in treatment and by choosing the correct modality either alone or in combination, as much as 95% (7) or more of renal and upper ureteric stones can be treated without open surgery.

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