

## New Techniques

### ELECTRONIC LITHOTRIPSY (URAT-1) IN THE MANAGEMENT OF BLADDER STONE IN ADULTS

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Operative removal of stone bladder is probably the oldest known operation. The perineal approach (lateral lithotomy) has been described in detail by the ancient Indians. In later period this operation was popular all over the world and the procedure was further refined in medieval Europe (Khan 1973).

The perineal approach was fairly successful in children but in adults the mortality and morbidity was very high. Alternative methods of stone removal were being explored all the time but it was only in the early part of the 18th century when technology reached a level where crushing of the stone by instruments introduced per urethra gave a glimmer of hope. These early instruments were rather friable but produced amazing results in the hands of the experts. Lithopaxy was less painful, carried a lower mortality and morbidity but it had its limitations (Thompson 1880).

At the turn of the century introduction of anaesthesia radically changed the operative approach to stone bladder and suprapubic vesicolithotomy was developed. This procedure could be used for all stone cases and secondary bladder pathology could also be dealt with at the same sitting. Lithopaxy was also improved for selected cases and the later instruments were easy to handle, and the stone could be crushed under vision. However, lithopaxy even in best hands has its limitations. The instrument cannot be used in children and for stones larger than 2 cm diameter. For endoscopic removal of large stones the Russians have developed a new concept of electrohydraulic lithotripsy.

In late 1950, Goligowsky and Yutkin two Soviet engineers developed an instrument (Urat-1) which used low amperage, high voltage direct current discharges in liquid media producing hydraulic shock waves. These waves are of such magnitude that they can break the urinary stone (Mitchell and Kerr, 1977).

The Department of Urology at Mayo Hospital acquired Urat-1 in 1971 and used it in 22 selected bladder stone patients. In this paper an assessment of Urat-1 has been made in view of conditions in Pakistan. Furthermore, the technical limitations and advantages of the instrument have been highlighted.

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*Instrument:* (Fig. 1) Urat-1 consists of a portable pulse generator unit. The voltage can be increased to a maximum of 3 kilovolts with minimum impulse current of 500 ampere. The pulse duration is of 1-5 microseconds with a rate of 30 to 100 cycles per second. The generator unit runs on 220 volts and is suitably earthed during operation. A foot pedal controls the impulses from the generator unit which are fed through a cable to a 10F stone probe. The probe is passed through a cystoscope and used under vision (Fig. 2).

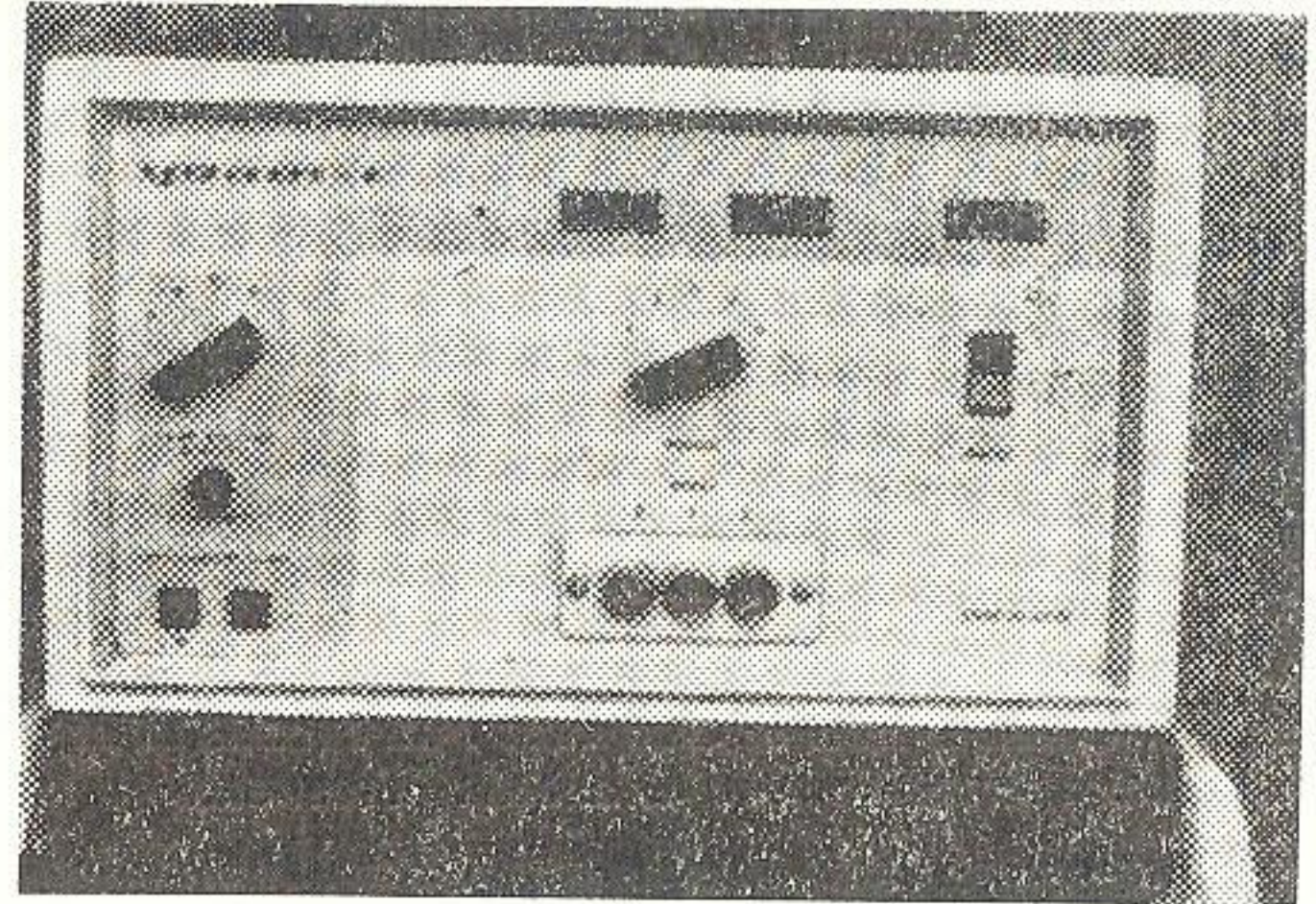


Figure 1 shows the front panel of Urat-1

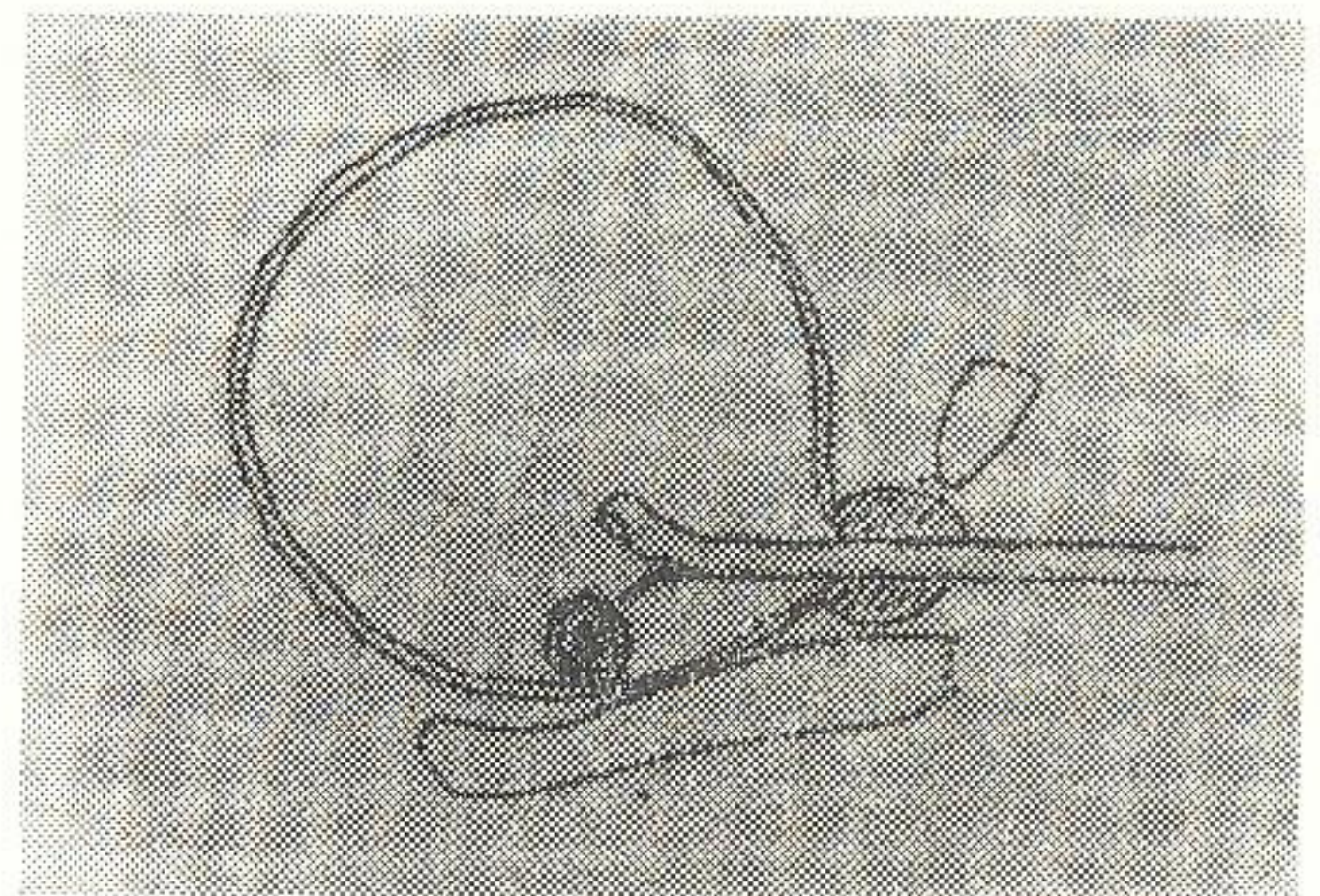


Figure 2 shows the cross-section of the bladder with reverse angle cystoscope in position showing the tip of the probe near the bladder stone.

### Material and Method

Between 1971 and 1974 a total of 22 patients with bladder stone disease were operated by electrohydraulic lithotripsy.

These patients had primary bladder stone disease with stone size of more than 2 cm. Patients with outflow obstruction or other bladder pathology were not included in this series. The type of bladder stone did not influence patient selection. Age was not considered in the patient selection as long as the urethra was able to accept 24F cystoscopes.

All the patients were operated under spinal anaesthesia. Preliminary cystoscopy and urethroscopy was done to rule out bladder and bladder neck pathology.

The bladder was distended with about 200 ml of fluid. The 10F probe was passed through 24F cystoscopes. For electrohydraulic lithotripsy a reverse angle cystoscope is ideal since there is a danger of lens injury if the probe end is very near (Fig. 2).

The probe tip was manipulated to a position on to the stone surface. The best results are obtained if the stone is rough and of soft consistency (struvite stones). The probe end was kept a few millimeter away and perpendicular to the stone surface. Several short bursts lasting 1 to 3 second were used with 5 to 10 seconds interval between bursts for the probe generator unit to build up energy. For hard stones the discharge of cycles per second was increased. Once a crack in the stone was made the bursts were directed against it. The stone was fragmented upto a size little larger than the probe tip. The small stone fragments tend to bounce off at higher cycles and are best dealt with at 30 cycles per-second. We however find it easier to use the mechanical lithotrite for complete and quick removal of the small fragments. In-dwelling catheter drainage was used for 24 hours and the patient was discharged after 2 days.

## Results

The age variation of our 22 patients was between 16 years to 84 years. Eight patients were over 50 years of age. There were two females in the series.

Out of 22 patients we were unsuccessful in 4 patients. These 4 patients were treated in the early part of this series. The reason of our failure was bleeding from bladder neck in one case and in the other three we managed to break the stone but the fragments were too large and it was felt that removal by the suprapubic route was quicker.

In 18 successful cases we took few minutes to 2 hours to break the stone. The operating time depends upon the hardness and the size of the stone. This can be reduced with practice. Two patients required a second sitting.

The most common post-operative complication was difficulty of micturition (4 cases) or retention of urine (2 cases) due to stone fragments. By the use of mechanical lithotrite in later cases this was eliminated.

A rather serious complication faced by us in the second case was shattering of the telescope lens. We henceforth used cystoscope angled in reverse. However, if the Albrarran's lever is pulled out and the probe tip carefully kept away normal cystoscope can be used.

Probe tip when placed at a distance of less than 1 cm from the bladder wall can lead to slight haemorrhage which is usually not troublesome but may obscure the field.

There were no deaths in this series.

We feel that after 4 to 8 hours use the lithotiptic probe tends to loose its efficiency and has to be replaced.

## Discussion

Urat-1 using electrohydraulic waves can successfully break bladder stone of any size or consistency and thus is a useful tool for the Urologist.

The early work was done by Russian Urologists who treated over 1000 cases and presented detailed data on 300 cases (Clinical data Urat-1, 1965).

By 1970 reports on Urat-1 began to appear in the European journals. From Greece, Rouvalis (1970) published his experience with 100 cases. Reuter (1970) published 50 cases and Albrecht et al (1972) presented their experience with 62 cases from West Germany.

Urat-1 was little late in reaching U.S.A., but the first report was published in 1972 (Eaton et al., 1972). Since then Tessler and Kossow (1975) and Mitchell and Kerr (1977) have presented their results.

All these workers and the present series show that Urat-1 is a significant advancement in the treatment of bladder stone with minimal complications.

It is an ideal form of treatment for stones which cannot be crushed by the mechanical lithotrite. The procedure is successful under topical anaesthesia and thus can be used in the Out Patient Department (Clinical data 'Urat-1', 1965; Rouvalis, 1970). Urat-1 lithotripsy can be combined with T.U.R. in cases of stone secondary to prostatic hypertrophy (Mitchell and Kerr, 1977). Minimal postoperative complications reported by all workers are of obvious values. However, one case of perforation of the bladder has been reported (Mitchell and Kerr, 1977). The short hospital stay of the patient is an attractive aspect of this treatment.

For Pakistan with a high incidence of bladder stone disease in adults Urat-1 is an important addition in the management of these cases (Khan 1975). There are certain technical limitations in the free use of the instrument. The familiarity with the use of cystoscope is the basic essential before Urat-1 can be used. The cystoscope with reverse angle would be safer to prevent lens injury. Special systoscopes have been manufactured to offset this drawback (Reuter 1970). Finally the short probe life, in use and in storage, has posed a grave problem since replacements have not been possible in Pakistan.

Urat-1 is an excellent form of treatment in selected cases of adult bladder stones. Its introduction in Pakistan can, at the moment, only be limited to selected centers for the reasons already discussed.

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