Extracorporeal Shock Wave Lithotripsy of Middle Ureteral Calculi: Ventral Shock Wave Application

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Abstract
A total of 150 patients presenting with stone in the middle iliac ureter were treated with extracorporeal shock wave lithotripsy using a Dornier HM-4 lithotriptor. For adequate radiological stone visualization and excellent fragmentation, the prone position was used in all patients. In 45 patients (30%) an ureteral stent was placed before treatment. The overall success rate was 82% (123 of 150 patients). All patients were treated on an outpatient basis without anesthesia.

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Introduction
Extracorporeal shock wave lithotripsy (ESWL) has become the preferred treatment modality for stones of the urinary tract. The part of middle or iliac ureter presented a problem for treatment with ESWL, because of the interposition of bony structures between the shock wave generator and the stone to be treated. Treatment in the conventional supine position was not feasible [1]. Up to now, there have been only a few reports on experience with a small number of patients with iliac stones treated with ESWL in the prone position [1-5]. We report our experience in the treatment of 150 patients who underwent in situ ESWL for iliac ureteral stone with the Dornier HM-4 lithotriptor.

Patients and Methods
During a 33-month period, ESWL using the Dornier HM-4 lithotriptor was performed in 150 patients with stones in the middle ureter, especially over the os sacrum. The 95 men and 55 women ranged in age from 25 to 77 (mean 49.6) years. The stone size ranged from 0.5 to 2.0 (mean 1.2) cm. All

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stones were radiopaque. A ureteral catheter or a double-J catheter was placed in 45 patients (30%) beside the stone before ESWL to facilitate location. All the treatments were performed with the patient in the prone position, without anesthesia and on an outpatient basis. The mean duration of treatment was 47 (range 30-65) min. The mean number of shock waves was 2,800 (range 2,220-3,600). The generator voltages ranged between 22 and 26 kV. Patient and stone characteristics are shown in table 1. All patients were followed with abdominal radiographs on the 1st postprocedural day and 1, 3, 6, and 12 weeks after treatment, according to the results.

Table 1. Patient and stone characteristics

| Stone Free in 1 Week | 21% |
| Complete Evacuation Ureteroscopic Extraction | 61% |

Fig. 1. Results after one ESWL session.

Results

All patients were treated on an outpatient basis and were not hospitalized after ESWL. The abdominal radiograph of the patients on the first postprocedural day showed that 128 of 150 patients (85.3%) had complete stone fragmentation after ESWL. The remaining 22 patients with ESWL failure underwent ureteroscopic extraction of their stones. During the next 2 months of follow-up, of the 128 patients with complete stone fragmentation, 5 (3.3%) underwent ureteroscopic extraction of their fragments because of persistent pain or development of an infection; 32 (21%) patients were stone free 1 week after ESWL, while 91 (61%) patients were stone free after a 2-month period. Complications were not recorded in any of the patients. The overall results are shown in figure 1.

Discussion

ESWL is rapidly gaining wide acceptance. The forerunners using this procedure initially excluded patients with ureteral calculi [6]. However, indications were extended later to selected cases with upper ureteral stones [7, 8] with the same success rate as in the treatment of simple renal stones. The iliac ureter has represented for some time the limit of applicability of ESWL in the standard supine position because the interposed bone blocked shock wave transmission and because geometric limitation of the Dornier machine prevented accurate targeting in some patients [3, 9].
In order to overcome this disadvantage, a simple modification was done in the original Dornier HM-3 lithotriptor patient support. This permits placement of the patient in the prone position, so that successful pulverization of stones in the iliac crest can be obtained. Up to now there have been only a few reports with a small number of patients about the treatment of middle ureteral calculi with this modification, with a success rate ranging between 80 and 100% [1-3]. The same results are confirmed in our series with the newer Dornier model HM-4 lithotriptor that permits easier and more comfortable placement of patients in the prone position.

The ventral shock wave application is advantageous because it permits the accurate placement of the stone at the second focal region, allowing successful fragmentation of the stone and preventing blockage of shock wave energy from the bony pelvis because the shock waves enter anteriorly.

The results obtained so far with ventral shock wave exposure achieved with the prone placement of the patients without complications are promising and justify in situ ESWL as the initial approach in the treatment of stones located in the middle ureter.

References

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