INITIAL EXPERIENCE WITH SHOCK WAVE LITHOTRIPSY AT ARMY HOSPITAL (R & R) DELHI CANTT

Surg Lt Cdr KSK PATRULU⁺, Dr PS KHATANA⁺,
Lt Col RAJEEV SOOD,^{VSM #}, Lt Col N SRINATH^{**},
Col SV KOTWAL⁺⁺

ABSTRACT

Army Hospital (R & R) has acquired an Electrohydraulic Lithotripter (DIREX NOVA), the first of its kind in the Armed Forces for the treatment of stone diseases. The first 200 patients who underwent Extracorporeal Shock Wave Lithotripsy (ESWL) have been analysed in this study. This being a pilot study would serve as a beginning of an ongoing experience with this non-invasive procedure and its benefits for the stone population in the Armed Forces.

MJAFI 1999; 55 : 6-8

KEY WORDS: ESWL, Lithotripsy.

Introduction

Surgery for stone disease constitutes 50-60% of the work load at the urology centre Army Hospital (R & R). Over the last six years, a large volume of experience has been built up with minimally invasive techniques like percutaneous nephrolithotomy (PCNL) and uretero-rensoscopy (URS), which were offered as the primary modality of treatment at this centre. With the installation of the state of art DIREX-NOVA Lithotripter, an entirely non invasive arm has been added to the armamentarium. The advantages of lithotripsy include, low incidence of complication, technical ease and high level of patient acceptance [1]. Currently, ESWL and other minimally invasive endourological techniques have reduced the need for open surgery to between 1% to 2% [2]. We present the initial experience with ESWL in the treatment of urinary tract stones. The aim of this study is to evaluate the efficacy of this non-invasive treatment modality in the Armed Forces stone population.

Material and Methods

The Direx Nova an electrohydraulic Lithotripter, was installed on 3rd of July 1997, at the Department of Urology, of the Army Hospital (Research & Referral). The Direx Nova Lithotripter is a 2nd generation lithotripter having combined fluoroscopic and ultrasonic stone localization facilities and an electrohydraulic shock wave generator. ESWL was offered to patients with renal calculi less than 25 mm in aggregate diameter with a non-obstructed system and for patients with upper ureteric stones less than 10mm in size. Also keeping in view, the service conditions, we selected the cases which were expected to clear in a maximum of two sittings, as the patients were referred from far flung peripheral hospitals and could not be called back for multiple sittings. Pregnant

women, obstruction distal to the stone, cardiac pacemaker, patients with bleeding diathesis and patients with active urinary tract infection were not considered for ESWL. Pre-procedure evaluation included a complete haemogram, screening for coagulation abnormalities, blood urea, serum creatinine, urine analyses, urine culture, ECG and an intravenous urogram. Auxiliary procedures by way of Double J stenting was done prior to ESWL therapy in patients having renal stone burden more than 20 mm in diameter, in impacted upper ureteric stones, and in patients having stones in solitary functioning kidney.

Patients were admitted on the day of the procedure after pre anaesthetic check up. Inj. Voveran and Inj Gentamicin were given 20 minutes before the procedure. Intravenous sedative analgesia with varied doses of pethidine and diazepam was given at the start of the procedure. Patient's vital parameters were closely monitored and the procedure was terminated in the event of any cardiac arrhythmia.

Routine stone localization was done with fluoroscopy and ultrasonic localization was done only in cases where the stone was radio-lucent. A maximum of 3000 shock waves were delivered at not more than 20 KV setting. Stone fragmentation was fluoroscopically monitored periodically. Patients were discharged after a 24 hour period of observation, on being asymptomatic, haemodynamically stable with a benign abdomen. Post-procedure follow up included plain radiograph, KUB region, at 24 hours. It was repeated at the end of 15 days and 3 months to assess the stone clearance. Subsequent sittings were offered if significant (5mm) residual fragments were present. In case of renal calculi, sittings were repeated not earlier than 4 weeks and in case of ureteral calculi after 48 hours.

Results

The first two hundred patients who underwent ESWL for Renal and Ureteric calculi from 03 July 97 to 18 Dec 97 were analysed. An average of 1.25 sessions of ESWL were required. Of these two hundred patients 150 (75%) were male and 50 (25%) were female. The youngest patient being a 14 year boy and the oldest patient being a 67 year woman. 175 patients had stones in kidney and 25

* Classified Specialist (Surgery). DNB (Urology) Resident, ⁺ DNB (Urology) Resident, [#] Classified Specialist (Surgery & Urology), ^{**} Classified Specialist (Surgery) & Urologist. ⁺⁺ Senior Adviser (Surgery & Urology) Army Hospital (R & R), Delhi Cantt-110010.

patients had stones in the upper ureter. 40 patients were hypertensives with blood pressure well controlled with drug therapy. 137 patients had stones less than 10 mm in diameter, 58 had stones between 11 mm and 20 mm and 5 patients had stones between 21 and 25 mm. Three patients had radiolucent stones and ultrasound localization was used for ESWL. DJ stenting was done prior to ESWL in 25 patients among them only one had a solitary functioning kidney. 154 patients received single sessions of ESWL, 43 had 2 sessions and 3 had 3 sessions of ESWL with a re-treatment rate of 23%. Stone status at the end of three months was determined. Patients were considered as clinically cleared of their stones if they were stone free as per X-ray KUB at the end of three months or if they had less than 5 mm residual fragments (clinically insignificant fragments). The stone status in the present study is shown in Fig. 1, and the stone status with reference to their location is shown in Fig. 2. The stone status with reference to the stone size is shown in Fig. 3.

110 patients were totally stone free on X-ray KUB. 48 patients had stone fragments less than 5 mm in diameter (all renal stones) and 42 patients had residual fragments of 5 mm or more in diameter. 158 patients (79%) who were stone free or with less than 5 mm fragments were considered clinically stone free and no further treatment was offered. However the patients with residual fragments, were advised periodic review to document the clearance of the remaining fragments.

33 patients with renal stones and 9 patients with ureteric stones had fragments more than 5 mm in size. 2 among the 9 patients with ureteric stones underwent ureterolithotomy and 7 underwent PCNL. 4 patients among the 33 with renal stones who did not have any significant fragmentation underwent PCNL for removal of their stones. Remaining 29 patients had clearance of more than 50% of their stone burden and were subjected to further ESWL therapy.

The following complications were noted in the study. Nearly 90% of the patients had bruising at the site of contact. Transient haematuria lasting less than 24 hours was noted in all patients except one, who had persistent haematuria which lasted for 15 days before subsiding on its own. Steinstrasse (stone street), lining up of stone fragments after the ESWL in the ureter, was seen in 10 cases (5%). Steinstrasse cleared spontaneously, on watchful waiting and only one patient required URS and removal of fragments. 15 patients had fever in post-ESWL period and none of them had associated obstruction on ultrasound studies. All of them responded to appropriate antibiotic therapy.

Discussion

Since its introduction in clinical practice in 1980, ESWL has become the preferred modality for upper urinary tract stones [3]. Due to service constraints, the first lithotripter in the Armed Forces could be installed only in July 97 at the Army Hospital (R & R). Prior to the era of ESWL in the Armed Forces, the technique of PCNL was practiced at our Urology center, for the management of renal stone disease. Studies have shown that the Direx Nova Lithotripter used in this study is comparable to other second generation Lithotripters in fragmentation of renal and ureteric calculi [4].

The largest experience with ESWL in literature has been with Dornier HM 3 electro-hydraulic lithotripter

Fig. 1 : Stone status

Fig. 2 : Stone status with reference to stone location

Fig. 3 : Stone status with reference to stone size

and the stone clearance rates of upto 80% have been reported for renal pelvic stones and 73% to 56% clearance rates for calyceal stones [5]. Our initial study has shown a clearance rate of 81% in renal calculi and 64% in cases of upper ureteric calculi. The re-treatment rate was 24%.

Lithotripters offering anesthesia-free lithotripsy, have been found to have lower stone clearance rates and higher re-treatment rates [6]. Though anaesthesia free, the Direx Nova does require strong analgesia, particularly in patients with poor tolerance to pain.

Renal injury following ESWL has been studied in experimental models and clinically by enzymatic response, histopathology and various imaging modalities. Focal intra-renal haemorrhages, haematomas and

edema of varying degrees have been reported following ESWL [7]. The injury appears to resolve over days to months and heal by focal scarring. Subcapsular and perirenal collections have been described in 24-32% of patients on ultrasound. However clinically significant perirenal haematoma, occurs very rarely [8]. In this study no perirenal hematomas were detected. Gross haematuria following ESWL therapy occurred in all our patients, but it was transient and self limiting.

Complications due to the passage of fragments may occur in the form of steinstrasse, obstruction and infection. Steinstrasse is reported to occur in 5-10% of cases and usually the fragments clear on their own on expectant management [9]. In our study there was a 12% incidence of steinstrasse. However only one patient required ureteroscopic removal of fragments. If there is obstruction and infection with steinstrasse, energetic endourologic intervention is required to save nephron mass. Septic complications have been reported in about 1% of cases [10]. Obstruction with urosepsis may result in renal loss unless urgent relief of obstruction is ensured. We had low complication rates with no case ending with uro-sepsis or loss of kidney function.

Our patient population predominantly consists of soldiers and effective and rapid therapy is required for early return to combat duties to conserve trained manpower. In view of this, lithotripsy was used in cases with stone burden of less than 25 mm, which were likely to clear in one or two sessions. Patients with a larger stone burden were preferably cleared by endourological procedures like PCNL or URS.

In this pilot study of the initial 200 cases of upper urinary tract stones treated by ESWL at Army Hospital (R & R) the results of ESWL are comparable to those reported in the literature. Keeping in view of the service requirements the conventional indications for ESWL have been strictly adhered to so as to achieve

stone clearance with the least number of sessions of ESWL. Studies are being conducted to further refine techniques to identify the stones suitable for ESWL.

Studies are being planned using stronger drugs like Fentanyl for sedoanalgesia during the ESWL procedure. The use of X-ray densitometry for predicting fragility of stones before ESWL and computerized image processing to determine fragmentation will be studied as part of an AFMRC Project and these parameters are expected to further refine our methodology of case selection in the future.

REFERENCES

1. Fuchs G, Chaussy C. Selection for Extracorporeal Shock Wave Lithotripsy. In : McCullough D, editor; *Difficult diagnosis in Urology*. New York, Churchill Livingstone, 1988:12.
2. Boyle ET, Segura JW, Patterson DE, et al. The role of open stone surgery in stone disease. *J Urol* 1989;141 (4): 293A.
3. Schmiedt E, Chaussy C. Extracorporeal shock wave lithotripsy of kidney and ureteric stones. *Int Urol Nephrol* 1984;16:273.
4. Livine PM, Simon D, Servadio C. Experience in Israel with Direx Tripter X-1. In : Lingeman JE Newman DM, editor; *Shock wave lithotripsy II: Urinary and biliary*, New York , Plenum press, 1989:363.
5. Cass AS. Equivalence of mobile and fixed lithotriptors for upper tract stones, *J Urol* 1991;146:290.
6. Cass AS. Lithotripter Efficacy. In AD Smith ed. *Controversies in Endourology*, Philadelphia WB Saunders, 1995: 78.
7. Newmark Jr, Lingeman JE, Woods JR. Complications of extracorporeal shock-wave lithotripsy. In : AD Smith ed. *Controversies in Endourology*, Philadelphia, WB Saunders: 1995,185.
8. Cass AS, Clinic Brooker W, Duthoy E, et al. Clinically diagnosed renal haemorrhage after extracorporeal shock wave lithotripsy with Dornier HM3 and Medstone Lithotripter, *J Endourol* 1991;5:413.
9. Roth RA, Beckman CF. Complications of ESWL and percutaneous Nephrolithotomy, *Urol Clin North Am* 1988;15:155.
10. Silber N, Kremer I, Gatton DD, Servadio. Severe sepsis following extracorporeal shock wave lithotripsy. *J Urol* 1991; 145:547.