Urology Journal
UNRC/IUA

Vol. 2, 19-21 Spring 2004
Printed in IRAN

Transcutaneous Ultrasound Guided Nephrolithotomy: The First Report from Iran

ETEMADIAN M, AMJADI M, SIMFOROOSH N

Department of Urology, Shaheed Labbafinejad Medical Center, Shaheed Beheshti University of Medical Sciences, Tehran, Iran

ABSTRACT

Purpose: To evaluate the safety and efficacy of transcutaneous ultrasound guided nephrolithotomy.

Materials and Methods: From December 1999 to December 2000, 12 patients with renal stone were selected for PCNL. Six patients had failed ESWL and the remainder had multiple and large stones in pelvis and lower calyx. Ultrasonography was used in 11 patients during the entrance to the system and dilatation of the tract. Entrance to the system was impossible in one case for which open surgery with dorsal lumbotomy was performed.

Results: The stone was removed by just one session of PCNL in 8 and the residual stone was less than 1 cm in the 3 other cases. Repeated PCNL from the same tract was performed in one case and ESWL was carried out in the other 2 cases. After three months, all of the 11 patients were stone free.

Conclusion: It seems that ultrasonography could replace fluoroscopy in patients with dilated collective urinary system and a single large stone in calyx or pelvis.

KEY WORDS: percutaneous nephrolithotomy, ultrasonography, renal stone

Introduction

Despite its short age, the scope of endourology has been widened and its success rate has increased by medical engineering.[1] The development of imaging was essential in the progression of endourology as the innovation and progression of PCNL was impossible without fluoroscopy.[2] The use of fluoroscopy to enter collective system and dilatation could expose patients and physicians to x-ray irradiation. Since endourologists are highly exposed to x-ray irradiation during endourologic surgeries, the use of alternative methods for the entrance into collective system and dilatation of tract could be safe and less expensive.

Ultrasonography is one of the substitutional methods.[2-5] In this study 12 patients with renal stone underwent PCNL by the use of ultrasonography.

Materials and Methods

From December 1999 to December 2000, 12 patients with renal stone were selected for PCNL. Routine blood and urine tests were carried out and medical conditions were studied. Patients were enrolled in PCNL if normal tests and negative urine culture were achieved.

Cystoscopy was carried out under general anesthesia and a 5 F ureteral catheter was inserted into the kidney. Patients were positioned prone and then appropriate position for PCNL. Thirty to 60 ml (based on the dilation of collective system) normal saline was infused into the kidney through ureteral catheter. Thus, a complete dilatation of collective urinary system was performed. Then, by using ultrasonography and the observation of dilated system at the stone site, the tract and the site of needle entrance was detected after which the needle was inserted into the system by ultrasonography. Then a 0.038 inches guide wire was inserted into the kidney, the needle was removed, and the exact distance between the skin and the

Accepted for publication in May 2002

system was measured. The tract was dilated by elastic semirgid dilatators to 12 F and then, by telescopic metallic dilatators to 27 F, using ruler and accurate measurement of tract.

During dilatation, besides the measurement and ultrasonographic control of dilatators, normal saline was always infused, so that it should have been drawn from around the dilatators. Thus, the surgeon could assure the insertion of dilatators in the urinary system. Next, a 28 F Amplatz sheet was placed by which nephroscopy was performed and the observed stone was fragmented by lithoclast and extracted by forceps.

By the end of surgery, the kidney was irrigated and a 24 F nephrostomy was placed and fixed to the skin and clamped for 4 hours. KUB was conducted 24 hours later for control and if there was no residual stone, nephrostomy catheter would be removed 48 to 72 hours later and ureteral catheter would be removed 1 to 3 days after the removal of nephrostomy tube if there was no leakage from the site of nephrostomy. Finally, the patient would be discharged. In the presence of any urine leakage ureteral catheter would be preserved until the complete stop of leakage.

Results

Twelve patients (8 males and 4 females) with a mean age of 39 (range 11 to 67) years were selected for this study. The stone location was the right kidney in 4 patients and the left kidney in 8. The reasons for performing PCNL were: a large pelvic stone associated with a lower calyx stone in 3 cases, 2 pelvic stones in 2 cases, and obstructive stone in UPJ in one. Six patients had a pelvic stone sized more than 2 cm with failed ESWL (table 1).

Puncture of system was easily performed in 11 cases and entrance into the system was impossible in one case for which dorsal lumbotomy was carried out in prone position and the stone was removed by nephrotomy, following PCNL, A residue of less than 1 cm was present in 3 patients which was removed by repeated PCNL using the same tract in one case and by ESWL in 2. No stone was seen in the control KUB taken 3 months postoperatively in all of the patients.

TABLE 1. *The reasons for performing PCNL*

Cases	No.
Pelvic and calyx stones	3
Multiple pelvic stones	2
UPJ stone	1
Failed ESWL	6

Mean duration of the patients' hospitalization was 4 (range 2 to 6) days. No blood transfusion was needed and no visceral, vascular, pleural injury, or long term urinary leakage was seen.

Discussion

As a world wide and regional common disease, urinary stones are one of the recurrent diseases and if we consider surgery as its solely possible treatment, it will lead to limitations in treatment and may practically cause serious risks during multiplied surgeries. Researchers have tried to introduce more noninvasive methods consisting of endoscopic methods to prevent such risks and ease urinary stones treatment.[1] The first percutaneous nephrostomy for stone removal was performed by Fernstom and Johannson in 1976. In 1981, Alke et al from Germany and in 1983, Wiekham et al from England extracted the stones percutaneously.[1,5,6] To date, PCNL is considered as a routine technique in treating upper urinary tract stones in most urologic clinics.

Fluoroscopy is required for PCNL. Long-term x-ray exposure may cause deleterious effects for both patient and physician. To decrease irradiation, in addition to taking some general interventions, many instruments were also developed. Using C-arm fluoroscopies in which radiation producing tube is located under the bed, leads to the reduction of received radiation by 40 times for physician and by 150 times for patient.[7] Ultrasonography could be of help in collective system puncture,[3,4,5,7] which is easily practical in dilated systems.[4,5] However, dilatation needs more accuracy and it is preferable to be conducted by fluoroscopy guidance and contrast media. Dilatation could also be performed under ultrasonography direction, by using accurate measurement of the distance between the skin and the collective system. In this study normal saline was frequently injected through ureteral catheter to produce hydronephrosis, prevent collapse of system and facilitate dilatation. The leakage of fluid around metallic dilatators indicated the right tract.

The accession of system and dilatation of tract was carried out with no particular problem in 11 patients. The entrance to the system was impossible in one; thus, the patient underwent dorsal lumbotomy in prone position. No loss of tract or unusual hemorrhage was occurred in our patients.

No large vessels or visceral injury was observed.

The use of ultrasonography prevents the exposure of patient and physician to x-ray. However, performing PCNL by the guidance of ultrasonography needs more attention and experience and the surgeon should be familiar with the ultrasonographic anatomy of kidney.

In the cases that the system is not dilated or the pelvis is intra-sinus and there are multiple calices, the use of ultrasonography may practically lead to incorrect tract or unusual hemorrhage. In such cases it is preferable to apply an ultrasonographic prob which has an opening on it for the entrance to system; otherwise, fluorscopy should be used. In general, for dilated systems which have relatively large pelvic stone and not so many calices, the use of this method is more appropriate and less expensive. Since endourologic beds are so expensive and it is impossible to use them in all urologic centers, it seems that those who are completely familiar with PCNL could perform it by the use of ultrasonography in which there is no need for endourologic beds. Eight out of 11 patients became stone-free by just one session of PCNL. Repeated PCNL was performed in 1 and ESWL was carried out in 2. Three months later, all of the patients were stone-free.

Hydronephrosis facilitates the observation of collective system and ultimately eases its availability via ultrasonography. More care should be taken in choosing patients for ultrasonographic PCNL. Sever hydronephrosis, few calices, and single and large pelvic stone could increase success rate and facilitate the accessibility of stone and tract dilatation. Those kidneys with multiple major and minor calices in collective system, intra-sinus pelvis, and mild hydronephrosis are not good candidates for ultrasonographic PCNL.

Conclusion

In some selected cases (dilated systems and single pelvic stones) classic PCNL could be replaced by ultrasonographic PCNL for reducing the physician and patient exposure to x-ray and avoiding the need to endourology beds. A large stone in a relatively dilated pelvis is the best case for ultrasonographic PCNL. Other stone cases could be treated by this method as well, but with less success rate. Experienced physician, accurate system entrance, and right tract dilatation are needed for ultrasonographic PCNL.

References

1. *Basiri A, et al. Endourology till now. Iranian Journal of Urology 1994; 1: 3-18.*
2. *Clayman RV. Endouorology of the upper urinary tract. In: Walsh PC, Retik AB. Campbell's urology. 7th ed. WB Saunders; 1998. p. 2789-2790.*
3. *Grasso M. Techniques for Percutaneous renal access. In: Sosa RE. Textbook of endourology. 1st ed. WB Saunders; 1997. p. 101-102.*
4. *Korth K. Percutaneous surgery of kidney stones. 1st ed. Berlin: Springe verlay; 1984. p. 25-27.*
5. *Trade T, Hatzinger M, Rassweiler J. Ultrasound in endourology. J Endourol 2000; 15:3-15.*
6. *Darabi MR, Kianian HR. The treatment of kidney stones by PCNL. Iranian Journal of Urology 1987; 4(15-16): 27-37.*
7. *Clayman RV. Endourology of the upper urinary tract. In: Walsh PC, Retik AB. Campbell's urology. 7th ed. WB Saunders; 1998. p. 2794-2796.*