SHORT REPORT

Effect of percutaneous nephrolithotripsy under guidance of B-ultrasound for the treatment of complex renal calculi

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Abstract

The purpose of this study was to investigate the effect of percutaneous nephrolithotripsy guided by B-ultrasound in the treatment of complex renal calculi. A total of 82 patients with complex renal calculi were selected, who underwent percutaneous nephrolithotripsy guided by B-ultrasound. The average operation time was 101.52±8.35 minutes, the average intraoperative bleeding volume was 132.86±7.22 ml, the average hospital stay was 10.47 ±1.68 days, the primary calculi clearance rate was 85.37% (70 cases), and the secondary calculi clearance rate was 95.12% (78 cases). Postoperative complications occurred in 18 (21.95%) cases, including fever in 13 (15.85%), residual stone in 4 (4.88%), and delayed bleeding in 1 (1.22%) case. The findings show that percutaneous nephrolithotripsy guided by B-ultrasound is safe and effective in the treatment of complex renal calculi and is suitable for popularisation and application in primary hospitals.

Keywords: B-ultrasound, Complex renal calculi, Percutaneous nephrolithotomy.

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Introduction

Complex renal calculi refers to staghorn calculi, multiple renal calculi, cast calculi or multiple calculi with abnormal renal structure and kidney function, including isolated kidney stones, huge kidney stones (stones with the diameter larger than 2.5 cm) and so on.[1] The treatment of complex renal calculi is still a challenge. As traditional open operation treatment needs cutting off the renal parenchyma, the probability of complications, such as surgical trauma, intraoperative blood loss, postoperative haemorrhage, and infection obviously increases, it is no longer the first choice for the treatment of complex renal stones.[2] Open surgery has been largely replaced by minimally invasive surgery. Percutaneous nephrolithotripsy (PCNL) has become a first-line treatment of complex renal stones due to its advantages of minor trauma and rapid recovery.[3,4]

Although traditional X-ray guided puncture is straightforward in the course of minimally invasive transcortical lithotripsy,[5] X-ray is limited in clinical application because it is radioactive and cannot provide real-time image. In recent years, B-ultrasound guided puncture has been accepted by a large number of urologists. Compared with X-ray guided puncture, B-ultrasound guided puncture has its advantages as it involves zero radioactivity, low safety risk for doctors and patients, and dynamic observation.[6]

Some studies have shown that PCNL guided by B ultrasound is safe and effective in the treatment of complex urolithiasis in children.[7] PCNL guided by B-ultrasound was safe and effective in the treatment of complex renal calculi, and there were no side effects of radiation for both the patient and the surgeon.[8]

In recent years, B-ultrasound guided PCNL has also been used in the treatment of complex renal calculi, with good results.

Patients / Methods and Results

This retrospective study was conducted at the Second Affiliated Hospital of Guilin Medical College, China, from May 2018 to December 2020. After obtaining the necessary ethical approval, a total of 82 patients with complex renal calculi were selected for the study. The patients who underwent blood cell count and classification and routine urine examination; who were diagnosed with complex renal calculi (including staghorn calculi, multiple calculi, kidney stones within ectopic kidney) on plain X-ray of the kidney, ureter, bladder (KUB), intravenous pyelography (IVP), CT, and B-ultrasound examination; who had earlier failed multiple extracorporeal shock wave lithotripsy; and who had impaired renal function due to obstruction of large stones without contraindication to operation were included in the study. Written consent from the study participants was taken. Patients with hypertension, diabetes mellitus, abnormal kidney, heart disease and pulmonary dysfunction, coagulation dysfunction, contrast agent allergies, pregnant women, children and patients who

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refused to join in the study were excluded.

PCNL under B-ultrasound guidance was performed in all patients by the same team of surgeons, under general anaesthesia. Catheterisation of ureter on the affected side was performed at lithotomy position, and 5F ureteral catheter was indwelled before starting the procedure. The puncture point was chosen by combining pre-operative plain X-ray of KUB, IVP, CT and B-ultrasound examination of calculus position, and it was often located below the 12th rib margin between posterior axillary line and scapular line or at the middle of the 11th rib. B-ultrasound localisation was first performed to assess the structure of the affected kidney, the position of the calculus and the situation of adjacent organs. Then, the distance from the skin to the targeted kidney calyces was measured to confirm the puncture channel. Finally, the puncture was conducted with 18 G puncture needle according to the direction and depth of B-ultrasound guided puncture line to avoid organs such as intestinal tract, liver, spleen, and pleura. If there was an empty feeling or urine overflow when the puncture needle entered the targeted kidney calices, it confirmed that the puncture was successful. Guide wire was inserted via the puncture needle, the skin was incised about 1 cm, and fascial dilator expanded 14-24°F along the guide wire. Percutaneous renal channel was established and ureteroscope was imbedded to inspect the calculi. Pneumatic lithotripsy was adopted to suck all kidney stones. After the operation, 5-7°F double-J tube and 14-22°F nephrostomy tube were placed routinely, and antibiotics were also used for one week to prevent infection. Fluid infusion and diuretic therapy were performed and urine colour was observed. After routine placement of nephrostomy tube for 3-5 days, plain X-ray of KUB was reviewed or CT was checked. If calculi were completely removed and there was no discomfort after clipping the nephrostomy tube, it was removed. The double-J tube could also be removed after four weeks. If plain X-ray of KUB or CT showed that there were multiple residual calculi ($\geq$ 4 mm diameter), the second phase of PCNL was performed.

Figure-1a: PCNL with stone removal.

Figure-1b: The calculi removed at one time.

SPSS 25 was used for logging data. Of the 82 patients, 52 (63.41%) were males and 30 (36.59%) were females; they were aged between 38 and 64 years, with the average age of 48.61±3.48 years. The stone diameter was 2.60-4.20 cm, and the average stone diameter was 3.06±0.57cm. Forty-two (63.41%) patients had staghorn calculi, 28 (34.15%) had multiple calculi, and 2 (2.44%) had kidney stones within ectopic kidney.

The average operation time was 101.52 ±8.35 minutes, the average intraoperative bleeding volume was 132.86±7.22 ml, the average hospital stay was 10.47 ±1.68 days, the primary calculi clearance rate was 85.37% (70 cases), and the secondary calculi clearance rate was 95.12% (78 cases). Postoperative complications occurred in 18 (21.95%) cases, including fever in 13 (15.85%) cases, residual stone in 4 (4.88%) cases and delayed bleeding in 1 (1.22%) case.

Typical cases: a female patient, 56 years old, under the guidance of B-ultrasound to perform PCNL with calculi removal, as shown in Figure-1 a-b.

Conclusion

PCNL guided by B-ultrasound is safe and effective in the treatment of complex renal calculi and is suitable for

popularisation and application in primary hospitals.

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Conflict of Interest: There is no conflict of interest.

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