Original Article

Percutaneous nephrolithotomy (PCNL) in horse shoe kidneys

Sabooh Razvi, Zafar Zaidi
The Kidney Centre Postgraduate Training Institute, Karachi.

Abstract

Objective: To review our experience of PCNL in horse shoe kidneys.

Methods: Between June 2001 and January 2005 we performed PCNL in 16 Horse shoe kidneys in 14 patients with calculi, 2 patients had bilateral calculi. Percutaneous puncture was made with patient in prone position. Their ages ranged between 4 to 52 years with a mean age of 26.3 years. Our mean stone burden was 820 mm^2 (range 40-1370 mm^2). PCNL access tract was made in upper pole of the kidney in 13 (80%) while 3 (20%) had mid-pole access.

Results: Stone clearance after primary PCNL was achieved in 12 kidneys. Of the remaining 4 kidneys, 2 underwent re-look PCNL via the same tract and one more kidney was rendered stone free, while the other had an insignificant residue of 3mm. Hence we achieved a stone clearance rate of 81% after primary and secondary PCNL. Further 2 kidneys underwent single session ESWL for residual stones and became stone free improving our complete stone clearance rate after auxiliary procedure to 93.7%.Mean hospital stay for these patients was 3.8 days (range 3-10 days). Follow up available for these HSK patients with PCNL was 11 to 49 months with a mean follow up of 29.1 months. Complications were seen in 3 (21%) patients who developed transient post operative pyrexia and 1 (7%) patient presented on the 18th post operative day with a stone fragment in ureter and leakage from PCNL site. He was managed by ureteric catheterization for 48 hours when he passed the fragment spontaneously and became dry. None of our patients developed post PCNL bleeding or wound infection.

Conclusion: PCNL in horse shoe kidneys is no more difficult than normal kidneys and does not carry a greater risk than reported for normal kidneys. This effective modality resulted in almost 93% stone clearance with minimal complications (JPMA 57:222;2007).

Introduction

Horse shoe kidneys (HSK) are the most common congenital renal fusion anomalies with a prevalence of 1/400 to 1/800.[1] During embryogenesis fusion of the lower poles prevents normal ascent and causes malrotation with anterior displacement of the collecting system. Insertion of the ureter on the renal pelvis is displaced superior and later, probably as the result of incomplete renal rotation is associated with a significant rate of ureteropelvic obstruction. These factors contribute to impaired drainage of the collecting system, resulting in stasis. Patients with HSK have a higher incidence of urinary tract infections (24%), urinary calculi (20%) and hydronephrosis.[2,3] PCNL is an effective and well established treatment for renal calculi in anatomically normal kidneys with success rates of up to 98% for simple stones.[4,5] However the use of PCNL in congenitally anomalous kidneys particularly HSK has received little attention in literature. In view of the possibility that the abnormalities associated with a HSK may cause percutaneous access problems, a higher incidence of complications and a lower success rate. Most surgeons do not feel comfortable to subject HSK to any type of surgery and particularly to PCNL. There have been few reports on the management of calculi in HSK using ESWL or PCNL. These reports suggest that although acceptable stone free rates can be achieved by ESWL but these appear to be much better following PCNL and it is no more difficult to perform PCNL in patients with HSK than those with normal renal anatomy.[6,7] In several small series PCNL has been shown to be highly successful in horse shoe kidneys with an overall stone-free rate of up to 89%.[6-9]

We report our experience with PCNL for stones in horse-shoe kidneys. An attempt is made to show variation in technique to address the anomalous anatomy.

Patients and Methods

Between June 2001 and January 2005 we performed PCNL in 16 Horse shoe kidneys in 14 patients with calculi. Two patients had bilateral calculi.

Patient's assessment included a medical history , physical examination, urine culture, renal functions tests, serum biochemical evaluation related to stone forming tendency, excretory urography , ultrasonography and, where required radioisotope scanning.

All procedures were done under general anaesthesia with intravenous antibiotic cover. The procedure started with retrograde ureteric catheterization and delineation of pelvicalyceal system with contrast (urograffin) while the patients were in lithotomy position. The patients were then placed in prone position for percutaneous renal access. Percutaneous renal access was established by the urologist under fluoroscopic guidance using the previously highlighted PVC system as a guide. The initial puncture was done by spinal needle (18G) followed by guide wire insertion (0.32G). This was followed by dilatation of tract by means of facial dilator (11Fr) and then by serial metallic dilators (from 9Fr to 27Fr). Finally Amplatz sheath of 28 Fr was placed through which 26 Fr nephroscope (Karl Stortz ™) was passed. Stone fragmentation was performed using pneumatic lithoclast (Swiss Lithoclast™) in all cases. The fragmented pieces were removed by means of forceps. At the end of the procedure nephrostomy tube was placed in all tracts and left on free drainage.

Post operatively plain tomography was performed. The ureteric catheter was removed when x-ray KUB showed complete stone clearance. Nephrostomy tubes were removed on 2nd post operative day. Patients were followed up in out-patient clinic one week after discharge with report of stone analysis. Appropriate dietary counseling was given at this time.

Results

PCNL was performed in 16 renal units in 14 patients. Of these there were 12 males and 2 females. Their ages ranged between 4 to 52 years with a mean age of 26.3 years. Eight patients had stones in right kidney, 4 had stones in left kidney while 2 patients had bilateral stones.

Solitary stones were seen in 7 renal units, 2 kidneys had 2 stones each, 1 kidney had 3 stones while 6 kidneys had more than 5 stones. There were 5 pelvic stones, 4 lower calyceal while 7 kidneys had stones in multiple sites. Stone burden was measured by calculating the digitized surface area. This was done by determining the product of maximum dimensions of the stone on plain X-ray.[6] Surface area in mm^2 was thus calculated for each stone and where more than one stone was present, sum of products was calculated. Our mean stone burden was 820 mm^2 (range 40-1370 mm^2).

Eleven patients (78%) presented with lumbar pain, 3 (21%) had dysuria, 2 (14%) haematuria, while 1 patient presented with bilateral testicular pain. HSK were detected by IVU as an incidental finding in all patients. Pre-operative urine culture revealed no growth of organisms in all cases.

PCNL access tract was made in upper pole in 13 kidneys (80%) while 3 kidneys (20%) had mid-pole access. Complete stone clearance after primary PCNL was achieved in 12 kidneys. Of the remaining 4 kidneys, 2 underwent re-look PCNL via the same tract and one more kidney was rendered stone free, while the other had an insignificant residue of 3mm. Hence we achieved a complete stone clearance rate of 81% (n = 13) after primary and secondary PCNL. Further 2 kidneys underwent single session ESWL for residual stones and became stone free thus improving our complete stone clearance rate after auxiliary procedure to 93.7% (n = 15). Mean hospital stay for these patients was 3.8 days (range 3-10 days, re-look PCNL and ESWL included).

Patients were followed up for 29.1 months (range 11-49 months). Complications were seen in 3 patients (21%) who developed transient post operative pyrexia while 1 patient (7%) presented on the 18th post operative day with a stone fragment in ureter and leakage from PCNL site. He was managed by ureteric catheterization for 48 hours when he passed the fragment spontaneously and became dry. None of our patients developed post PCNL bleeding or wound infection.

Stone analysis showed Calcium Oxalate constituting more than 80% of all stones with phosphate, magnesium, ammonium and uric acid constituting the rest in variable proportions.

Discussion

In horseshoe kidneys, while performing percutaneous surgery, two main factors differ from the normal renal anatomy and have to be taken into account: blood supply and the orientation of the collecting system. An important observation is that all blood vessels except some to the isthmus enter the kidney from its ventro-medial aspect[6], whereas percutaneous access is gained on the opposite side. The dorsal arteries to the isthmus are protected by the spine and are situated away from the nephrostomy tract. With PCNL access in prone position the risk of arterial bleeding is therefore not higher than in a normal kidney.

In the horseshoe kidney most of the calyces point either dorsomedially or dorsolaterally. Generally the orientation of the collecting system offers surprisingly good access to percutaneous nephrolithotomy.[6] The anomalous anatomy results in a lower and more medial position of the nephrostomy tract with a more or less dorsoventral orientation.

In our series percutaneous access was attained after retrograde delineation of pelvicalyceal system, and then the kidneys were punctured with the patient in prone position. In these cases tract was made near or through the paraspinal muscles and was more medial than in an anatomically normal kidney. We found that the tract formed by this method allowed good manipulation of nephroscope. The pelvicalyceal system could easily be inspected for multiple calculi in different calyces. In contrast, in previous series it was found that rigidity of the nephroscope limited free inspection of pelvicalyceal system and they used flexible nephroscope in 80% of their cases to adequately access stones in various calyces.[9] All fragments were easily removed either by forceps or by flushing technique. In one of our patient who had multiple small calculi (more than 100), the kidney was rendered stone free by forming a nephrostomy tract and simply flushing the stones out. In none of our cases more than one tract was required. In the patients who required redo PCNL, the same tract established for initial PCNL, was used. This was done during the same admission.

We found upper pole puncture to be much safer as this resulted in less bleeding and allowed good calyceal inspection. In patients with normal renal anatomy the upper pole calyx typically lies anterior to the posterior portion of the 11th and 12th rib, often requiring a supra-costal approach which may result in intra-thoracic complications.[7] In HSK upper pole percutaneous access is often essential and it is relatively safe due to the inferior displacement of the kidneys away from the pleura and since supra costal approach is not required, violation of the pleural cavity is rare. Because of the malrotation of the kidney, the pelvis may be deep in relation to the puncture site. Extra long Amplatz sheath may help but it is usually the length of the nephroscope that is the limiting factor. One option is to cut the Amplatz sheath to allow the nephroscope to be inserted to maximum.

Al-Otaibi[9] recommends CT scan abdomen in every case before surgery because of the concern of abnormal relationship of the horseshoe kidneys with other viscera particularly the posterior position of bowel, which could result in nephrostomy tract puncturing the bowel. We did not find this to be of any problem while getting percutaneous access. The minimal complications which we encountered in our series included 3 post operative fevers and one wound leakage which occurred on 18th post op day after the patient had been discharged home. This compares favorably with other reported series 25-42%.[7,9,10]

Our series highlights the fact that PCNL in horseshoe kidney does not require any special preoperative investigation or intra operative care provided the surgeon is experienced enough.

There have been few reports on management of calculi in HSK using ESWL. Stone free rates do not compare favorably with PCNL in HSK. Serra[11] showed stone clearance after ESWL in 16 out of 48 kidneys (33%). while Kirkali[12] reported a 28% stone free rate following ESWL in 18 HSK patients. In this series no fragmentation was seen in 22% while residual fragments persisted in 50% with a mean follow-up of 55 months. Clayman[13] demonstrated a 30% stone free rate after ESWL in 10 patients. The current series shows stone free rate following PCNL or re-look PCNL in HSK to be 81%. This is far superior to clearance reported by ESWL and compares favorably with other reported series of 72%[7], 75%[9] and 87%.[10] ESWL as an auxiliary procedure after PCNL improved our complete stone free rate to 93.7%. Moreover mean stone burden as measured by digitized surface area in our series was 820 mm^2 and was significantly larger than 448 mm^2 as reported earlier.[10]

Conclusion

We conclude that PCNL in horseshoe kidneys is no more difficult than in normal kidneys and does not carry a greater risk than reported for normal kidneys. In our hands this effective modality resulted in 93% stone clearance with minimal complications.

References

1. 1.Kaufman E. Lehrbuch der speziellen pathologisten anatomie 2 Berlin; de Gryter 1957; pp. 427-436
2. Evans WP, Resnik MI. Horseshoe kidney and urolithiasis. J Urol 1981;125:620-1.
3. Pitts WR, Muecke MI. Horseshoe kidney and urolithiasis. J Urol 1975; 113: 743-6.
4. Jones DJ, Russell GL, Kellett MJ , Wickham JEA. The changing practice of percutaneous stone surgery. Review of 1000 cases 1981-1988. BJU Int 1990;66:1-5.
5. Segura JW, Patterson DE, Le Roy AJ, William HJ Jr, Barrett DM, Benson RC Jr, et al. Percutaneous removal of kidney stones: review of 1000 cases. J Urol 1985; 134: 1077-81.
6. Janetschek G, Kunzel KH. Percutaneous nephrolithotomy in horseshoe kidneys. Applied anatomy and clinical experience. BJU Int 1988;62:117-22.
7. Jones DJ, Wickcham JEA, Kellet MJ. Percutaneous nephrolithotomy for calculi in horseshoe kidneys. J Urol 1991;145:481-4.
8. Peartree RJ, Ruotolo RA, Khuri FJ, Valvo JR. Percutaneous stone removal in horseshoe kidney. Urology 1986;28:41-3.
9. AL-Otaibi K, Hosking DH. Percutaneous stone removal in horseshoe kidneys. J Urol 1999;162:674-7.
10. Raj GV, Auge BK,Weizer AZ, Denstedt JD, Watterson JD, Beiko DT, et al. Percutaneous management of calculi within horseshoe kidneys. J Urol 2003;170:48-51.
11. Serra AC, Moreno RP, Baron FR, Vicunna FMG, Baron AR , Rodriguez VJ. Current management of calculi in horseshoe kidneys. Scand J Urol Nephrol 200;34:114-8.
12. Kirkali Z, Esen AA, Mungan MU. Effectiveness of extracorporeal shockwave lithotripsy in the management of stone-bearing horseshoe kidneys. J Endourol 1996;10:13-5.
13. Clayman RV. Effectiveness of extracorporeal shockwave lithotripsy in the management of stone-bearing horseshoe kidneys (editorial comment). J Urol 1998;160:1949.