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Flexible ureteroscopy for lower calyceal stones in a horseshoe kidney – Is it the new treatment of choice?

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Abstract
Introduction: The efficacy of retrograde intrarenal surgery (RIRS) for the treatment of disorders in a horseshoe kidney has not been sufficiently studied so far. We report on our experience with this method for the treatment of lower-pole calculi in patients with a horse-shoe kidney.
Patients and methods: The files of 9 patients who underwent RIRS for lower calyceal stones in horseshoe kidneys between April 2012 and December 2014 were retrospectively analyzed. The stone-free status, postoperative complications, operative time and duration of hospitalization were assessed.
Results: In total, 12 renal units with lower calyceal stones were treated, as 3 patients had stones in both kidneys. In 8 renal units complete stone clearance could be achieved in one sitting (67.7%), while in 3 renal units 2 sittings were necessary in order to achieve stone clearance. One patient with a stone sized 18 mm still had residual stones after two sittings and, therefore, underwent percutaneous nephrolithotomy (PCNL) for stone clearance. No major complications (Clavien–Dindo grades III–V) were encountered.
Conclusion: RIRS for the treatment of stone disease in horseshoe kidneys has been shown to be a relatively safe and effective procedure. However, due to the anatomical abnormality, a second look may be needed to render the patient completely stone-free.

Introduction

Horseshoe kidney (HSK) is the most common of all renal fusion anomalies, with a prevalence of 0.25% in the general population [1]. Horseshoe kidneys are fused by the formation of an isthmus between the lower poles of the left and right kidneys during

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development [2]. The insertion of the ureter in the renal pelvis is displaced supero-laterally, probably as the result of incomplete renal rotation, and is associated with a significant rate of ureteropelvic junction 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 (UTI) (24%), urinary calculi (20%) and hydronephrosis [3,4]. There are various modalities used for the treatment of renal stones in HSK, such as shock wave lithotripsy (SWL), ureteroscopy (URS), percutaneous nephrolithotomy (PCNL) and open surgery [1]. The access to lower-pole calculi in a HSK with a flexible ureteroscope is difficult, probably due to the higher insertion of the ureter into the renal collecting system and the acute angle of the lower calyx. The efficacy of retrograde intrarenal surgery (RIRS) for the treatment of defects in a HSK has not been sufficiently studied yet. We herein report on our experience with this method for the treatment of lower-pole calculi in 9 patients with HSK.

Patients and methods

The files of 9 patients (7 men and 2 women) who underwent RIRS for the treatment of lower calyceal stones in a HSK between April 2012 and December 2014 were retrospectively analyzed. The data were recorded with an electronic data management system. Patient assessment included the detailed medical history, physical examination and laboratory tests including urinalysis, urine culture, complete blood count and serum biochemistry. Diagnosis of a lower pole stone was based on computed tomography (CT) including axial, sagittal and transverse sections or on a combination of kidney-ureter-bladder (KUB) radiography, intravenous urography (IVU) and ultrasonography. The stone size was assessed taking the longest axis of the stone. The patients' written informed consent with regard to the type of surgery, a possible need for staging the procedure, the possibility of residual fragments and the possible need for ancillary procedures was obtained prior to the surgery.

Assessment of the surgical results included the stone-free status, postoperative complications, operative time and duration of hospitalization. On the first postoperative day, the patients were subjected to a serum biochemistry test and blood count. In addition, all patients underwent CT or a combination of KUB radiography and ultrasonography for the confirmation of stone clearance one month following the intervention. Treatment success was defined as a stone-free status or the presence of clinically insignificant residual fragments $\leq$4 mm. The patients were followed up every 3 months, subjecting them to urinalysis, urine culture and ultrasonography.

Technique

All procedures were performed using a 7.5Fr FLEX-X2 flexible ureteroscope (Karl Storz, Tuttlingen, Germany) or an Olympus p6R 7.9Fr flexible ureteroscope. All patients received prophylactic antibiotics prior to the procedure. Under general anesthesia, the patient was placed in the lithotomy position on a fluoro-endoscopic table. A hydrophilic guide wire was introduced into the renal pelvis, and balloon dilatation of the ureteric orifice was done. For optimal visualization, a ureteral access sheath was placed over a 0.035″ safety guidewire which was introduced into the renal pelvis. This helps to maintain a low intrarenal pressure and facilitates extraction of stone fragments. A 9.5/11.5Fr sheath was used in cases where the 12/14Fr ureteral access sheath could not be easily maneuvered under fluoroscopic control. When it was not possible to place an access sheath, a double-J stent was placed and the patient was postponed for a 2nd stage procedure.

A holmium: YAG laser (Lumenis, 200 μm caliber fiber) was used for stone fragmentation until they appeared small enough to pass spontaneously. At the beginning of laser lithotripsy, the laser parameters were 0.8 J/15 Hz. When the stone size had decreased to 10 mm, these parameters were changed to 0.6 J/10 Hz in order to avoid the pneumatic effect of the laser, which could result in the stone migrating to other poles. When necessary, residual fragments were extracted using tipless nitinol baskets. The double-J stent inserted routinely in all patients at the end of the procedure was removed during the first postoperative month.

Results

In total, 12 renal units with lower calyceal stones were treated, as 3 patients had stones in both kidneys. Previous renal intervention had been recorded for 7 renal units (58.3%). It consisted of PCNL for 5 (41.6%) and SWL for 2 (16.66%) renal units. The average stone size was 15.41 ± 2.9 mm. In 4 renal units (33.3%) access to the lower calyx was very difficult due to an acute bending of the lower calyx, and therefore stone fragmentation proved to be inadequate. Complete stone clearance in one sitting was achieved in 8 renal units (67.7%), while 2 sittings were required for 3 renal units. One patient with a stone sized 18 mm still had residual stones after two sittings and, therefore, underwent PCNL for stone clearance. The average operative time was 84.2 min. A ureteral access sheath was used in all patients. Complications, all of which were classified as Clavien–Dindo grade I or II, were encountered in 4 cases (33.3%): postoperative fever encountered in two patients was managed with intravenous administration of antibiotics and resolved within 24 h, while one patient complained of stent discomfort and was treated conservatively with analgesia. The remaining patient was re-admitted to the hospital one day after the initial discharge due to acute pyelonephritis. This patient had had prolonged surgery. He underwent PCNL after two unsuccessful attempts at stone clearance. No major complications (Clavien–Dindo grades III–V) were encountered.

Stone analysis revealed calcium oxalate dehydrate in 9 renal units (75%), while a mixed stone type was found in 3 renal units (25%). However, the stone type did not appear to influence stone clearance.

Discussion

Compared to ureteroscopy in the normal urinary system, ureteroscopy in HSKs is significantly more difficult due to the anatomical abnormalities [5].

The technical feasibility as well as the medical condition of the patient often dictate the nature of treatment offered and might preclude some procedures [6]. The treatment options for stones in HSKs include SWL, URS, PCNL and open surgery. SWL may fragment the stones, but due to anatomical variations the passage of stone fragments is not optimal in a substantial number of patients [6].

PCNL has also been used successfully to remove stones from HSKs. Usually, the upper calyx and middle calyx, but not the lower pole calyces are recommended for initial punctures [7]. However, although PCNL is the most commonly used modality for stone treatment in HSKs, it is associated with significant complications [5]. Moreover, flexible nephroscopy plays a vital role in rendering patients stone-free when performing PCNL in anomalous HSKs, especially in the case of isthmic stones [7]. New-generation flexible ureterorenoscopes allow access to almost all calyces. Along with laser lithotripsy and other devices such as access sheaths and baskets, they enable the removal of most calculi. The reported stone-free rates for calculi <1.5 cm range from 50% to 80%, but larger stones can also be treated successfully with PCNL [8].

In the present study, the stone clearance rate was 67.7% after the first sitting. In 3 patients stone clearance could be achieved after the second sitting. In these patients, visualization was poor due to an injured mucosa and bleeding during laser lithotripsy. In one patient, the stone had migrated to an inaccessible calyx after lithotripsy and could not be located, not even in a second sitting. This patient was subjected to PCNL and was rendered stone-free. Stone size and lower pole location are statistically significant factors for failure of RIRS in HSK. This may be due to an acute bending of the entrance of the calyx into the pelvis [9,10]. The difficult procedure is reflected in the long operative time of 92–126 min reported by various authors [10,11]. Our average operative time was 82.4 min.

None of our patients had any major complications or required blood transfusion.

Careful management is needed for patients with preoperative pyelonephritis or pyuria as these are risk factors for postoperative febrile UTI and sepsis [12]. The degree of pyuria is associated with the severity of postoperative febrile UTI [13]. In our series, 2 patients had low-grade postoperative fever. The administration of antibiotics resulted in the fever subsiding within one day. One patient had acute pyelonephritis and needed readmission. At our center, we perform RIRS only when the urine culture is negative and the patient has been afebrile for 48 h.

The limitation of this study lies in the fact that it is a retrospective study and that the number of cases is low due to the rarity of patients with stone disease in a HSK.

Conclusions

RIRS for the treatment of stone disease in HSKs has been shown to be a relatively safe and effective procedure. However, due to the anatomical abnormality, a second look may be needed to render the patient completely stone-free. Further studies on a larger number of cases will be necessary to establish RIRS as the treatment of choice.

Ethical committee

Institutional ethical committee approval was taken whose Chairman was Dr. Chan Bir Singh.

Authors contribution

Dr. Punit Bansal: main operating surgeon and collection of data (drpunitb@gmail.com).

Dr. Anand Sehgal: operating surgeon and manuscript preparation (sananduro@gmail.com).

Dr. Neeru Bansal: evaluation and editing of manuscript (drpunitb@yahoo.com).

Dr. Subhash Singla: helped in designing of study (subhashsingla@gmail.com).

Conflict of interest

No conflict of interest.

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