Treatment of Renal Lithiasis in Patients with Anomalies of the Upper Urinary Tract

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Abstract

Introduction and objectives. Treating urolithiasis is one of the basic skills of urologists, because this pathology affects 1-5% of the population, predominantly the male population. The technique used makes the difference. Renal anomalies make access to the renal collecting system more complex. The aim of this study was to compare two types of minimally invasive treatment – PCNL and fURS with Ho:YAG laser lithotripsy for kidney stones, in patients with anomalies of the upper urinary tract.

Materials and Methods. Two groups of patients with renal lithiasis and associated anomalies of the kidney or of the collecting system were treated with either fURS (18 patients) or PCNL (11 patients). STORZ equipment and Laser Holmium 20w Dornier Medilas with 270 micron fiber optics were used for fURS. For PCNL, Olympus instruments (nephroscope, graspers) and Wolf Swiss LithoClast 2 pneumatic lithotripsy were used.

Results. Although the stone-free rate of PCNL is higher (91%) vs fURS (77.7%), the complication rate is also higher, but the complications are low degree (Clavien Dindo I). Hemoglobin was decreased, on average, by 1.7 g / dL in the PCNL group. There was mild incision site pain in 6 patients after PCNL which required medication only in 2 of them. The hospital stay was longer in the PCNL group.

Conclusions. Both treatment methods are effective and technically feasible. There is a higher stone-free rate in favor of PCNL, but also a longer hospitalization time and an increased risk of peri- and postoperative complications, although these are low grade. In the hands of experienced surgeons, in high patient volume centers, percutaneous access to the upper urinary tract of patients with renal anomalies is safe.

Key-words: flexible ureteroscopy, Holmium laser, renal anomalies, PCNL

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Introduction and Objectives

Urological access to the collecting system and lithotripsy has been described for normal kidneys and normal collecting systems. Any alteration of these may result in changes in vascularization, localization and orientation of the calices, requiring a change in the approach, technique and lithotripsy method. These factors, in theory, increase the difficulty of an intervention and increase peri- and post-operative risks.

The kidney is thus constructed and has thus evolved from an anatomical and embryological point of view to perform its function perfectly. Changes in renal and pielocaliceal system anatomy can lead to urinary stasis and calculus formation. Anomalies which are of interest to this study are the ones that make the access to the upper urinary tract by percutaneous or endoscopic means more difficult and these are represented by anomalies of number, form and fusion, ascent, rotation and anomalies of the collecting system.

Among the changes, renal ectopia has an incidence of 1 in 400 in necropsy series (Campbell, 1930, Coman I 2002) and represents an abnormal kidney migration during intrauterine life. The abnormal, non-anatomical location of the kidney makes endoscopic and percutaneous access difficult.

Unilateral renal agenesis has an incidence of 1:1100 births (Campbell-Walsh Urology, 2011, pag 3132).

The horseshoe kidney occurs in 0.25% of the population (Campbell 2011) or in 1 in 666 individuals (Weizer et al, 2003, cited by Campbell, 2011). It is a challenge because of associated vascular abnormalities – which are very common, both for the intrarenal and extrarenal vasculature, due to the different "wheel spike" disposition of the calyces. The renal pelvis points forward (anteriorly) while the calyces point posteriorly. The horseshoe kidney can be represented by a simple fibrous isthmus between the two renal units, these having separate collecting systems, to the parenchimal isthmus with a modified arrangement of the calyces in order of a full draining of the renal parenchyma and the isthmus. Also, the ureter is implanted higher in the renal pelvis and overlies the isthmus (Tratat de Urologie, page 578, Obstructive Malformations of the Urinary System). These changes may lead to disruptions in urine evacuation, urinary stasis and calculus formation.

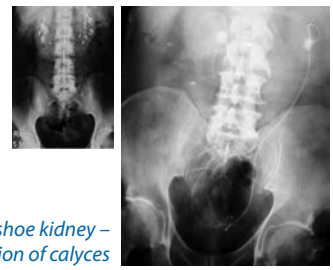

Fig. 1 – Horseshoe kidney – disposition of calyces

The most common collecting system abnormalities are calyceal diverticula, infundibular stenosis with congenital hydrocalicosis, uretero-pelvic junction (UPJ) obstruction, bifid pelvis and pyeloureteral duplication.

Rotational anomalies are usually asymptomatic, so setting the actual incidence is difficult. (Coman I. 2002, Citing Campbell 1963). Any deviation from the lateral orientation of the calices and medial orientation of the renal pelvis, represents malrotation. Older necroptic series reveal an incidence of 1 in 939 individuals (Campbell 1963).

The difficulty associated with percutaneous access to the collecting system in these cases, makes fURS an appealing approach and the logical choice over PCNL. Accessing the upper urinary tract in a retrograde fashion should be safer and easier, which compensates for the increased cost of the intervention (materials and operating time wise).

Materials and Methods

We selected 29 patients with renal abnormalities. Of these, 18 were treated by fURS and 11 were treated by PCNL.

For the PCNL group, the calculi were located as follows: pyelic (6 cases), inferior calices (1 case), multiple affected calices (4 cases).

For the fURS group, calculi were pyelic (5 cases), inferior calices (5 cases), upper calices (3 cases) and several calyceal groups affected (5 cases).

For fURS, STORZ equipment and Holmium Laser 20W Dornier Medilas with 270micron fiber optics were used.

For PCNL, an Olympus Percutaneous Nephroscope set was used with rigid grasping forceps, rigid fine teeth forceps and pneumatic lithotripsy with a Wolf Swiss LithoClast 2 pneumatic lithoclast.

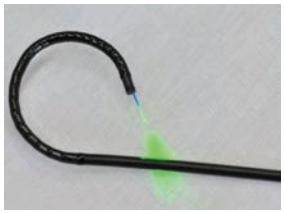

Fig. 2 - Activated laser fiber

Fig. 3 - Pneumatic Lithoclast

Results

The stone free rate was 77.7% in fURS-treated patients and 90.9% in those treated by PCNL.

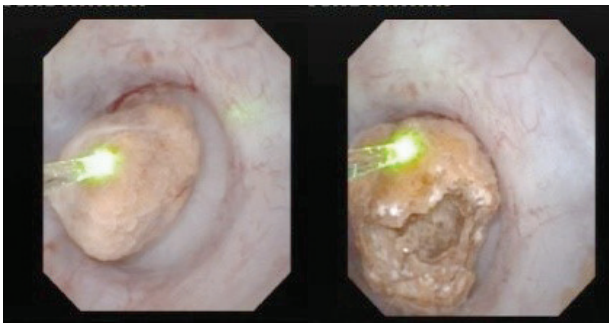

Fig. 4 - In situ caliceal stone laser lythotripsy

In the literature, there seems to be a consensus that PCNL is more likely to generate complications, both haemorrhagic ones (acute anemia, increased transfusion rate) and regarding injuries of the adjacent organs as well as being associated with increased hospital stay. Our findings reveal that there is a higher incidence of blood loss and hospital stay in the PCNL group, hence we abide by this consensus. However, complications were reduced and of low grade - Clavien I. In our study, post-operative complications were mild (Clavien I): haematuria, pain, urinary tract infection.

The decrease in hemoglobin and hematocrit was negligible for the fURS group.

In the PCNL group, hemoglobin decreased on average by 1.7 g / dL and the hematocrit by 5.36% (maybe also in the context of intravenous infusions for post-operative fluid and electrolyte management).

Also, the mean hospitalization period is higher for PCNL patients - 6.4 days, compared to 2.5 days for the fURS group.

Post-operative stenting was used in all cases. In the fURS lot, JJ stents were used in all cases. In the PCNL group, JJ stents were used in 6 cases and simple ureteral stents in 5 cases.

In two cases of the PCNL group, there was an increase in serum creatinine of 0.1 mg/dL, probably by reflex vasoconstrictor mechanism, as demonstrated by Rajash K. Handa in "Percutaneous Access: Acute Effects on Renal Function and Structure in a Porcine Model"; Also, in two cases, a decrease in creatinine was observed with 0.1 mg/dL probably via urinary release, according to "Impact of Stone Removal on Renal Function: A Review" - Kyle Wood, et al.

Conclusions

Both treatment methods are effective and technically feasible for patients with anomalies of the upper urinary tract. There is a higher stone-free rate in favor of PCNL, but also a longer hospitalization time and an increased risk of peri- and postoperative complications, although these are low grade.

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