Flexible ureterorenoscopy in position or fusion anomaly: Is it feasible?

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Article received: 7/3/2017
Accepted for publication: 7/21/2017

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http://dx.doi.org/10.1590/1806-9282.63.08.685

Summary

Objective: To analyze the results of flexible ureterorenoscopy (F-URS) with holmium laser in the treatment of kidney stones with ectopic and fusion anomalies (horseshoe kidney and rotation anomalies).
Method: We reviewed data from 13 patients with fusion and ectopic renal anomalies that underwent F-URS from April 2011 to April 2017. We analyzed demographic and clinical data (age, gender, BMI, anatomical abnormality, location and dimension of the renal calculi) and perioperative data (method of treatment, stone-free rate, number of days with DJ catheter and perioperative complications).
Results: The mean stone size was 12.23 +/- 5.43 mm (range 6-22mm), located in the inferior (58.33%) and middle (16.76%) calyceal units, renal pelvis (16.67%) and multiple locations (8.33%). All 13 patients were treated with Ho-Yag laser, using dusting technique (25%), fragmentation and extraction of the calculi (58.33%) and mixed technique (16.67%). We did not have any severe perioperative complication. After 90 days, nine patients (75%) were considered stone free.
Conclusion: Our data suggest that F-URS is a safe and feasible choice for the treatment of kidney stones in patients with renal ectopic and fusion anomalies.

Keywords: urolithiasis, kidney calculi, kidney diseases, fused kidney.

Introduction

Nephrolithiasis is an increasingly common condition, affecting 5-15% of the world's population and mainly individuals at a productive age between the second and sixth decade of life.[1] In recent years in Brazil, according to Datasus, the number of hospital admissions and costs for the treatment of this condition has increased, with a total expenditure of BRL 29.2 million/year with hospital admissions alone, causing a high impact on public health.[2]

Renal anomalies are relatively rare. Horseshoe kidney (HK) represents the most common fusion anomaly, with an incidence of 0.25%, while the incidence of pelvic kidney varies from 1/2,100 to 1/3,000 and the variance of crossed renal ectopia is 1/1,000.[3] These conditions make it even more challenging to treat urinary lithiasis, with lower success rates in endourologic procedures and increased intraoperative risks due to anatomical differences in renal structure, rotation, and vasculature.[4,5]

Extracorporeal lithotripsy (ESWL) and percutaneous nephrolithotripsy (PCNL) are currently the most common treatment methods for kidneys with fusion or position abnormalities.[6-8] The choice of flexible ureterorenoscopy with holmium laser – Yag (Ho-Yag) as the first line of treatment for stones < 20 mm has been increasing due to important technological advances, but only a few studies have reported their results on anomalous kidneys.

Objective

To analyze the results of flexible ureterorenoscopy (F-URS) with Ho-Yag laser in the treatment of stones in kidneys with position and fusion anomalies (horseshoe kidneys, pelvic kidneys and crossed renal ectopia), evaluating stone-free

rates, operative time, difficulty accessing the calyces and complications.

Method

Data collection

We prospectively collected data from 13 patients with fusion or position abnormalities submitted to the F-URS between April 2011 and April 2017 at the Hospital São Paulo (Federal University of São Paulo – Unifesp, SP, Brazil) and at the Denver Health Medical Center (University of Colorado, CO, USA). Demographic and clinical data (age, gender, BMI, anatomical abnormalities, size and location of the stone), as well as perioperative data (stone treatment method, stone-free index, DJ catheter time and perioperative complications) were collected from the medical records. All patients underwent a control exam within 90 days, either by non contrast-enhanced computed tomography for lithiasis investigation or simple abdominal X-ray. The tomography protocol used the low-dose radioactive modulation technique, with the exception of patients with BMI > 30.[9] The abdominal X-ray, in turn, was used for monitoring patients with radiopaque stones and viewed in this examination prior to surgery.

Surgical technique

The surgical procedures were performed by two endourologists with extensive experience in F-URS (AM, WRM), all under general anesthesia and in a lithotomy position. After performing asepsis and placing sterile fields, cystoscopy was performed with identification of the ureteral meatus looking for abnormalities (duplicity). In all cases, after positioning the guidewire, a semi-rigid retrograde ureteroscopy was performed followed by an attempt to pass an 11/13 Fr or 12/14 ureteral sheath (Boston Scientific). After access to the renal pelvis with the flexible ureteroscope (Storz Flex X2, Oympus URFP5) through the ureteral sheath, a 200 or 273 µm laser fiber was used for the treatment of the stone, adjusted according to the stone's location and composition (pulverization, fragmentation and removal or mixed technique). To perform the mobilization or the removal of stones, we used a 1.9 Fr Zero Tip nitinol stone retrieval basket or 1.9 Fr Escape model (Boston Scientific). In all cases, a double J catheter was used postoperatively. Patients in whom residual fragments < 2 mm were found in the control exams after 90 days were considered as stone free.

Results

A total of 13 patients (six male and seven female) with anomalous kidney stones (five with rotational defects and eight with horseshoe kidneys) were submitted to the F-URS between 2011 and 2017. A non contrast-enhanced abdominal CT was used to determine the dimensions of the stones, with a mean value of 12.23 mm +/- 5.43 mm (ranging from 6 to 22 mm), mostly distributed in only one calycinal group (58.33% in upper calyx, 16.67% in medium calyx, 16.67% in pelvis and 8.33% in multiple calyces). All patients were treated with Ho-Yag laser, with fragmentation and removal of stones in seven cases (58.33%), pulverization in three cases (25%) and mixed technique in two cases (16.67%).

In relation to perioperative complications, there were no intraoperative complications and only one patient with a rotational defect had a mild complication in the first 24 hours after the procedure (hematuria). There were no patients with Clavien III or IV complications during postoperative monitoring. The DJ catheter was maintained for an average of nine days +/- 3.46 (ranging from 6 to 14 days). Ninety (90) days after the procedure, nine patients were stone free (75%), while residual stones were identified in only three cases (25%) (Tables 1 and 2).

Discussion

Renal fusion and positional anomalies are related to an increase in the frequency of kidney stones.[10-12] Anatomic factors associated with concomitant metabolic disorders contribute to this condition, and make endoscopic treatment difficult.[13-15]

TABLE 1 Preoperative findings.

	n (%) or n
Age (years)	46.07 +/- 13.97
Sex	
Male	6 (46.1%)
Female	7 (53.8%)
BMI	26.06 +/- 2.4
Anatomical anomaly	
Rotational defect	5 (38.46%)
Horseshoe kidney	8 (61.54%)
Site of the stone	
Lower calyx	7 (58.33%)
Middle calyx	2 (16.67%)
Pelvis	2 (16.67%)
Upper + Middle + Lower calyx	1 (8.33%)
Stone volume (mm)	12.23 +/- 5.43
Stone density (UH)	924 +/- 328.01
Preoperative stent	
Yes	11 (84.62%)
No	2 (15.34%)

TABLE 2 Perioperative findings.

	n (%) or n
Treatment method for the stone	
Fragmentation	7 (58.33%)
Pulverization	3 (25%)
Mixed	2 (16.67%)
Complications within 24h	
No	12 (84.61%)
Yes	1 (7.69%)
Time with stent (days)	9 +/- 3.46
Stone-free rate after 30 d	9 (75%)
Yes	3 (25%)
No	

PCNL is the chosen option for the treatment of anomalous kidney stones, especially for stones larger than 20 mm, with stone-free rates between 80 and 90%.[16-20] The success of the procedure is impaired by features such as renal pelvis and anteriorly positioned calyces, vascular abnormalities and different anatomical relationships with adjacent organs, which increases the risk of perioperative complications and the difficulty of the procedure.[6-8] A routine preoperative abdominal CT scan can reduce the risk of visceral injury in PCNL, especially in pelvic and horseshoe kidneys.[20,21] Auxiliary methods to aid puncture, such as laparoscopy or ultrasonography, have been described, and present good results.[16,17,22] However, the potential severity of these lesions, in addition to increasing the inherent cost of these auxiliary procedures, favors the search for more conservative treatments.

ESWL remains an interesting option for anomalous kidneys due to its non-invasive nature, although anatomical variations (high ureter implantation, JUP stenosis, etc.) make it difficult to pass stones in a significant number of patients, and complementary procedures are usually required.[1,2] The stone-free rates in anomalous kidneys vary in the literature and depend on the dimensions of the stones. Sheir et al.[23] reported a general success rate of ESWL in anomalous kidneys of 72.2%, with only 46.1% for stones > 15 mm.[1] Tunc et al.,[24] in turn, reported a rate of 92% for stones < 10 mm, but 34% for those greater than 30 mm.[3] Coupled with lower efficiency of ESWL in eliminating larger stones, Ray et al.[13] has pointed out that 51% of their patients needed an additional procedure, but that little improvement occurred after the second session, revealing a limitation in the number of attempts that could be made.

The technological advances in flexible ureteroscopy have allowed its use to be expanded, and it is increasingly used in cases of renal anomalies, especially horseshoe kidneys. Its greater deflection capacity (up to 270°), coupled with progressively thinner laser fibers and the development of nitinol stone extractors have allowed the access and treatment of stones located in lower calyces or erratically-positioned calyces, leading to stone-free rates ranging from 70 to 88.2% in up to 1.5 sessions for stones < 30 mm in diameter.[25-28] Techniques such as reallocation of stones from the lower calyx to the middle or upper calyx aid in the success of the procedure by facilitating fragmentation, as well as increasing the useful life of the apparatus by avoiding excessive use of deflection. For cases with residual calculi, ESWL, PCNL or another F-URS session can be performed, but conservative treatment should not be ruled out when possible. In our series of cases, we obtained a stone-free rate of 75% for stones with a diameter of 12.22 mm (+/- 5.43 mm), with minimal complication rates (one case of transient hematuria), reinforcing data in the current literature that F-URS is currently a safe and effective procedure for the treatment of stones < 30 mm in anomalous kidneys.

Conclusion

Patients with renal position and fusion anomalies are predisposed to the formation of stones and lower success rates in interventional procedures. Although traditionally ESWL and PCNL are the treatments of choice for these patients, advances in F-URS technology have now allowed them to be treated less invasively and with excellent results.

Resumo

Ureterorrenolitotripsia flexível no tratamento de cálculos em rins anômalos: Qual a viabilidade?

Objetivo: Analisar os resultados da ureterorrenolitotripsia flexível (ULT-F) no tratamento de cálculos em rins com anomalia de posição e de fusão (rins em ferradura e rins com vício de rotação).
Método: Realizamos a coleta prospectiva dos dados de 13 pacientes com anomalias de fusão e de posição submetidos a ULT-F entre abril de 2011 e abril de 2017. Analisaram-se dados clínicos (idade, gênero, IMC, anormalidades anatômicas, dimensão e localização dos cálculos) e perioperatórios (método de tratamento do cálculo, índice de *stone free*, tempo de cateter DJ e complicações perioperatórias).
Resultados: Nos 13 pacientes, os cálculos mediam em média 12,23 mm +/- 5,43 mm (variando de 6 a 22 mm),

em sua maioria distribuídos em apenas um grupo calicinal (58.33% em grupo calicial inferior, 16.67% em grupo calicial médio, 16,67% em pelve e 8,33% em múltiplos cálices). Todos os pacientes foram tratados com utilização de laser Ho-Yag, com fragmentação e retirada de cálculos em sete casos (58,33%), pulverização em três casos (25%) e técnica mista em dois casos (16,67%). Não houve complicações intraoperatórias ou pós-operatórias graves. Após 90 dias, nove pacientes tornaram-se *stone free* (75%).
Conclusão: A ULT-F apresenta-se como método seguro e eficaz no tratamento de litíase em rins com anomalia de posição e de fusão.

Palavras-chave: urolitíase, cálculos renais, rim fundido, nefropatias.

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