Actas Urológicas Españolas. 2011;**35(2)**:108–114

Actas Urológicas Españolas

www.elsevier.es/actasuro

SURGICAL TECHNIQUE

Retrograde intrarenal surgery (RIRS). Technical complement for cases of acute lithiasis

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Received December 14, 2010; accepted December 14, 2010

KEYWORDS
Retrograde intrarenal surgery;
Flexible ureterorenoscopy

Abstract

Introduction: Retrograde intrarenal surgery (RIRS) is the ideal complementary approach to flexible ureterorenoscopy (URF) when lithiasic fragmentation is significant or if the anatomy of the renal cavities may obstruct the spontaneous elimination of fragments.

Materials and methods: We performed 37 RIRS on 35 patients with renal lithiasis (14 men, 21 women) with a mean age of 56 (range 33-72) years, divided into two groups in accordance with the size of their kidney stones. Group A, 23 patients with lithiasis <1.5 cm; Group B, 12 cases with lithiasis >1.5 cm. 28 patients had a single kidney stone and 7 had multiple stones. Approach: Flexible ureterorenoscopy, 7.5 Fr (Flex-X2®, Karl Storz) by means of a ureteral access sheath. Holmium laser lithotripsy (Calculase®, Karl Storz) using 200 and 365µ fibres. Fragment extraction with 1.7 Fr nitinol baskets (N-gage, Cook). In cases of excessive stone burden, the renal cavities were washed with low-pressure fluid irrigation using a ureteral access sheath, which was collected together with the stone fragments carried by the "mini-perc" sheath (Ultrax-x® 18Fr, Cook) placed using the percutaneous endoscopic technique at the level of the calyx-papilla selected for fragment drainage.

Results: The mean diameter for group A was 9.13 (range 5-13) mm and 20.25 (range 16-28) mm for group B. The overall mean operating time was 81 (range 30-160) min. Group A required 66.43±35.18 min. and group B 107.5±46.73 min. (p=0.006). The rate of absence of stones immediately after surgery was 83.2%, 93.1% at 3 months (95.6% for A and 83.3% for B; p=0.217). In no case was ureteral stenosis observed as a result of the use of ureteral access sheaths. In 7 group B patients (58.3%) with excessive stone burden and/or alteration in their pyelocaliceal anatomy, we performed active lavage of the renal cavities applying the aforementioned percutaneous technique. The mean post-surgery hospital stay was 2.1 (range 1-4) days. There were post-surgery complications (Clavien 1) in 7 patients (20%). Two patients required a second FURS.

Conclusions: RIRS can be effective treatment for >1.5 cm kidney stones. Lavage of the renal cavities helps to eliminate stone fragments, reducing the possibility of retreatment.

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PALABRAS CLAVE
Cirugía retrógrada intrarrenal;
Uteterorrenoscopia flexible

Cirugía retrógrada intrarrenal (CRIR). Complemento técnico para casos con excesiva carga litiásica

Resumen

Introducción: La cirugía retrógrada intrarrenal (CRIR) es el procedimiento técnico complementario ideal a la ureterorrenoscopia flexible (URF) cuando la carga litiásica fragmentada es grande o si la anatomía de las cavidades renales puede dificultar la eliminación espontánea de fragmentos.

Material y métodos: Hemos realizado 37 CRIR en 35 pacientes con litiasis renal (14 hombres, 21 mujeres) con edad media 56 (rango 33-72) años, divididos en dos grupos de acuerdo al tamaño litiásico: Grupo A, 23 pacientes con litiasis < 1,5 cm; Grupo B, 12 casos con litiasis > 1,5 cm. En 28 pacientes la litiasis fue única y en 7 múltiple. Técnica empleada: Ureterorrenoscopia flexible 7,5 Fr (FlexX2®, Karl Storz) a través de vaina de acceso ureteral. Litotricia con láser holmium (Calculase®, Karl Storz) utilizando fibras de 200 y 365 µ. Extracción de fragmentos mediante cestas de nitinol de 1,7 Fr (N-gage, Cook). Ante carga litiásica abundante se lavaron cavidades renales introduciendo liquido de irrigación a baja presión a través de la vaina de acceso ureteral y recogiéndolo junto con los fragmentos litiásicos arrastrados por vaina de "miniperc" (Ultraxx® 18 Fr, Cook) colocada vía percutánea, bajo control endoscópico a nivel de la papila del cáliz seleccionado a modo de sumidero de fragmentos.

Resultados: El diámetro medio para el grupo A fue 9,13 (rango 5-13) mm y 20,25 (rango 16-28) mm para el grupo B. El tiempo medio operatorio global fue 81 (rango 30-160) min. El grupo A precisó 66,43 ± 35,18 min y el grupo B 107,5 ± 46,73 min (p = 0,006). La tasa de limpieza de litiasis en el postoperatorio inmediato fue 83,2%, a los 3 meses 93,1% (95,6% para A y 83,3% para B; p = 0,217). En ningún caso se observó estenosis ureteral como consecuencia del empleo de vainas de acceso al uréter. En 7 pacientes del grupo B (58,3%) con excesiva carga litiásica y/o alteración en la anatomía pielocalicial se realizó lavado activo de las cavidades renales con la maniobra percutánea descrita. La estancia media postoperatoria fue 2,1 (rango 1-4) días. En 7 pacientes (20%) hubo complicaciones postoperatorias (Clavien 1). Dos pacientes precisaron una segunda URF.

Conclusiones: La CRIR puede ser un tratamiento eficaz en litiasis renal > 1,5 cm. El lavado de cavidades renales ayuda a eliminar los fragmentos litiásicos disminuyendo la posibilidad de retratamiento.

Introduction

The constant evolution of flexible ureterorenoscopy (FURS) with a trend to decrease the calibre and improve the deflection of these devices, together with the design of nitinol devices for the manipulation of kidney stones and the use of holmium laser have extended the therapeutic possibilities of retrograde intrarenal surgery (RIRS), particularly in the field of kidney stones.

In principle, the indications for RIRS were circumscribed to the treatment of failed extracorporeal shock wave lithotripsy (ESWL), mainly in kidney stones of the extremitas inferior renis, limiting their size to 1.5 cm.[1,2] There is currently a clear tendency to use this surgical approach in larger,[3-5] multiple[6] and even stag-horn[7] kidney stones, challenging the use of percutaneous nephrolithectomy (PCNL) with the aim of preventing its potential complications.[8]

However, if RIRS is used for stones smaller than 1.5 cm, it has a higher success rate with very little morbidity. In larger kidney stones, it has some setbacks inherent in excessive stone burdens that are difficult to solve, firstly, the longer operating time, not only of lithotripsy, but also as a result of the need to remove the most fragments to prevent them from accumulating in the lower calyx. Therefore, as the size of the stones increases, the lower the rate of resolution and consequently, the procedure must be repeated once or twice more.[3,4,6,7]

In this work, we present our experience in the treatment of kidney stones with RSIS, underlining the management of >1.5 cm calculi. We describe the technical procedure that is complementary to FURS and that we use when the fragmented stone burden is large or when we observe a renal cavity anatomy that could make the spontaneous elimination of fragments difficult.

Materials and method

Patients

From June 2009 to July 2010, we treated 35 patients suffering from kidney stones (14 men and 21 women), with a mean age of 56 (range 33-72) years, by means of RSIS at our centre. We divided the patients into two groups, in accordance with stone size. i. Group A, corresponded to <1.5 cm stones: 23 patients, ii. Group B, >1.5 cm stones: 12

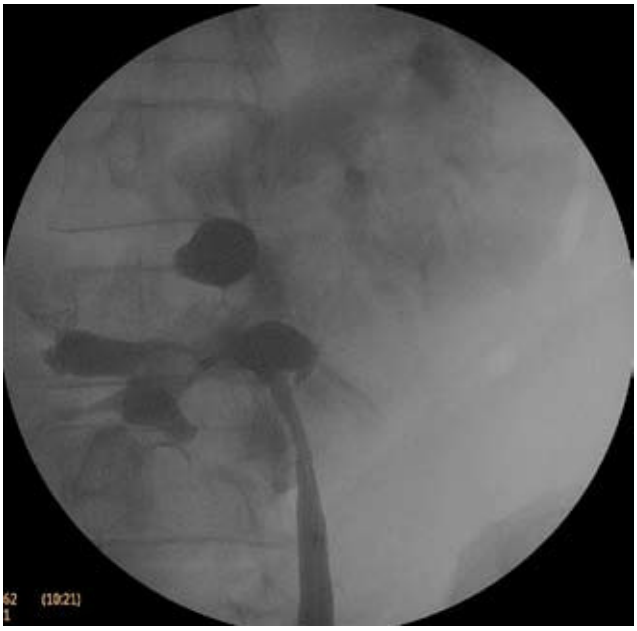

Figure 1 1.8 cm stone in lower calyx of horseshoe kidney.

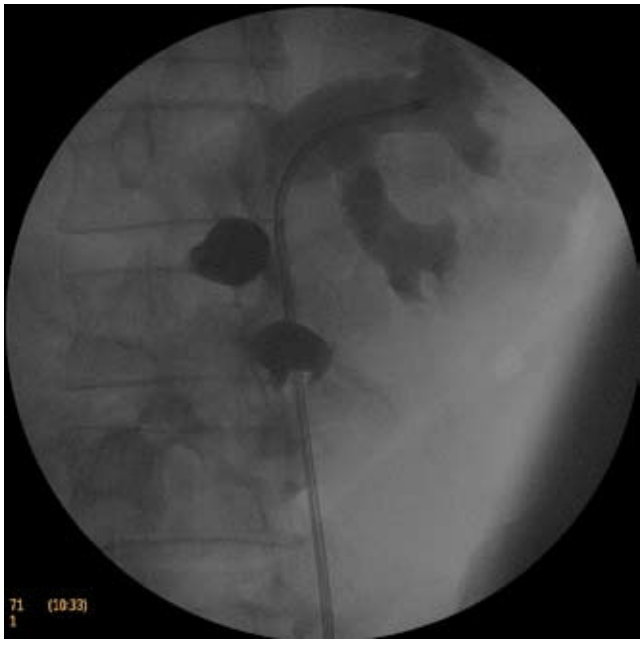

Figure 2 Selection of calyx for fragment elimination.

cases. The inclusion criteria for this treatment were: lithiasis refractory to ESWL (17 cases), post-PCNL residual lithiasis (5 cases), primary treatment indication (13 cases). 28 patients had a single kidney stone located in the extremis inferior renis in nine of them, in the medial calyx in six, in the extremitas superior renis in seven cases and in the pelvis in six cases; seven patients has multiple stones and there was one case of a horseshoe kidney stone (figs. 1-4).

Surgical technique

With the patient in lithotomy position and under general anaesthesia, we began by performing a rigid ureteroscopy

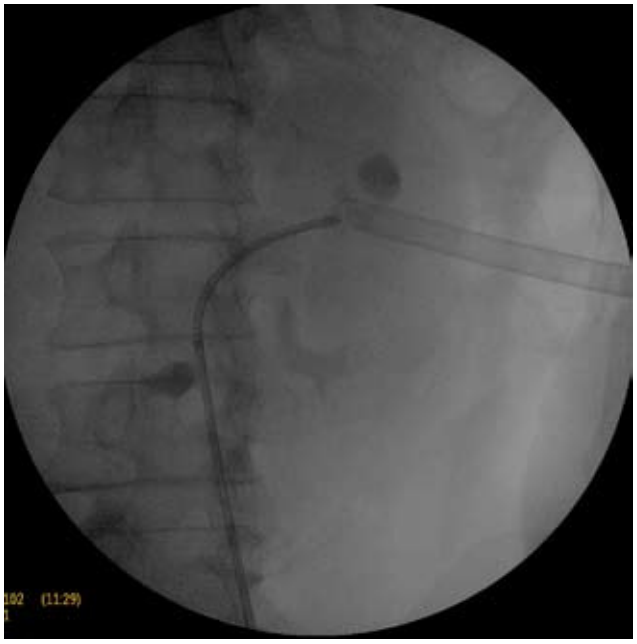

Figure 3 Miniperc® sheath for fragment drainage.

(URS) to dilate the last section of the ureter under direct vision. We passed a 0.038" hydrophylic guide wire (Sensor®, Boston Scientific) through to the renal cavities. On it, we displaced a ureteral access sheath (Navigator® calibre 13-11 Fr, Boston Scientific / Flexor® 14.5–9.5Fr, Cook). In two cases, as we found it difficult to displace the sheath, so we dilated the pelvic ureter with a balloon catheter (Uromax Ultra® 12Fr, Boston Scientific) for five minutes. We introduced a 7.5 Fr (Flex X2, Karl Storz) flexible ureterorenoscopy on the guide up to the renal cavities. After inspecting the renal cavities and locating the stone, we performed lithotripsy using a holmium laser (Calculase, Karl Storz) with 200 and 365µ fibres (figs. 1 and 5). When

Figure 4 Control of tract sealing with Floseal®.

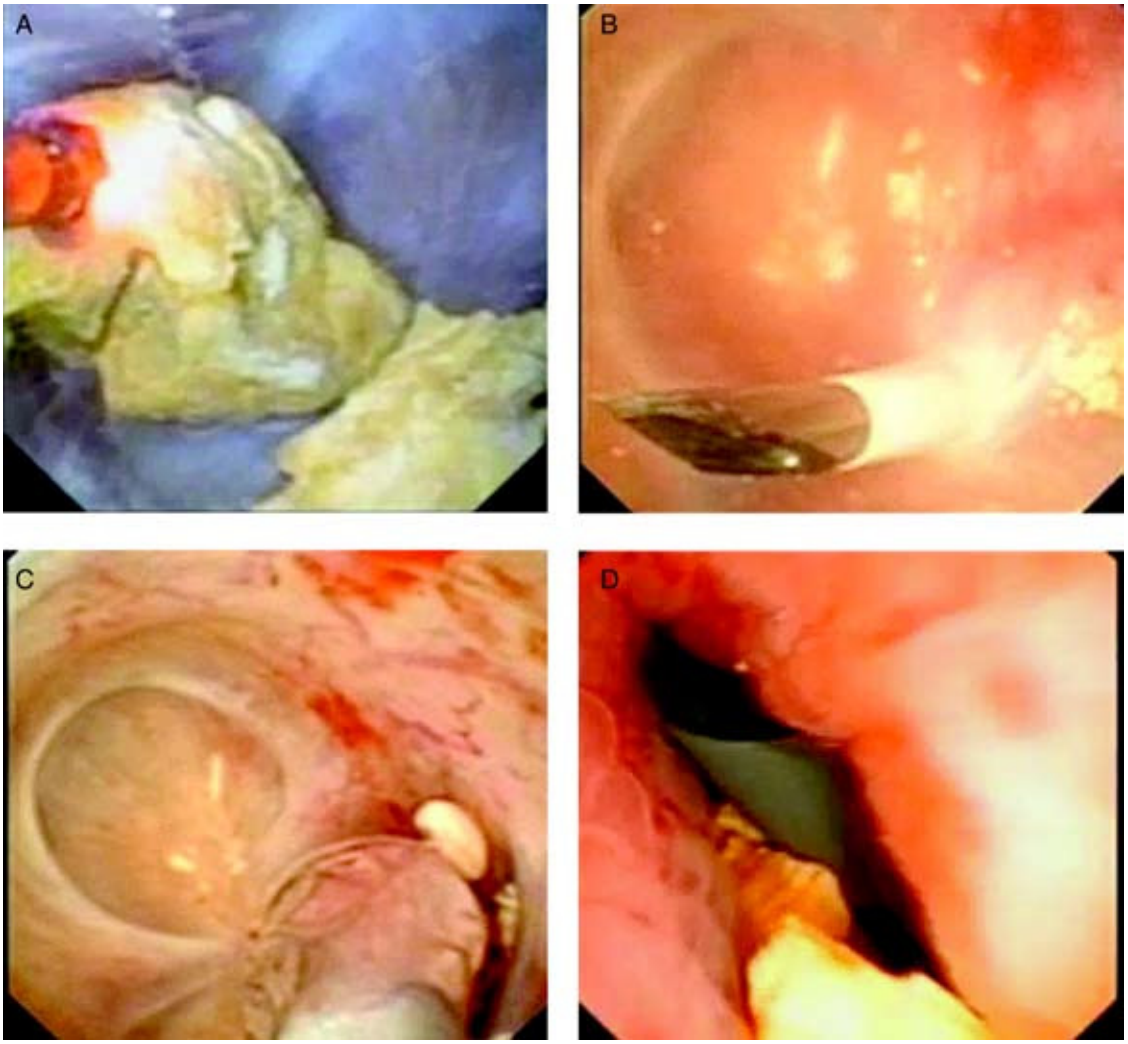

Figure 5 Endoscopic view: (A) Lithofragmentation with Holmium laser; (B) Visual control of the calyx puncture; (C) Dilation with Miniperc® balloon; (D) Stone fragments and sheath to drain them.

the stone had settled in the lower calyx, to avoid working in force deflection, we proceeded to move it using a 1.7 Fr nitinol basket (N-Gage®, Cook) up to the upper calyx to perform the lithotripsy there. If the size of the stone or the impact prevented it from moving, we initiated gross *in situ* fragmentation that allowed us to move the fragments. After completing the lithotripsy, we proceeded to extract the stone fragments through the ureteral sheath by trapping them with the nitinol basket. We concluded by leaving a ureteral catheter for 24 hours or a double-J stent catheter for three weeks, depending on our impression of the clean renal cavities or whether there were small lithiasic remains.

Technical complement for excessive stone burden

After the lithotripsy, we observed a significant fragmented stone burden and completed the lithotripsy by placing a miniature percutaneous access sheath (Ultraxx® 18Fr, Cook) at the level of the calyx papilla, chosen as the fragment drain. The puncture, dilation and placement of the sheath was facilitating by means of endoscopic view (figs. 2, 3 and 5). We performed lavage of the renal cavities by introducing irrigation fluid at a low pressure through the ureteral access sheath and collecting it together with the fragments carried by the miniperc sheath (figs. 5 and 6). Having checked for the absence of lithiasic remains under visual examination, we inserted a Floseal® laparoscopic applicator to free it in the path simultaneously as we removed the sheath (fig. 4). Direct intracavity view also helped us to control this procedure.

Results

We completed the RSIS successfully in 34 of 35 patients. One case had to be interrupted due to bad visualization as a result of bleeding of the excretory duct and we completed it in a second intervention a week later, after placing a double-J catheter for passive dilation of the ureter. This was the only intraoperative complication worth mention.

Figure 6 Spontaneous fragment elimination through sheath.

The average diameter of the stones for group A was 9.13 (range 5-13) mm and 20.25 (range 16-28) mm for group B. The mean overall operative time was 81 (range 30-160) min. Group A required an operative time of 66.43±35.18 min., while group B required 107.5±46.73 min. (p=0.006).

The postoperative success rate immediately after the surgical procedure checked by means of a CT scan and simple x-ray was 83.2% At 3 months, after performing a urographic study, we found that the overall rate of stone elimination was 93.1%(95.6%for group A and 83.3%for group B; p=0.217). None of the patients suffered ureteral stenosis as a result of the systematic use of ureter access sheaths.

In 7 of the group B patients (58.3%) in whom we diagnosed excessive stone burden and/or alteration in the pyelocaliceal anatomy (horseshoe kidney, moderate stenosis of the pyeloureteral union, hydrocalyx), we performed active lavage of the renal cavities. We placed the miniperc sheath used to drain the fragments in a lower calyx (or in an upper calyx in the case of horseshoe kidney) through the simultaneous control of fluoroscopy and FURS. There were no intraoperative or postoperative complications in relation to this complementary technique, or with the sealing of the tract with Floseal®. We repeated the treatment in two patients (one case from group A interrupted due to bleeding and the other from group B due to multiple kidney stones), thus the overall rate of retreatment was 1.05.

The mean postoperative hospital stay was 2.1 (range 1-4) days. We did not find alterations in the levels of haemoglobin or creatinine in any of the patients. There were postoperative complications (Clavien 1) in 7 patients (20%), which consisted of paralytic ileus, abdominal pain, fever in two cases, small perirenal haematoma and haematuria in two patients. They were all successfully resolved with conservative treatment.

Discussion

The advances in the design of ureterorenoscopies added to the use of the holmium laser, have allowed extending the field of indication of FURS, which was initially restricted to diagnosis for the treatment of ureteral and intrarenal lithiasis.[9] On the other hand, it became evident that the evolution of extracorporeal lithotripsy towards the second and third generation of lithotripters had decreased its efficacy, particularly in lithiasis of the extremitas inferior renis,[10] and that FURS was less invasive than PCNL to treat this type of lithiasis.

Notwithstanding, although the first reports on RSIS reported by a few groups that had ample experience informed of high rates of lithiasic resolution (88.5% 92%),[11,12] in the year 2005, the group for the "Study on Kidney Stones of the Lower Pole II", in work designed prospectively in which 19 centres participated, concluded that there are no significant differences in the rate of success when comparing FURS with ESWL in kidney stones of <1 cm, both of them obtaining poor results (50% and 35%, respectively).[13] Probably the differences between the results of these studies is due, on the one hand, to the variations in the methodology of the technique, given that in the multicentre study, there could be technical biases due to the diversity of the surgeons and, therefore, to the differences in the methodology to evaluate residual lithiasis.

Successive studies reaffirm the use of FURS for solving intrarenal lithiasis and inform of high success rates (75% 95%) with few complications (1.5% 12%).[14-16] For this reason, in 2008, RSIS was considered in the guides of the European Association of Urology (EAU) as a second-line option for the treatment of kidney stones refractory to ESWL <1.5 cm.[17]

It was thus demonstrated that the success rate of lithiasis with RSIS was directly related to the size of the stone. In a prospective comparative study, Preminguer[18] concluded that FURS is not efficacious with >2 cm stones, given its small success rate and the high rate of recurrence in the first six months. However the consensus to limit RSIS to stones smaller than 1.5 cm[16,19] was not accepted by several authors who have extended the indications of RSIS to >2 cm calculi, achieving similar successive rates to those of PCNL.[3-7]

However, in relation to the treatment of these calculi, we believe that some aspects, which in our modest opinion have been undervalued, are worthy of discussion, such as the operating time and rate of retreatment. The operating time in RSIS has decreased with respect to the initial series, probably due to the technique being mastered. Nonetheless, in stones >2 cm, it competes with the time used in PCNL at the expense of not removing the stone fragments. In the Mariani series,[7] an average of 64 minutes were employed to resolve 2 to 4 cm branched stones, leaving the fragments to auto-expel themselves. In our study, with the reservations of an even smaller series, the mean operating time was 81 min., and in the >1.5 cm stone group, it was 107.5 min. The latter, although longer than the other groups for this stone size, is acceptable if we take into account that we were trying to remove the majority of the fragments in all the cases. It is obvious that the subgroup of the group B patients (7 patients) in which we performed lavage of the cavities by applying the complementary technique described, helped to achieve this, given that the additional time spent placing the sheath was compensated by the speed of removal of fragments through it.

The second aspect to take into account is the rate of retreatment. RSIS offers the possibility of carrying out a direct evaluation of the stone burden and its degree of fragmentation. This visual control allows identifying which fragments must be trapped and extracted through the sheath and which fragments considered "insignificant" (<4 mm), can be left for their subsequent expulsion. Yet it is evident that the multiple fragments accumulated and left *in situ* and expected to spontaneously expel themselves, as occurs with ESWL, may once again re-accumulate in the lower pole, which would explain the low rate of stone clearance (45%-52%) in large calculi after the first procedure.[4,5,7] In the Grasso and Ficazzola series,[12] for >2 cm calculi, only 45% of calculi clearance was achieved the first time, with a 65% success rate achieved with the second FURS.

Likewise, in multiple calculi, Breda et al.[6] manage to increase the calculi-free rate for stones >2 cm from 52% to 85% using a second procedure. In their series, the average surgical procedures per patient were 1.6. Mariani[20] treated >4 cm branched stones, achieving a calculi-free rate of 88% with a mean of 2.6 procedures.

The justification and acceptance by patients and urologists of a second intervention as opposed to surgery such as PCNL, which can achieve a success rate higher than 90% in a single operation is due to the higher morbidity of PCNL. However, is it really acceptable to repeat surgery that, although it presents few complications, requires general anaesthesia? Supported by the technical variant that we have described, our results shed light on this dilemma. In our series, despite one third of the patients having >1.5 cm stones, we achieved an overall calculi clearance rate of 93.1%, with a mean of 1.05 surgical procedures per patient.

We believe that whenever feasible, a second intervention must be avoided. To achieve this, it is absolutely necessary to eliminate most of the fragments, as the evolution of these fragments is towards progression and the need for retreatment in 63% of the cases due to a clinical condition.[21] On the other hand, their extraction by means of nitinol baskets is an excessively time-consuming task and may be unsuccessful when the fragments are very small because they cannot be captured.

Different approaches have been proposed that attempt to prevent the accumulation of fragments in the lower calyx, such as changing the patient's flank position and placing him/her in a lateral position,[22] or the creation of an autologous clot in the calyx to block the re-accumulation of fragments.[23,24] The technical complement that we propose in the case of a large fragmented burden or when the anatomical conditions of the excretory duct are not optimum for the spontaneous expulsion of the small fragments can effectively solve this problem. Obviously, our study is not random and, moreover, we can be criticized that with the approach that we have described, we increase the possibilities of complications, as we have to perform a percutaneous tract. To defend ourselves, may we indicate that there were no complications in relation to this procedure. The advantage of being able to carry out a precise puncture, as described by Grasso et al.[25] under ureteroscopic control, and the use of a miniature sheath, minimize the morbidity of the procedure. Moreover, the sealing of the tract with Floseal® is also controlled visually, which means that it can be carried out with precision. In our study, with the reservations that the subgroup treated in this manner is small, there were no complications associated with the approach. Finally, we do not consider that to complement FURS with the fragment lavage system by means of a percutaneous surgery sheath is endoscopic combined intrarenal surgery (ECIRS) in the strictest sense, as the tract that we made is not operative, but is used exclusively to drain the fragments.

Conclusions

Retrograde intrarenal surgery can be an efficacious treatment for kidney stones with a diameter of more than 1.5 cm, given that lavage of the renal cavities helps to eliminate most of the stone fragments and decreases the risk of requiring new treatments.

Conflict of interest

The authors declare not to have any conflict of interest.

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