

# THE USE OF URETERAL BALLOON PROBE IN URETERAL CALCULI LITHOTRITY

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**Keywords:** ureteral calculi, lithotripsy, balloon ureteral probe

**Abstract:** The study objective is to evaluate the use of balloon ureteral probes with the purpose of blocking the migration of calculi fragments during ureteral lithotripsy. We have evaluated the data of 110 patients who had retrograde ureteroscopy rigid ureteroscope and ultrasonic lithotripsy for ureteral calculi during 2006 -2010. In 46 patients lithotripsy was applied without using balloon probes – group 1, and group 2 with the use of the probe. The calculi size, time of intervention, success rate and intra-operation complications were compared retrospectively for the two groups. The patient's average age was 34.4 in group 1, and 31.8 in group 2. The average calculi size was of 6.9, respectively 7.4 mm. The average operation time was 65.3 minutes for group 1 and 52.5 minutes for group 2. The success rate was 87.3%, 78.9 for group 1, and 96.8 for group 2, significantly higher for group 2. In both groups there were two minor ureter perforations, solved during the same session. The balloon ureteral probe is a tool useful not only for the widening of the ureteral lumen but also for preventing the ascending migration of calculi fragments resulted during ureteral calculi lithotripsy, insuring the stone-free state.

**Cuvinte cheie:** calculi ureterali, litotriție, sondă ureterală cu balonet

**Rezumat:** Obiectivul acestui studiu este evaluarea utilității sondelor ureterale cu balonet cu scopul blocării migrării fragmentelor de calculi în timpul litotriției ureterale. Material și metodă: Am evaluat datele a 110 pacienți la care s-a practicat ureteroscopie retrogradă cu ureteroscop rigid și litotriție ultrasonic pentru calculi ureterali pe perioada 2006-2010. La 46 pacienți s-a practicat litotriția fără utilizarea sondelor cu balonet, numit grupul 1 și grupul 2 cu utilizarea sondei respective. S-au comparat retrospectiv dimensiunea calculilor, timpul intervenției, rata succesului și complicațiile intraoperatorii la cele două grupuri. Rezultate: Vârsta medie a pacienților a fost în grupul 1:34,4 ani și în grupul 2 :31,8 ani. Dimensiunea medie a calculilor în primul grup a fost de 6,9 mm, respectiv 7,4 mm în al doilea grup. Timpul mediu al operațiilor a fost de 65,3 minute la grupul 1 și 52,5 minute la grupul 2. Rata succesului a fost de 87,3% în total. În grupul 1 de 78,9% și de 96,8% în grupul 2, semnificativ mai ridicat în grupul 2. În ambele grupuri am avut câte două perforații minore de ureter rezolvată în aceeași sesiune. Concluzie: Sonda ureterală cu balonet este un instrument util nu doar în dilatarea lumenului ureteral dar și în prevenirea migrării ascendente a fragmentelor de calculi ureterali, asigurând starea de stone free.

## INTRODUCTION

The treatment for ureteral calculi has marked a continuous evolution in the last two decades by using on a wider scale extracorporeal lithotripsy and ureteroscopy by using different types of lithotriptors: ultrasonic, electro-hydraulic, lithoclast and holium YAG laser for their fragmentation [1, 2, 3]. During disintegration, the retrograde migration of calculus fragments appears in 5 - 40% of the cases [6, 7]. The risk of the retrograde migration is influenced by the irrigation pressure of the working fluid, the type of energy source used in lithotripsy, the position of the pilot calculus, its impacting degree and the degree of hydronephrosis [7, 8, 9]. To solve the problem, balloon probes, stents and more recently NTrap probes are used at present. In this paper we will show our 5-year experience in using the balloon ureteral probe during the lithotripsy for ureteral calculi.

## THE AIM OF THE STUDY

The study objective is to evaluate the use of balloon ureteral probes with the purpose of blocking the migration of the

calculi fragments during ureteral lithotripsy.

## MATERIAL AND METHOD

The retrospective study comprised data on 142 patients on whom ureteroscopies were performed for ureteral calculi. The patients on whom the calculus endoscopic approach was not successful for different reasons, as well as the patients with urinary infections discovered post-operation or whose calculus size required ureterolithotomy were not included in the study. Retrograde ureteroscopy was performed on 138 patients, for 29 of whom the intact extraction of the calculus was successful, a calculus tuck being used or Dormia hamper. 110 patients needed the ultrasonic lithotripsy of the calculus. They were split into two groups: 1 without the balloon probe and 2 with the balloon probe. A rigid 14 Charier Karl Storz ureteroscope was used and an ultrasound lithotripter (sonotrode) made by the same company. The 66 mm 5 Charier ureteral balloon probes, the balloon inflated with a 6 mm diameter, with a 10 cm length which is introduced on a previously placed metallic guide

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## CLINICAL ASPECTS

positioned above the calculus that is to be operated under visual control. The balloon pressure during use was of 2 atmospheres. The calculi size was between 5-10 mm. The calculi type was mostly dihydrate and uric acid, for the oxalate monohydrate ones the fragmentation failed (4 cases). For the correct diagnostic and assessment of the number, type and size of the calculi, the urine test and uroculture, ecography of the urinary apparatus, reno-vesical radiography and urography were performed. The patient had unilateral ureteral lithiasis. Preventively, antibiotics were administered pre-operation to all patients. The operations took place under general anaesthesia, in lithotomy position. Before the introduction of the ureteroscope, a 0.038 inch metallic guide with flexible tip was introduced, with the need for widening the ureteral orifices in some cases. For group 2, the balloon probe was introduced on the guide above the calculus that was to be fragmented with positioning through direct visualization after the introduction of the ureteroscope and the introduction of 5 ml serum into de balloon. Once the calculus is spotted and it is observed that it is impossible to extract it without fragmentation, the lithotripter is introduced on sight and the calculus fragmented. The fragments are removed as much as possible with the calculi tuck; they are qualitatively analysed, and the chemical composition is checked. At the end of the intervention and after the kit used is extracted, ureteral stents were inserted for one week. The operation was considered successful when there were residual fragments bigger than 2 mm and other therapeutic procedures were not necessary. The second day post-operation investigations involved the ecography of the urinary apparatus and the reno-vesical radiography, with the discharge of the patients and the extraction of the ureteral stent after one week. After one month the urine test, ecography and urography were repeated to evaluate the stone-free state.

### RESULTS

The post-operation results of the 110 patients are summed up in the table below.

**Table no. 1. The success rate, surgery time and the complications of the using of the balloon**

	<b>1<sup>st</sup> Group Without balloon</b>	<b>2<sup>nd</sup> Group With balloon</b>
Succes Rate	73,9% (34/46)	96,8% (62/64)
Succes Rate at the dimension of the calculi ≤ 7mm(%)	78,9% (15/19)	90,9 % (20/22)
Succes Rate at the dimension of the calculi >7mm (%)	70,3% (19/27)	100% (42/42)
Time of surgery(min)	65,3	52,5
Intrasurgery complication	4,34 % (2 patients)	3,1% (2 patients)
Failure rate	26,1%(12/46)	3,1%(2/64)
Rate of the calculi migration	21,7% (10/46)	0%

See: table I, figure 1 and 2

In the study took part 46 patients in group 1, of which 34 men and 12 women with the average age of 34.4 years; in group 2 there were 64 patients, on which 43 men and 21 women with the average age of 31.8 years. The average calculi size was of 6.9 mm (5-11 mm), and 7.4 mm (5-12 mm) in group 2, the success rate of endoscopic lithotripsy for the 110 patients was of 87.3% ( 96 patients ), 73.9% (34 out of 46) for group 1, and 96.8% (62 out of 64) for group 2. The success rate for 7mm or under 7 mm calculi was of 78.9% (15 out of 19) in the first group without using the balloon probe, and 90.9% (20 out of 22)

for the second group. For over 7 mm calculi the success rate was of 70.3% (19 out of 27) and 100% (42 out of 42) when the balloon probe was used. The average intervention time for the first group is 65.3 minutes and 52.5 minutes for the second group with the use of the balloon. The failure rate was 26.1% (12 out of 46) for the first group, where in 10 cases there was an ascending migration of the calculi into the kidneys (21.7%) with ureteral stent insertion, needing in the second phase extracorporeal lithotripsy in 4 cases, and the repetition of the ureteroscopy in 2 other cases after 2 weeks. The migrated calculi had sizes between 5-7 mm. For 2 other cases the ureter was perforated intra-operation, the lithotripsy having to be interrupted and a stent had to be inserted for one month (4.34%). For the second group the failure rate was lower due to the absence of calculi migration during the interventions. Nevertheless, there were minor ureteral perforation incidents in this group, in one case during guide manipulation and during the lithotripsy in another case (31.1%). The solution involved the insertion of a stent for one month. All the patients that were operated had transitory hematuria 24-48 hours after the operation, which did not require extraordinary measures. There were no severe complications such as ureteral avulsion. In the first week after the operation the patients had fever in 6 cases, urinary infections treated with antibiotics in 3 cases, and 5 patients had irritative symptoms due to the stent. All of them evolved favourably after the stent was extracted. There were no long-term complications or differences of evolution for the two groups.

### DISCUSSIONS

In the last two decades the methods to tackle the ureteral calculi have changed significantly by generalizing the use of extracorporeal lithotripsy and of ureteroscopy [1, 2, 3]. Extracorporeal lithotripsy is the preferred method in the treatment of ureteral lithiasis, but there are certain circumstances in which ureteroscopy is preferred, for the removal of calculi, although it has a bigger invasion degree [3, 4, 5]. The result of the ureteroscopy approach depends on a complex of factors which includes the place, size, chemical composition, impacting degree, type of lithotripter used and state of upper urinary tract, respectively the degree of hydronephrosis. Thus, for the calculi located on the lumbar ureter, the use of pneumatic lithotripter or a hydronephrosis increase the chances of retrograde migration of the calculi in the pyelocaliceal system [6, 7].

In the specialty literature it is mentioned that the pneumatic lithotripsy has the highest rate of reflux of calculi fragments (15-48%) (8). The ultrasonic lithotripsy is a safe efficient procedure of controlled calculus destruction, and it allows the rapid removal of the fragments resulted under endoscopic tests [7, 9]. The migration of the calculi during fragmentation represents a serious problem, increasing the operation time, the need for a costly flexible kit for the detection and removal of the fragments from the pyelocaliceal system, the need for treatment and additional procedures in order to reach the stone-free state.

The authors recommend the use of temporary obstruction tools during lithotripsy, such as balloon probes, catheters, calculi cones and lately calculi hampers similar to Dormia tucks (N Trap) [9, 10]. The disadvantage of these probes is the fact that they are for one use only, the balloon being once inflated it will not set accordingly on the probe when deflated, won't fit on the cystoscope's work canal [7].

### CONCLUSIONS

This study demonstrates the fact that the use of baloon probes increases the success rate in removing the fragments during retrograde ureteroscopy, especially of over 7 mm calculi.

## CLINICAL ASPECTS

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The tool's usefulness is proved not only for the widening of the ureter during stenosis, but also for the prevention of ascending migration of calculi during endoscopic lithotripsy, ensuring the safe removal of the fragments with minimum incidents.

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