

# Ultrasound Guided Retrograde Endoscopic Ureteral Stenting: Feasibility in Selected Cases

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## ABSTRACT

### Introduction

Ureteral stenting is a routine procedure in urology for a broad range of indications. Impending or actual ureteric obstruction is the most common indication for ureteric stenting and it can be caused by extrinsic or intrinsic compression or by changes of the ureteric wall itself. Obstructed pyelonephritis and intolerable renal colicky pain require urgent stenting. In case of malignant ureteral obstruction it has been recently highlighted that the antegrade approach should be the first choice for the stent placement due to the technical success rate. But, especially in case of stone- or non- stone-non malignant indications to ureteral catheterism, retrograde stenting is the gold standard of ureteral obstruction relief. From a technical point of view, ultrasound guide may be a good practical approach to avoid radiation exposure for the patients and the operators.

### Material and Methods

A retrospective review of consecutive patients that underwent ultrasound guided retrograde endoscopic ureteral stenting (UGREUS) from 2014 to 2021 for several non primary oncologic indications was performed. Patient data were extracted from our internal database. Real time ultrasonic guidance was provided by an expert urologist in ultrasound with fluoroscopy available on standby. Ultrasound was used to visualize advancement of guidewire (placed into the stent if already in site) and the ureteral stent through the ureter and up to the renal pelvis. Procedures were performed in sedo-analgesia in the operating room.

### Results

Fourty-eight patients were identifying that underwent 58 ureteral stenting procedures, 34 (71%) female and 14 (29%) males, bilateral in six cases (12,5%). Operative time varied from 2 to 10 minutes. No major complications related to procedure per se or to anesthesia were recorded. One day surgery was applied in 62,5% of patients. Registered data were compared with a control group of 60 ureteral stenting procedures performed under fluoroscopic guidance and general or spinal anesthesia in the same period.

### Conclusion

UGREUS is a safe, feasible and radiation-free option in the management of ureteral obstruction. Ultrasound could check guide wire progression through the ureter and finally verify the correct stent placement in the kidney, sparing radiation exposure to both patient and operators.

**Keywords:** *Ureteral stenting; Ultrasound; Sedation.*

## INTRODUCTION

Ureteral stenting is a routine procedure in urology. Indications are several and the most common is the impending or actual ureteric obstruction due to extrinsic or intrinsic compression or by changes of the ureteric wall itself. Obstructed pyelonephritis and intolerable renal colic pain require urgent stenting.<sup>1</sup> In case of malignant ureteral obstruction it has been recently highlighted that the percutaneous nephrostomy with or without an antegrade stenting approach should be the first choice for the stent placement due to the technical success rate.<sup>2,3</sup> Especially in case of stone- or non-stone-malignant indications to ureteral catheterism, retrograde stenting is the gold standard of ureteral obstruction relief. From a technical point of view, ultrasound guide may be a good practical approach to avoid radiation exposure for the patients and the operators.

Aim of this retrospective study was to define the feasibility of ultrasound guided retrograde ureteral stenting (UG-REUS) in terms of complications and success rate respect to the same classical fluoroscopic guided procedure (FG-REUS), performed for stone or non-stone-malignant indications, in our daily clinical practice.

## MATERIAL AND METHOD

A retrospective review of consecutive patients that underwent retrograde endoscopic ureteral stenting, ultrasound guided (UG-REUS) and under classic fluoroscopic guidance (FG-REUS), from 2014 to 2021, for several indications, was performed. Patient data were extracted from our internal database. In UG-REUS procedures, real time ultrasonic guidance was provided by an expert urologist in ultrasound with fluoroscopy available on standby. Ultrasound was used to visualize advancement of guidewire (placed into the stent if already in site) and the ureteral stent through the ureter and up to the renal pelvis.. Procedures were performed in sedo-analgesia in the operating room with the assistance of an anaesthetist. As soon as the patient arrived in the operating room, a short peripheral cannula was inserted into the back of the hand, forearm or antecubital fossa and, monitoring of vital parameters began: heart rate, blood pressure and oxygen saturation, which continued until the end of the procedure. Sedation was achieved administering Fentanyl (0.7-1.2 gamma/Kg) and Propofol (1-2 mg/Kg). Most patients remained in spontaneous breathing with supplemental oxygen (2-3L) through nasal cannulae if need. In any case, assistance materials were ready for immediate use if respiratory depression occurred or if other anaesthesiological plans like general anaesthesia hard to begin. After the procedure the patients remained on the ward for 3 hours before being discharged home. During this time, heart rate, blood pressure and oxygen saturation were monitored approximately every 30 minutes. In FG-REUS, after a retrograde contrastography of urinary tract, the procedures were performed previous insertion of a guidewire into the ureteric orifice which is brought up into the kidney under fluoroscopic guidance. Over this wire, the ureteric stent was introduced with a pusher, under x-rays screening. Procedures were performed in spinal or general anesthesia in the operating room. Informed, written consent was taken from each patient before the endoscopy, after explaining all merits and demerits of the procedure. Detailed history and physical examination of every patient was done. Abdominal ultrasonography was done in every patient to see the degree of hydronephrosis and/or the side affected. Patients who were not infected received a single prophylactic dose of intravenous antibiotics two hours before stent insertion. Infected patients had the stenting covered by specific antimicrobial therapy, according to urine culture. This treatment continued until there was no fever and any evidence of infection disappeared. A Foley's catheter was left in the bladder for 48 hours in patients with positive urine culture. In each case, the type

of stent inserted was that of 5 or 6 F and remain in place according to the pathology necessitating stenting. Complications were noted in immediate post-operative period and on follow up.

## RESULT

In Table 1 we reported the non oncological indications to stenting in UG-REUS group. Forty-eight patients underwent 58 ureteral stenting procedures, 34 (71%) female and 14 (29%) males, bilateral in six cases (12,5%). Symptomatic no septic idronephrosis was prevalent (55%). Others indications were presenting before intrarenal surgery (21%), double J routine substitution (17%) and therapy resistant flank pain in pregnancy (7%). Mean age was 38 (29-51), Body mass index (BMI) 27 (26-29). Pre-operative and intraoperative data were reported in Table 2. Operative time varied from 2 to 10 minutes. No major complications related to procedure per se or to anesthesia were recorded. One day surgery was applied in 62,5% of patients. In Table 3 we reported the characteristics of the control group (FG-REUS procedures). Comparing the study group data with this analogue number of ureteral stenting procedures performed in the same period under fluoroscopic guidance, we find only a significative difference in term of procedures mean time duration. All parameters considered were analogue between the two groups of patients.

**Table 1.** Non oncological indications to stenting in UG-REUS group.

INDICATION	N
PRESTENTING BEFORE INTRARENAL SURGERY	12
HYDRONEPHROSIS SYMPTOMATIC NO SEPTIC	32
FLANK PAIN IN PREGNANCY	4
DOUBLE J SUBSTITUTION	10
	58

**Table 2.** Pre operative and operative data

Characteristics	
Age, y	38 (29-51)
Stents, n	58
BMI, kg/m2	27 (26-29)
Sex F/Sex M	14/34
Right	36
Left	16
Bilateral	6
Procedure duration mean, minutes	4 (2-10)
Complications procedural related	0
Complications anesthesia related	0

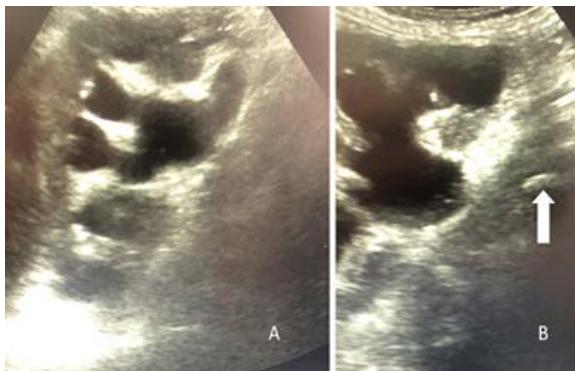
**Table 3.** UGREUS group compared with the FG-REUS population

Characteristic	Study Group UGREUS	Control Group FGREUS
Age, y	38 (29-51)	43 (39-48)
Stents, n	58	60
BMI, kg/m2	27 (26-29)	26 (25-27)
Sex F/Sex M	14/34	20/40
Right	36	33
Left	16	22
Bilateral	6	5
Procedure duration mean, minutes	4 (2-10)	10 (5-15)
Complications procedural related	0	0
Complications anesthesia related	0	0
Retrograde contrastographic evaluation	0	38

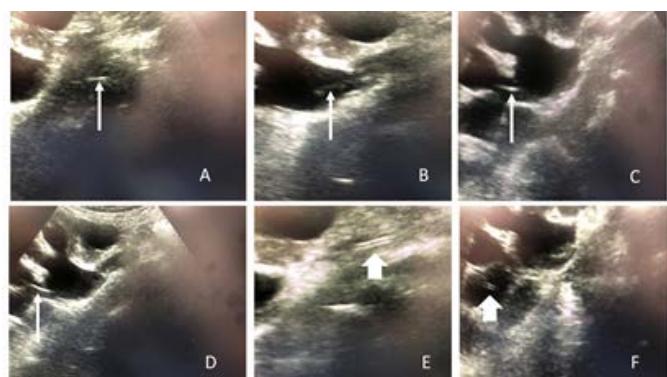
## DISCUSSION

The indications for stent placement are reconducted into three essential categories. First, stent placement may promote ureteric healing by allowing alignment of the wall and decreasing the inflammation and the urine extravasation and directs epithelial growth. Ureteral stenting may prevent complications as, for example, after pyeloplasty or after ureteric repair/replant or as a safety device for the easy identification of the ureter in difficult pelvic surgery procedures. Second, the stent placement is an adjunct to stone treatment both as a method of drainage in the acute presentation, allowing for stabilization of the patient and as a safety device following endourological procedures. Finally, the stent is an optimal device for maintaining long-term patency of the collecting system, most often in the malignant obstruction setting.<sup>4</sup> In our small case series, the patient selection for UGREUS started from the careful evaluation of the possible complexity of the procedure. In a non-oncological setting, ureteral stenting has the greatest chance of success without complications. Then, the use of a technique that could allow the rapid execution of the maneuver cannot disregard all clinical pre procedural information's. Nevertheless a retrograde contrastographic study before inserting the stent is strongly recommended in order to establish the anatomy of the ureter and the collecting system, we think that this is an optional need, being omitted in case of a patient careful selection. As in our case series, the lack of a retrograde contrastographic of the ureter and collecting system did not lead to any complications in the procedure. In general, the use of ultrasound in the diagnosis and management of flank pain or in routine oncologic evaluations has reduced the risk of potentially morbid radiologic studies. Although it is generally accepted that the judicious use of radiation exposure is not contraindicated, the risk-benefit ratio must be carefully weighed. As showed in the figures, the UGREUS procedures allow performing the ureteral stenting without any problem emerging from the lack of contrastographic pre-procedural evaluation (Figure 1 A, B). The guidewire and the stent could be monitored in his advancement until the caliceal system. (Figure 2 A-F). From an anesthesiological point of view, since the urological procedures were very short and minimally invasive, we believed that it is disproportionate to subject patients to other types of anaesthesia such as general or subarachnoid anaesthesia. The type of anaesthesia chosen significantly reduced haemodynamic complications, as it was never necessary to administer volume replacement or inotropic drugs. The procedures were performed on an outpatient basis, and the sedation facilitated a rapid discharge from hospital that would not have been possible after general or subarachnoid anaesthesia.

**Figure 1.** Idronephrosis (A) caused by an iperechoic image (B, arrow) located under the ureteropelvic junction.



**Figure 2.** The progressive advancement of guidewire (thin arrow) is followed by ultrasound through the ureteral obstacle (A), the renal pelvis (B) and the calyxes (C,D). At the end of the procedure, the correct stent positioning is checked (E,F); the stent appear like a binary image (arrow). .



## CONCLUSION

UGREUS is a safe, feasible and radiation-free option in the management of ureteral obstruction. Ultrasound could check guide wire progression through the ureter and finally verify the correct stent placement in the kidney, sparing time of operating room occupation and radiation exposure to both patient and operators.

## CONFLICTS OF INTEREST

None.

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