



# Guidewire for Retrograde Passive Dilatation of Ureter in Pediatric Patients with Urolithiasis: A Novel Technique from a Tertiary Center in Nepal

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## Authors' contributions

This work was carried out in collaboration among all authors. Authors AKS and UBB conceptualization, study design, statistical analysis, and writing the original draft. Authors RKP and GKS reviewing, editing. Authors UBB and RKP data collection and literature search. All authors read and approved the final manuscript.

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## ABSTRACT

**Objective of the Study:** We sought to evaluate the role of guidewire placement as ureteral stent in passive ureteral dilatation for uretero-roscope negotiation in pediatric patients.

**Study Designs:** This was a prospective cross-sectional study.

**Place and Duration of the Study:** Department of Urology, Manmohan Memorial Medical College and Teaching Hospital, Kathmandu, Nepal, (December 2019 to November 2020).

**Methodology:** All pediatric patients (<18 years) diagnosed with more than 6mm size of distal ureter stone undergoing ureteroscopic lithotripsy under general anesthesia in which ureteroscope (4.5/6.5 Fr) negotiation and double J (DJ) ureteral stent (4 Fr) insertion could not be successful in first sitting were selected for the study. Data collection included demographics, clinical parameters, and perioperative and postoperative complications of those patients undergoing preoperative ureteral stenting with guidewire for 2 weeks for ureteroscopic management of ureteric stone after removal of guidewire. The statistical analysis of data was done using Microsoft Excel.

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**Results:** A total of 12 (41 %) cases underwent passive dilatation of ureter with guidewire. The mean age of the patients and mean stone size were  $8.42 \pm 1.7$  years and  $6.1 \pm 0.65$ mm respectively. None of the patients developed intraoperative and postoperative complications related to the procedure.

**Conclusion:** Guidewire placement as ureteral stent for 2 weeks would result sufficient passive ureteral dilatation for the ureteroscopy negotiation without any complication. PUD with guidewire is safe and effective. Additional research is necessary to determine whether the findings will be similar or not.

*Keywords: Guidewire; passive ureteral dilatation; pediatrics urolithiasis; ureteroscopy.*

## 1. INTRODUCTION

Narrow ureter is the most common difficult condition that restricts uretero-rensoscopy (URS) negotiation at first attempt [1]. The prevalence of urolithiasis in children varies worldwide. It accounts about 2-3% of the total stone formers population. The prevalence is gradually increasing in different countries [2,3]. The management of ureteric stone in pediatric patient is almost similar as in adult. However, due to delicate tissue and small caliber organ structure, management of ureteric stone in pediatric patient becomes harder compared to the adult [4]. Stones less than 3mm in size may pass spontaneously while the stones larger than 3mm need surgical management [5].

Many procedures are recommended for the treatment of distal ureteric stone but no methods are ideal [4]. The selection of methods depends upon the age of patient, stone size, location, nature, cost, availability of techniques and expert [6].

In the era of endourology, miniature semi-rigid ureterorenoscopy (URS) (6/7.5Fr 5<sup>0</sup>) with working channel 3mm is newer development in Urology [5]. However, this miniature scope is not applicable in pediatric patients due to virgin and undilated ureters. Sometimes, even the smallest size DJ stent (3.8Fr) may not be negotiable to drain the hydronephrotic kidney [7]. To overcome this situation, the existing ureter may have to dilate actively by serial taflon dilators (cooks) or by scope which may be hazardous to virgin and small pediatric ureter causing injuries resulting in complications like hematuria, stricture, retrograde urinary tract infection and/or vesico-ureteric reflux (VUR) [7-9].

We experienced a new technique to passively dilate the small caliber pediatric ureter by retrograde placement of hydrophilic guidewire (GW) of size 0.02/0.035 inch for at least 14 days in the first sitting when the semi-rigid

ureteroscopy (6/7.5 Fr) could not be successfully negotiated. We aimed to assess the role of the guidewire as ureteral stent placement for preoperative ureteral stenting in children patients. Various techniques of PUD have been tried, but there is no such literature available on the trial of GW with the same objective. Therefore, we justify here to publish the outcomes of our trial.

## 2. MATERIALS AND METHODS

This is a prospective hospital-based, descriptive and cross-sectional study conducted in pediatric patients at the Department of Urology, Manmohan Memorial Medical College and Teaching Hospital, Kathmandu from December 2019 to November 2020.

All pediatric patients (<14 years) diagnosed with more than 5mm size of distal ureter stone undergoing ureteroscopic lithotripsy under general anesthesia in which ureteroscopy (6/7.5 Fr) negotiation and double J (DJ) ureteral stent (4 Fr) insertion could not be successful in the first sitting were selected for the study. They underwent ureteral stenting with straight tip and soft end hydrophilic guidewire (Terumo, 0.02 or 0.035 inch diameter) under the C-arm Figure intensifier control/fluoroscopy guided (Fig. 1). Hypothesis was same as pre-stenting a narrow ureter prior Retrograde Intra Renal Surgery (RIRS) [10]. The guidewire (GW) was fixed with Foley catheter externally by adhesive tape and distal end of GW was inserted inside the urobag (Figs. 2,3). Type of ureteric orifice and the level of difficulty with intraoperative complications in terms of bleeding and ureteric injury were assessed.

It was kept in situ for at least two weeks. Assessment of the patient was done on the phone during the period on every alternate day. The procedure was completed with semi-rigid ureteroscopy (6/7.5Fr with 3mm working channel) following the removal of GW after two

weeks in the second sitting. The scope was negotiated with the guide of stented GW in situ. Scope was negotiated in the dilated ureter without any resistance up to the location of the stone. Stone was identified and fragmented into small pieces by lithotripter (pneumatic) and the procedure was ended with postoperative ureteral stenting with 3.8Fr DJ stent under fluoroscopy for 2-3 weeks. Data collection included demographics, clinical parameters (size of stone), and perioperative and postoperative complications (flank pain, bleeding, fever, urinary tract infection, bladder spasm requiring anticholinergic). Statistical analysis was done with Statistical Package for Social Sciences (SPSS) version 21.



**Fig. 1. Fluoroscopic Figure showing retrograde insertion of guidewire up to renal pelvis**



**Fig. 2. Guidewire has been fixed with the Foley catheter by an adhesive tape**



**Fig. 3. The distal end of the guidewire has been inserted inside the urobag.**

### 3. RESULTS

During the one year study period, we encountered 12 pediatric patients, who needed ureteral stenting with GW due to failure of small size ureteroscopy negotiation in the first sitting. The mean age of the patients was  $8.4 \pm 1.7$  years. There were five male and seven female patients in the series (Male: Female = 1:1.4). It accounted for 41% of the total pediatric cases (29 cases) undergoing URS for ureteric stone management. Laterality of the intervention showed seven ureteral units in the left side whereas; five in the right. According to the selection criteria all the stones were found impacted at the distal part of the ureter. The mean stone size was  $5.1 \pm 0.7$  mm. The mean operative time of first sitting was  $31 \pm 1.4$  minutes, whereas; that of the second sitting were  $55 \pm 11$  minutes. There was no complication encountered during the period of GW ureteral stent in situ.

A majority of the patients (72%) complained of lower abdominal discomfort, but none of them was clinically significant because they did not require any additional intervention. We found significantly dilated and wide ureteric orifice and the lumen so that the negotiation of same ureteroscopy (6/7.5Fr) was easily successful in the second sitting without any resistance or difficulty. None of the subjects developed ascending urinary tract infection, hematuria, and stricture of ureter, which was diagnosed with the help of urine cultures, guidewire tip culture and post-operative USG imaging of upper tract.

**Table 1. Demographic and clinical variables in the study population**

<b>Variables</b>	<b>Findings</b>
Mean Age (Years)	8.4 +/- 1.7
Gender	5 male and 7 female (M:F = 1:1.4)
Laterality	5 right and 7 left
Location of stone	Distal ureter (100%)
Mean stone size (mm)	6.1 ± 0.7
Mean operative time (Minutes): First sitting	31 ± 1 4
Mean operative time (Minutes): second sitting	55 ± 11
Complications	None
Duration of guidewire placement in ureter	14 days

#### 4. DISCUSSION

Globally, pediatrics urolithiasis is increasing gradually [11]. The association of metabolic factors has been found more in children group than in adults. The mean diameter of the ureter in children varies from 2 to 5mm [6]. Locations of ureteral orifice, intramural ureter, level of iliac vessels crossing and uretero-pelvic junction are considered as the narrower part, which results in difficulty in negotiation of URS [7]. Age, height, weight and body mass index are not the predictors of successful ureteroscopy negotiation [1]. However, some literatures quote the age of the patient, expected pathology (stone size and location, UPJ obstruction), presence of either an indwelling ureteral stent or an indwelling nephrostomy tube, coexisting musculoskeletal problems as the factors determining access in the pediatric ureter [5–7,12].

URS is considered as standard of care and first line of treatment modality for the management of ureteric stones in children [6]. Ureteroscopy is safe and effective method to manage urolithiasis in pediatric patients. Routine ureteral dilation and ureteral stent placement are not necessary in this population rather it may increase number of operative sittings, treatment cost and the associated complications [13–15].

Invariably, we may have to abandon ureteroscopy procedure because of the narrow ureter in children. Even the smallest double J (DJ) stents (3.8Fr) may not be successful to negotiate in those cases to drain the hydronephrotic kidney. In such situation, ureteral dilatation is necessary either in the form of active serial dilatation or passive dilatation by the placement of any ureteral means. Both of these procedures are harmful to delicate pediatric ureter [1,7]. The incidence of narrow ureter not accommodating the access of ureteroscopy in first sitting of our study was quite promising with

the findings of a similar study done by D.A. Hameed et al. in which 38.2% of the patients needed the preoperative ureteral stenting [16]. Another study by Carry W. Jr. Herdon reported only 13.79% of the pediatric ureteric stone patients needed preoperative PUD [16]. The overall failure to access rate was 2.5% in a Cochrane style systemic review [17].

The overall complication of URS procedure is 5.9% whereas; there was zero complication in our patients. The common complications of any type of ureteral stent placement are urinary tract infections, bladder spasms requiring anticholinergic, flank pain, hematuria and psychological anxiety [1,7,8]. This may cause ureteral injury, ischemia/stricture, hematuria, and/or vesico-ureteric reflux [8]. The findings of our study go in favor of a study done by Katherine C Hubert (2005). According to him, preoperative preparation for ureteroscopy by PUD is a straightforward, successful and beneficial technique in children, with no associated complications. None of the patients in his study needed active dilatation of ureter for ureteroscopy [8]. We did not find complications in terms of clinically significant flank pain and hematuria, fever, urinary tract infection, ureteric injury and bladder spasm requiring anticholinergic in any patient. The finding can be compared with the systemic review by Hiro Ishii (2014). According to the review, there were 10.5% Clavien I–III complications, 2.2% with failure of URS negotiation in the first sitting where alternative procedure was performed. A higher failure rate (4.4 vs 1.7%) and a higher complication rate (24.0 vs 7.1%) were observed in children whose mean age was less than 6 years. However, URS for the management of ureteric stone in children is a relatively safe procedure [11]. According to the Cochrane style systemic review, the overall complication rate was 11.1% (MCCS – I = 69% and MCCS - II/III = 31%) [17].

Routine placement of ureteral stent is not necessary rather it may increase the number of attempts, costs and the complications [7]. Placement of a ureteral stent for passive ureteral dilation is not necessary for successful ureteroscopy in the first sitting. It decreases the number of procedures while maintaining a low complication rate [7,18]. The decision of preoperative ureteral stenting during URS depends upon the treating urologist and the surgeon's experience and the type of endoscopic instrumentation available [6].

Children require smaller diameter ureteroscopes together with lithotripsy modalities that can be negotiated through the small working channels [17]. In our study, all patients were treated with smaller size semi-rigid pediatric ureteroscope (6/7.5 Fr with 3 mm working channel). Stone fragmentation was done with pneumatic lithotripter. The ureteroscopic management of ureteric stone has been considered challenging. This is why it is reserved as a salvage option for last resort. The refinement in designs of scope and miniaturization ureteroscopes and advancement in ancillary instruments have proven a quite promising interest of urologist in coming worldwide [17,19,20]. Newer advancement in the endourological armamentarium is available. They are rigid, semi-rigid (4.5 Fr) and flexible (6 Fr) ureteroscopes for children patients. Improved designs of the scopes and fiber-optics have made the surgeon's life easier while managing the case [11,20].

Ureteric orifice may be spasmodic in cases of ureteric calculus which is normal phenomenon unless there is ureteric stenosis since birth. While doing Ureteroscopy such spasmodic ureteric orifice can be negotiated easily if done with skill [21]. A significant number of literatures are available there on the evidence of increasing number of urolithiasis in children groups but the original studies published on ureteroscopy in children and critical review still remains under-reported. Different clinical trials on advancement in pediatric ureteroscopy are needed. The implication of the evidence available from our study is promising but requires further large trails in the coming future.

## 5. CONCLUSION

Guidewire placement as ureteral stent for two weeks is an efficient and sufficient passive ureteral dilatation for ureteroscope negotiation

without any complications. PUD with guidewire is safe and effective.

## CONSENT

As per international standard, parental written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

The authors have obtained all necessary ethical approval from Institutional Review Board (IRB). This confirms either that this study is not against the public interest, or that the release of information is allowed by legislation. All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. A copy of Institutional Ethical Approval letter has been submitted with the manuscript.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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