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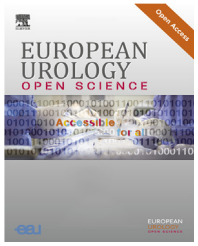

European Association of Urology

Stone Disease

Ureteroscopy in Patients with Urinary Diversion: Outcomes and Lessons Learned from Two European Centres

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Abstract

Background: Ureteroscopy (URS) in patients with urinary diversion is technically challenging. Common difficulties include anastomotic strictures, tortuosity, and failure to cannulate the ureteric orifice. There are few studies reporting outcomes in this special population.
Objective: Our aim was to report outcomes at two tertiary centres in Europe.
Design, setting, and participants: A multicentre retrospective cohort study was conducted between 2010 and 2022.
Intervention: URS (antegrade and retrograde) procedures carried out in patients with urinary diversions.
Outcome measurements and statistical analysis: Outcomes of interest included success at cannulating the ureteric orifice, stone-free rate (SFR), and complications. A logistic regression analysis was performed to identify potential predictors for success at cannulating the ureteric orifice and success at completing the intended procedure in a single session.
Results and limitations: Fifty patients underwent 72 URS procedures, with most (86%) undergoing a retrograde approach. The majority (82%) of patients had undergone ileal conduit. Wallace was the commonest anastomosis type (64%). Ureteric anastomosis was cannulated successfully in 81% of cases. The most common reason for cannulation failure was the inability to identify the ureteric orifice (11%). A multivariable analysis revealed that an endourologist performing the case was associated with a significantly greater likelihood of cannulation success compared with consultants (odds ratio 25.9, $p < 0.001$). The mean operative time and hospital stay were 49 min (range: 11–126) and 1 d (range: 0–10), respectively. SFRs were 75% (zero fragments) and 81% (residual fragments $\leq$2 mm). No intraoperative complications were recorded. The overall postoperative complication rate was 6%. This study is limited by its retrospective status.

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Conclusions: Endourological experience increases the likelihood of successful ureteric cannulation and procedural success. A low complication rate can be achieved despite this being a population with often multiple comorbidities.
Patient summary: Patients with previous bladder reconstructive surgery can undergo ureteroscopy with good outcomes. Surgeon experience increases the likelihood of treatment success.

1. Introduction

Ureteroscopy (URS) in patients with urinary diversion can be indicated for a number of reasons, including both diagnostic (eg, suspected malignancy) and therapeutic (eg, stone disease). In the context of this special patient group and the associated complex anatomy, URS is recognised to be technically challenging [1–3]. Anastomotic strictures, tortuosity, and inability to identify and cannulate the ureteric orifice represent common pitfalls [4]. This can result in the initial approach failing. A multimodal endourological approach can often therefore be required to achieve a successful result. However, there currently exists only a small pool of studies reporting the outcomes of URS in patients with urinary diversions [4]. Moreover, the presence of abnormal anatomy is a commonly reported exclusion criterion in prospective and randomised studies for stone disease [5–7]. While this particular clinical topic groups receive mention in current European guidelines, this is only limited [8]. It can therefore be argued that the evidence basis to guide endourological management for this special population remains lacking. Our aim was to report outcomes at two tertiary centres in Europe and identify any lessons to be learned regarding the endourological management of this special patient group.

2. Patients and methods

A retrospective analysis was performed for consecutive URS (antegrade and retrograde) procedures carried out between 2010 and 2022 at Haukeland University Hospital (Norway) and University Hospital Southampton (UK). Both these units are tertiary referral centres for urological cancer and endourology. The project was registered as a clinical audit at both sites. All patients undergoing URS for diagnostic and/or therapeutic purposes were included. These patients had also been discussed in a multidisciplinary team setting. This allowed, for example, a management plan to be established regarding approach type (antegrade/retrograde or combined), onward plan if initial surgery fails, and requirement for new imaging. Patients may also not have been seen in the clinic by a clinician with relevant experience, so it also acts as a safety measure. All patients undergoing antegrade URS had a preexisting nephrostomy. In all cases, these had been placed during a previous emergency admission rather than a planned nephrostomy before surgery. Where a patient had an indwelling nephrostomy, this was chosen as the approach method. For this study, antegrade URS was defined as the use of a flexible ureteroscope via the renal tract. Dilation ranged between using a ureteral access sheath via an established nephrostomy tract or dilating up to 24Fr using an Amplatz dilator depending on surgeon preference and individual patient factors. Individual patient consent was determined not to be necessary.

All types of urinary diversions were included as well as those performed for either malignant or benign indications. Patients undergoing retrograde URS with indwelling ureteral stent(s) were excluded. Endourological treatment of strictures was done using balloon dilatation. Patients had a preoperative urine analysis performed approximately 1 wk prior to surgery. If positive for infection, urine was sent for culture testing and antibiotics were commenced. These were adjusted based on sensitivity. The course was continued during the operative period. Urine culture was not repeated unless a time delay occurred until the operation date. A repeat urine analysis was done on the day of surgery, and unless patients had a tailored antibiotic strategy, they received empirical prophylaxis according to the local guidelines of the respective hospitals.

The primary outcomes of interest were success at cannulating the ureteric orifice and predictors of successfully managing the clinical problem in a single session (eg, clear stone burden, diagnose malignancy recurrence, or treat stricture). The secondary outcomes were stone-free rate (SFR), and success of endourological stricture treatment and complications. Postoperative complications were those recorded within the first 30 d and were graded according to the Clavien-Dindo system [9]. SFR was determined by computed tomography (CT) imaging performed at 3 mo after surgery. Two definitions for an SFR were used: zero fragments and residual fragments $\leq$2 mm. In addition to patient characteristics, data were also recorded on diversion type (ileal conduit, orthotopic bladder substitution, and Lundiana), anastomosis type for ileal conduit, time between original surgery and URS, use of an access sheath, exit strategy, operative time, duration of hospital stay, and operator experience. With respect to operator experience, an endourologist was defined as a surgeon having performed >500 flexible URS [10].

2.1. Statistical analysis

A logistic regression analysis was performed to identify potential predictors of success at cannulating the ureteric orifice and success at completing the intended procedure in a single session. The chi-square test was performed to compare categorical data. All statistical analyses were performed using R version 4.1.1 [11]. For all analyses, $p < 0.05$ was considered statistically significant.

3. Results

In total, 50 patients underwent 72 URS procedures (Table 1). The majority (86%) of these were retrograde URS procedures. With the exception of two cases, all operations were performed in the elective setting. The male to female ratio was 3:1, and the mean age was 67 yr (range: 19–91). The mean age-adjusted Charlson Comorbidity index (ACCI) was 5 (range: 1–10). Surgery was performed by a total of four different endourologists and nine different consultant urologists. The majority (82%) of patients had undergone

Table 1 – Patient and stone characteristics

Demographic	Total
Total number of patients	50
Total number of URS procedures	72
Male:female ratio	3:1
Age (yr), mean (range)	67 (19–91)
ACCI, mean (range)	5 (1–10)
Time setting, *n* (%)	
Emergency/elective	2 (3)/72 (97)
Indication for cystectomy	
Benign	20 (28)
Malignant	52 (72)
Diversion type, *n* (%)	
Ileal conduit	59 (82)
Orthotopic bladder substitution	12 (17)
Lundiana	1 (1)
Anastomosis type of ileal conduit, *n* (%)	
Wallace	38 (63)
Bricker/Nesbit	22 (37)
Time between cystectomy and URS (mo), median (range)	30 (11–70)
Indication for URS, *n* (%)	
Stone	21 (30)
Suspected malignancy/recurrence	24 (33)
Hydronephrosis and suspected stricture	26 (36)
Miscellaneous	1 (1)
Stone characteristics	
Single (%)/multiple (%)	67/33
Largest dimension index stone (mm), mean (range)	13 (3–26)
Cumulative size (mm), mean (range)	17 (3–37)
Location	
Ureter (%): distal/mid/proximal	24/10/10
Renal (%): upper pole/mid pole/lower pole/pelvis	5/10/19/24

ACCI = age-adjusted Charlson Comorbidity Index; URS = ureteroscopy.

Table 2 – Operative data

Anaesthesia, *n* (%)	
GA	69 (96%)
Spinal	3 (4)
Operator experience, *n* (%)	
Endourologist	60 (83)
Consultant urologist	12 (17)
Preoperative infection, *n* (%)	15 (21)
URS approach, *n* (%)	
Retrograde	62 (86)
Antegrade	8 (11)
Simultaneous retrograde/antegrade URS	2 (3)
Side, *n* (%)	
Right/left	43 (60)/29 (40)
Bilateral URS, *n* (%)	15 (21)
Access sheath use during retrograde URS, *n* (%)	12 (17)
Successful cannulation of ureteric orifice, *n* (%)	
Yes	52 (82)
No—not identified	7 (11)
No—anastomotic stricture	4 (6)
No—tumour at orifice	1 (1)
Successful access to renal unit, *n* (%)	
Overall	62 (86)
Retrograde:	52 (82)
Antegrade[a]	8 (100)
Simultaneous retrograde/antegrade[a] URS	2 (100)
Overall success of intervention in single session, *n* (%)	59 (82)
Postoperative drainage, *n* (%)	
JJ stent	32 (44)
Nephrostomy	20 (28)
Nothing	20 (28)
Operative time (min), mean (range)	49 (11–126)
Hospital stay (d), mean (range)	1 (0–10)

GA = general anaesthesia; URS = ureteroscopy.
[a] Success at accessing the level of pathology.

ileal conduit, and Wallace (64%) was the commonest anastomosis type. The median period between original surgery and URS was 30 mo (interquartile range 11–69). Indications for URS were as follows: stone disease (30%), suspected malignancy/recurrence (33%), hydronephrosis and suspected stricture (36%), and miscellaneous (1%). The ureteric anastomosis was cannulated successfully and access to the renal unit was gained using a retrograde approach in 81% of cases (Table 2). The most common reason for cannulation failure was the inability to identify the ureteric orifice (11%). In six of the seven cases where it could not be identified, retrograde URS had been performed by a general urologist, and when repeated by an endourologist, it was successful. In the remaining case, the patient had an antegrade stent placed. They were relisted and underwent successful surgery on the second attempt. Other cases of cannulation failure were stricture (6%) and tumour recurrence (1%), all of which went on to have reconstructive surgery to definitively treat the underlying problem. For ileal conduits and anastomosis type, no significant difference was found regarding cannulation success rate comparing Wallace (87%) and Nesbit (80%; $p = 0.8$). All cases performed using an antegrade approach were successful on the first attempt at reaching the level of the pathology. Five of the patients with stone disease experienced stone recurrence within the study period. The mean time to recurrence was 2 yr, and all patients had previously undergone CT confirming stone-free status prior to recurrence being identified. All cases that were successful at the time of initial URS were subsequently successful at the time of later URS for recurrence.

A multivariable analysis revealed that an endourologist performing the case was associated with a significantly greater likelihood of cannulation success (odds ratio [OR] 25.9, $p < 0.001$; Table 3). Success in this regard was also expected to be higher when URS is performed on the left side because of beneficial anatomy, but due to the limited number of patients, no significant difference was found in the present study (OR 5.0, $p = 0.1$). When the indication for URS was suspected stricture, this was a risk factor for failure (OR 0.1, $p = 0.018$). The mean operative time and hospital stay were 49 min (range: 11-126) and 1 d (range: 0–10), respectively. When assessing the likelihood of treating the clinical problem in a single session, this was achieved in 82% of cases. A univariable analysis revealed that the chances were significantly higher if an endourologist performed the case (OR 24.3, $p < 0.001$) and if a longer period had elapsed since the date of the original surgery (OR 9.6, $p = 0.022$). However, on a multivariable analysis, only the former achieved statistical significance (OR 19.0, $p < 0.001$; Table 4).

3.1. Complications

No intraoperative complications were recorded across the whole study period (Table 5). The overall postoperative complication rate was 6%. One patient was admitted to the intensive care unit due to urosepsis, and this represented the only major complication (Clavien-Dindo IV). No deaths were recorded, and no patients were lost to follow-up.

Table 3 – Multivariable regression analysis of predictors of ureteric cannulation success. Significant values are highlighted in bold.

Characteristic	Univariable				Multivariable		
	N	OR	95% CI	*p* value	OR	95% CI	*p* value
Operator	64			**<0.001**			**<0.001**
Consultant		–	–		–	–	
Endourologist		16.8	3.8, 87.2		25.9	4.0, 302	
Laterality	64			0.08			0.1
Right		–	–		–	–	
Left		3.7	0.9, 25.4		5.0	0.8, 59.0	
Diversion type	64			0.2			
Ileal conduit		–	–				
Other		0.4	0.1, 1.8				
Anastomosis type	64			0.8			
Bricker		–	–				
Wallace		1.4	0.3, 5.8				
Other		0.8	0.1, 4.5				
Indication diversion	64			0.6			
Malignancy		–	–				
Benign		0.7	0.2, 2.8				
Indication URS	64			**0.031**			**0.018**
Stone treatment/suspected malignancy and other		–	–		–	–	
Suspect stricture		0.2	0.1, 0.9		0.1	0.01, 0.7	
Years after surgery	61			0.13			0.4
<1		–	–		–	–	
1–3		0.9	0.2, 4.0		0.3	0.04, 2.2	
>3		4.2	0.7, 33.7		0.9	0.1, 10.5	

CI = confidence interval; OR = odds ratio; URS = ureteroscopy.

Table 4 – Multivariable regression analysis of predictors of treatment success in a single session. Significant values are highlighted in bold.

Characteristic	Univariable				Multivariable		
	N	OR	95% CI	*p* value	OR	95% CI	*p* value
Operator	72			**<0.001**			**<0.001**
Consultant		–	–		–	–	
Endourologist		24.3	5.9, 12.0		19.0	3.9, 13.0	
Laterality	72			0.3			
Right		–	–				
Left		1.9	0.6, 7.6				
Diversion type	72			0.3			
Ileal conduit		–	–				
Other		0.5	0.1, 2.0				
Anastomosis type	72			0.1			0.7
Bricker		–	–		–	–	
Wallace		4.0	1.0, 17.1		2.0	0.3, 14.8	
Other		1.4	0.3, 7.8		2.0	0.3, 19.2	
Indication diversion	72			>0.9			
Malignancy		–	–				
Benign		1.0	0.3, 3.9				
Indication URS	72			0.5			
Stone treatment		–	–				
Suspect malignancy and other		0.9	0.2, 4.5				
Suspect stricture		0.5	0.1, 1.9				
Antegrade or retrograde	72			0.4			
Retrograde		–	–				
Antegrade/other		2.4	0.4, 46.1				
Years after surgery	68			**0.022**			0.4
<1		–	–		–	–	
1–3		0.9	0.2, 3.6		1.1	0.2, 6.8	
>3		9.6	1.4, 195		5.1	0.5, 126	

CI = confidence interval; OR = odds ratio; URS = ureteroscopy.

Table 5 – Summary of complications

Intraoperative complications	
Total	Nil
Postoperative complications (within 90 d)	
Total	4 (6%)
UTI	1 (2%) CD II
Arrhythmia	2 (3%) CD II
Urosepsis	1 (2%) CD IV
New stricture on postoperative imaging	1 (2%)

CD = Clavien-Dindo; UTI = urinary tract infection.

3.2. Follow-up

SFRs were 75% (zero fragments) and 81% (residual fragments $\leq$2 mm). At follow-up CT imaging, the rate of new stricture formation was 2%. None of the patients treated endoscopically for stricture (6%) had resolution at the time of follow-up imaging. This resulted in the onward treatment plan being either surgical reconstruction (3%) or a more conservative approach in the form of lifelong ureteric

stent/nephrostomy (3%). This was based on a shared decision considering their own wishes, functional status, and individual case history. These strictures had all been located at the anastomotic site for cases undergoing diagnostic URS for hydronephrosis. Percutaneous nephrolithotomy (PCNL) was not performed in this series. Out of the two patients who underwent a combined approach, one required auxiliary treatment in the form of PCNL.

4. Discussion

This study from two tertiary centres shows that a high technical success rate (>80%) at cannulating the ureter can be achieved with retrograde URS in patients with urinary diversions. Furthermore, although many of the patients with urinary diversion had multiple comorbidities (mean ACCI 5), the complication rate was relatively low (6%). A recent systematic review revealed that only six studies on this topic have been published to date and these studies included a total of 190 procedures [4]. Reported success rates ranged from 56% to 80.4% [12,13]. The overall postoperative complication rate reported in the review was 10.6% [4]. Our study found that previous URS experience, that is, an endourologist, was associated with both success at cannulating the ureter and treating the clinical problem in a single session. Technical recommendations that have been put forward are the use of an initial contrast study to delineate anatomy, judicious use of access sheaths to negotiate tortuous segments, and employing guidewires of varying stiffness [1]. More novel solutions such as tattooing the anastomosis landmark at the time of the original surgery have also been put forward [14]. However, long-term studies recording the efficacy of this technique are lacking.

We recommend that in patients in whom access via nephrostomy is already established, this approach (ie, antegrade) is adopted rather than a retrograde approach. The surgeon can thereby circumvent the need to cannulate the ureteric orifice, which can not only be unsuccessful, but also be time consuming. Benefits of using a combined approach include that a through-and-through guidewire can reduce the risk of inadvertent access loss as well as add stability to the kidney, especially if switched to a stiff wire [15]. While it was not performed in this series, the surgeon can consider a percutaneous renal puncture at the time of surgery for those without indwelling nephrostomy to allow for a combined approach. Patients should therefore provide consent for this possibility preoperatively. However, potential challenges include the lack of a dilated upper tract, as well as an increased risk of complications such as bleeding and adjacent organ injury. It may also require the availability of interventional radiology and/or another surgeon if it is planned to work simultaneously from both ends.

The exit strategy can be tailored to the individual patient. Indications for a stent include if there has been bleeding, ureteral trauma, and residual fragments. In accordance with the European Association of Urology guidelines, this patient group can be considered at a higher risk of complications, so a lower threshold should be maintained for placing a stent [8]. Indeed, only 28% received no exit drainage in this study. An alternative for those with nephrostomy is clamping and removal after 24 h in case of asymptomatic and normal renal function.

No patients in this study achieved success with endourological treatment of their stricture. This is similar to previous studies, which have highlighted low overall success with such an approach and consequent need for surgical reconstruction, especially in those with ureteroileal stricture length >1 cm [16].

The low complication rate in this study (6%) is consistent with the low rates reported in other series evaluating URS in urinary diversions [1,2,4]. Given that all these published reports are from tertiary centres, the experience level and setting could be one explanation. In addition, given that many procedures in these studies are for diagnostic purposes, the complication rate may be lower than if all had undergone stone treatment.

4.1. Limitations

This study is limited by its retrospective status, but is strengthened by having consecutive data collected from more than one centre and across two different countries. The relatively low incidence of this surgery type renders prospective studies on this special population to be a challenge, and moreover, there has been none published to date. Our study therefore adds value to this small body of knowledge and represents one of the largest series reported. A prospective international registry could represent a means to accrue more patients within a reasonable time period. A larger sample size could have allowed statistically significant differences between outcomes related to anastomosis type to be identified, for example, success at retrograde cannulation. The lack of stricture length measurement also represents a limitation. In this article, the term endourologist has been used, but there may be urologists with high-volume experience in endourology who do not necessarily identify themselves as having this specific title. Moreover, consensus that defines this does not appear to exist. To this end, the findings of this study reflect how endourological experience has an impact rather than specifically being an endourologist.

5. Conclusions

URS in patients with urinary diversion is challenging, and a multimodal approach can be required. Patients should be counselled regarding this and expectations managed accordingly. Endourological experience increases the likelihood of successful ureteric cannulation and procedural success on the first attempt.

Author contributions: Patrick Juliebø-Jones had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Juliebø-Jones, Somani, Ulvik.

Acquisition of data: Juliebø-Jones, Moen, Antoniou, Ulvik, Æsøy, Gjengstø.

Analysis and interpretation of data: Juliebø-Jones, Moen, Ulvik.

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