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Challenges of Retrograde Ureteroscopy in Patients with Urinary Diversion: Outcomes and Lessons Learnt from a Systematic Review of Literature

Keywords

Urinary diversion · Retrograde · Ureteroscopy ·
Neobladder · Ileal conduit

Abstract

Introduction: Retrograde ureteroscopy (URS) can be safely and successfully performed in patients who have had previous urinary diversion (UD). With broadening indications and advances in technology, URS can be used in complex cases. In this review article, we have summarized the relevant published literature regarding the outcomes and challenges encountered during retrograde URS in patients with UD. **Materials and Methods:** We conducted a systematic review of literature according to Cochrane and preferred reporting items for systematic reviews and meta-analysis guidelines for all studies reporting on retrograde URS from inception to September 2017. A literature search was conducted through MEDLINE, EMBASE, CINAHL, and Cochrane library for all English language articles. **Results:** Our literature search identified 6 retrospective studies. In total, 125 patients with a mean age of 67 years (range 28–90 years) underwent retrograde URS (190 procedures) after UD for diagnostic and therapeutic purposes. The main indications included upper urinary tract filling defects (due to either intrinsic pathology or extrinsic compression), strictures due to ureteral thickening,

stone disease, and surveillance for suspected malignancy. The success rate and complications across the studies varied from 56 to 80% and 0 to 44% respectively, with most complications being Clavien I in nature. **Conclusion:** Retrograde URS can be technically challenging due to ureteric cannulation, strictures, and anatomical variations. However, there is very little evidence currently available on this topic with data based on retrospective case series. In experienced hands, it seems to be relatively successful with a low risk of major complications.

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Introduction

Retrograde ureteroscopy (URS) can be safely and successfully performed in patients who have had previous urinary diversion (UD). With broadening indications and advances in technology, URS can be used in complex cases. Nelson et al. [1] initially published promising results of retrograde URS in a limited cohort of patients with neobladders (NBs) associated with upper tract abnormalities. Hyams et al. [2] showed similar success rates for renal access in patients with UD.

However, endoscopic retrograde access to NB poses challenges such as identification and cannulation of ure-

Fig. 1. Preferred reporting items for systematic reviews and meta-analysis (PRISMA) flowchart of the included studies.

teral NB orifice [3]. The access to orthotopic NB is relatively straightforward with urethra in situ, but the difficulty in identifying the anatomy of the ureteric orifice makes this retrograde URS more challenging [4]. An important indication for retrograde URS is for diagnosis of low-grade non-invasive tumors like upper tract transitional cell carcinomas, which account for 5% of all urothelial cancers [5]. There is an increased risk of developing complications after UD. The common complications are stones in upper urinary tract or the reservoir, seen in patients with urinary intestinal diversion due to metabolic derangements, mucus, and associated urinary tract infection [6].

The incidence of upper tract stones in UD is between 11 and 20% [7–9]. The 5-year recurrence rate for patients with history of urolithiasis is 63% [2, 10]. Other long-term complications of UD include strictures, stenosis, parastomal hernia, metabolic disturbances, renal impairment, and urinary tract infection [11]. There is also an associated incidence of upper tract recurrence after radical cystectomy in these patients [12]. The complex anatomy of patients with UD along with associated co-morbidities, high recurrence rate of urolithiasis, and upper tract urothelial carcinoma poses surgical challenges in their management.

The aim of this article is, therefore, to review and summarize the current practice of retrograde URS for patients with UD.

Methods

The systematic review was performed according to the Cochrane review guidelines and the preferred reporting items for systematic reviews and meta-analysis guidelines. A literature search was conducted through MEDLINE, EMBASE, CINAHL, Cochrane library, Clinicaltrials.gov, Google Scholar, and individual urological journals for all English language articles. The search terms used in conjunction with each other included the following: “retrograde ureteroscopy,” “ureteroscopy,” “URS,” “retrograde intrarenal surgery,” “RIRS,” “tumor,” “calculi,” “stone,” “ileal conduit,” “neobladders,” and “urinary diversion.” The search covered the time period from inception of databases to September 2017 (Fig. 1).

Inclusion and Exclusion Criteria

All articles in English language on retrograde URS after UD were included in the study. Patients of all ages and articles of any study type were included. Authors were contacted wherever the data was not available or not clear, to be able to adequately assess inclusion of their study. If data was not extractable, provided or clarified, the study was excluded.

Case reports, review articles, laboratory, and animal studies were excluded. Articles from duplicate studies were also excluded. Where more than 1 study was available using the same data, more recent or updated study was included.

Two reviewers (M.N.R. and B.K.S.) identified studies that appeared to fit the inclusion criteria for a full review. Data were then independently extracted and analyzed for study type, journal published, time period of study, number of patients, number of procedures, number of renal units, type of UD, time period since diver-

Table 1. Summary of the relevant studies of retrograde ureteroscopy in patients with urinary diversion

Author	Study type	Journal	Year	Period of review	Number of patients (renal units)	Number of sessions
Nelson et al. [1]	Retrospective case series	J Urol	2003	1995–2002 (7 years)	8 (13)	9
Hyams et al. [2]	Retrospective case series	Urology	2009	2003–2008 (6 years)	15 (21)	28
Hertzog et al. [13]	Retrospective cohort study	J Urol	2013	1982–2010 (28 years)	9 (unknown)	9
Rivera and Krambeck [16]	Retrospective case series	J Endourol	2014	2002–2013 (11 years)	12 (17)	13
Singla et al. [14]	Retrospective case series	Urol Pract	2015	1995–2013 (18 years)	45 (97)	77
Olson et al. [17]	Retrospective case series	J Endourol	2017	2007–2016 (9 years)	36 (unknown)	54

sion, indications, success rates, complications, and management. Disagreement between the authors in study inclusion was resolved by consensus of both authors. The results from our review are presented descriptively.

Results

After initial identification of 128 articles, 57 abstracts were screened of which 12 full text articles were reviewed and 6 were included in the final review (Fig. 1). In total, 125 patients with a mean age of 67 years (range 28–90 years) underwent retrograde URS (190 procedures) after UD for diagnostic and therapeutic purposes. The main indications included upper urinary tract filling defects (due to either intrinsic pathology or extrinsic compression), strictures due to ureteral thickening, stone disease, and surveillance for suspected malignancy.

All papers were retrospective case series with 4 published in the last 5 years, with a third of patients undergoing bilateral URS procedures (Table 1). The lowest success rate in retrograde URS was 56% reported by Hertzog et al. [13] and the highest was Singla et al. [14] at 80.4%. All these articles were retrospective studies from large tertiary referral units. The failures to access in these cases related to stricture of ureteroileal anastomosis, identification or cannulation of ureteric orifice, or tortuosity of the ureter (Table 2).

Of the studies reporting on complication rates, [1, 2, 13–17] in 113 sessions of retrograde URS, the overall complication rate was 10.6% ($n = 12$), with 11 Clavien I and 1

Clavien IIIa complication. The Clavien I complication included hematuria, post-op pyrexia, acute renal insufficiency, obstruction, and ureteral perforation; and none of them needed active intervention. The Clavien IIIa complication involved bleeding that needed renal embolization.

Discussion

Meaning of the Study

Although very few studies are reported on retrograde approach in UD, our review shows that in experienced hands retrograde access can be achieved for these patients. The failure rate was variable and was due to anatomical considerations secondary to the diversion itself. Apart from 1 renal embolization, no other major complications were noted.

Study Details, Recommendations, and Lessons for Management

Nelson et al. [1] carried out an initial retrospective analysis of retrograde URS on a small number of patients who had undergone cystectomy with orthotopic ileal NB. In 1 patient, the surgeon placed a stent to allow for passive dilatation of the ureter and URS was performed 12 days later. Earlier published experiences had reported antegrade incision of the stricture to be safer and easier [3, 15]. Similarly, a single unit study by Gomez et al. [16] had a low threshold to convert to antegrade approach when the retrograde URS was not feasible. A further 10-year data from the same unit showed

Table 2. Outcomes of retrograde URS in patients with UD

Author	Age, years, (mean $\pm$ SD), range	M:F	Months since urinary diversion (mean $\pm$ SD), range	Urinary diversion type	Laterality (unilateral: bilateral)	Operating minutes (mean $\pm$ SD)	Indications	Success, %	Causes of failure	Complications	Clavien grade and resolution of complication
Nelson et al. [1], 2003	(64.9 $\pm$ 11.4) 42–76	6:2	(29.5 $\pm$ 23.2) 6–80	Orthotopic ileal neobladder	4:3	(78 $\pm$ 34) 26–145	Filling defects, stone disease, surveillance	76.9	Access, inability to find anastomosis	Haematuria (n = 1)	Clavien I Spontaneous resolution
Hyams et al. [2], 2009	74.3 (35–81)	U	Unknown	Ileal conduit, orthotopic bladder, Indiana pouch	U	U	Filling defects, strictures, stone disease, surveillance	75	Tortuosity of the segment, stricture, inability to identify anastomosis	Nil	Nil
Hertzog et al. [13], 2013	(71.6 $\pm$ 6.2) 58–78	8:1	(11.6 $\pm$ 9.5) 0.4–28.2	Ileal conduit	U	U	Stone disease	56 (3 stone free, 2 not stone free)	Stricture, ureteral perforation	Ureteral perforation (n = 1) Acute renal insufficiency (n = 2) Obstruction (n = 1)	Clavien I (no active intervention, only supportive management)
Rivera et al. [16], 2014	63.5 (27–75)	11:1	6.2 years (1.3–14.5) years	Ileal neobladder	9:4	U	Filling defects, strictures, stone disease, surveillance	59	Unclear anatomy, tortuosity of the segment	Nil	Nil
Singla et al. [14], 2015	(64.4 $\pm$ 10.5) 42–86	18:1	(52.2 $\pm$ 42.8) (3–261)	Neobladder	57:20	U	Filling defects, stone disease, surveillance	80.4	Stricture, unclear anatomy, calculi at the distal end	Not reported	Not reported
Olson et al. [17], 2017	61 (28–90)	U	13 years (0.08–53)	Ileal conduit	U	U	Filling defects, strictures, stone disease surveillance	74	Tortuosity of the segment, stricture, inability to identify anastomosis	Pyrexia (n = 6) Bleeding (n = 1)	Clavien I (treated with antibiotics) Clavien IIIa Embolization for ongoing bleeding

URS, ureteroscopy; UD, urinary diversion; U, unknown.

Table 3. Complements of URS in UD and their complications and challenges

	Tips and tricks of URS in UD	Complications of URS in UD	Challenges of Retrograde URS in UD
1	Use of flexible cystoscope and ureteroscope	Hematuria	Anastomotic strictures
2	Super stiff wire to negotiate strictures	Perforation of the urinary tract	Tortuosity of the urinary tract
3	Use of access sheath if indicated	Incomplete tumor removal or seeding	Anatomical challenges (unclear anatomy) or difficulty in identifying or cannulating the ureteric orifice
4	Use of radiopaque dye and fluoroscopy to delineate anatomy	Damage to adjacent organs	
5	Low threshold to combine antegrade approach when evaluating suspicious lesions		

URS, ureteroscopy; UD, urinary diversion.

a modest improvement in retrograde evaluation of upper tract abnormalities [14]. Sub-analysis highlighted the difference in success rates between NB subtypes (Hautmann pouch vs. Studer pouch) within the study population. The authors found that localization of ureteral orifice via retrograde approach accounted for a large proportion of failed cases, followed by cannulation of the orifice and anatomical tortuosity (both at the afferent and efferent limb).

A single surgeon series of 21 renal units (in 15 patients) reported a 75% success rate with retrograde ureteroscopies in patients who had undergone previous UD [2]. In this series, the types of diversion included ileal conduit, orthotopic bladder and Indiana pouch. Sub-analysis of the success rate for each type of diversion was 90% in patients with orthotopic bladder, 73% in ileal conduit, and 33% in those with Indiana pouch.

Hertzog et al. [13] reported their experience with URS for treatment of symptomatic stone disease. Due to problems with access to the upper tract, identification of ureteral orifices, and strictures, majority of the patients underwent percutaneous approaches. The lower success rate in this cohort may be attributed to the time period when the ureteroscopies were performed between 1993 and 2003. Techniques and equipment (or the lack of it) might have influenced the outcomes and the ability to safely perform the procedure.

Rivera and Krambeck [16] noted that their success rate was 59% in 12 patients who underwent 13 retrograde URS. The constraints identified were the NB anatomy, angulation, and tortuosity of the afferent limb. The low success rate was also attributed to the potential length of

time between NB diversions and attempted retrograde URS. In the successful group, the average time after diversion was 8.4 years when compared to 5.1 years in the unsuccessful group.

Olson et al. [17] reviewed their practice of retrograde URS for treating upper urinary tract abnormalities in 54 patients with UD. They reported a success rate of 74% in accessing the upper urinary tract (ureter or pelvicalyceal system) and their stone-free rate was 79% with a few minor complications. In 13 out of 54 patients (24.1%), further percutaneous access to the collecting system was performed for multiple stones, stone >1 cm, the need for dilatation of a stricture, calcified, or knotted stent. Six patients developed postoperative systemic inflammatory response syndrome requiring intravenous antibiotic therapy.

Lessons Learnt and Approach (Table 3)

In cases of retrograde approach for patients with UD, the authors recommend having all the necessary kit available. The ureteric orifice identification and cannulation should be followed by a retrograde pyelogram to identify any ureteric strictures. A safety wire is placed/secured and if necessary and deemed to be safe, a short UAS is inserted under fluoroscopy. The flexible URS is then inserted over the working guide wire. For ureteric strictures, the position of scope is checked, on whether it is in the renal pelvis (ureteric stricture is passable) or distal to the stricture (not passable). The laser endoureterotomy is then done in the same way as retrograde endopyelotomy. Balloon dilatation is then performed with contrast agent to dilate the incised area. For a correctly done endoureterotomy, a subsequent retrograde

pyelogram will show extravasation of contrast from the ureter. An internal stent (12F) should be inserted and left in place for 6 weeks with a urethral catheter for at least 24 h [18].

URS is the least invasive surgical approach to the upper tract lesion and is associated with reduced morbidity when compared to percutaneous access [19]. Studies with high number of patients have reported stone-free rate of over 70% when undergoing retrograde URS [1, 2, 14, 17]. Rivera and Krambeck [16] reported modest results of 59% success rate in 2014. A long and tortuous stricture often remains the main reason for failure and hence conversion to other procedures in retrograde URS. Vigilance and care are key attributes to avoid damage to the continence mechanism and the ureteral-enteric anastomosis. Depending entirely on this approach, when dealing with staging or resection of invasive lesions, is not advised due to potential staging errors and incomplete resections in patients with history of bladder and upper tract cancers. There are also theoretical risks of extraluminal spillage, NB perforation, and disruption of anastomosis, but the reported incidence is rare. Patients must be counseled for potential failure and the need to proceed through antegrade or open approach if necessary. Zhong et al. [20] performed percutaneous antegrade access in 20 patients with stone disease who initially had an attempt at retrograde ureteroscopic access with stone clearance in over 90% of the patients and a 15% complication rate. Some endourologists may choose to adopt combined antegrade and retrograde approach but this increases the complications of percutaneous renal puncture, bleeding, sepsis, and injury to the adjacent organs [21].

Limitations and Strengths of This Review

Our review is limited by the quality of included studies with all of them being retrospective case series. The data collection and reporting were not standardized and as such is difficult to combine or compare. The reporting of stone-free rates was also variable [22]. Despite these limitations, this is the first review to highlight potential pitfalls and suggestions to improve outcomes in these patients [23]. It shows that the success rate of retrograde URS in UD depends on anatomical challenges, tortuosity of the urinary tract, and the presence of any anastomotic strictures (Table 3). Furthermore, this can set a benchmark for patient counseling and future research.

Conclusion

The advancement of minimally invasive techniques has made retrograde URS safe when managing upper tract pathology in patients with UD. However, there is very little evidence currently available on this topic with data based on retrospective case series. The success rate and complications across the studies varied from 56 to 80% and 0 to 44%, respectively, with most complications being Clavien I in nature. Retrograde ureteroscopic evaluation is feasible in these patients using a combination of endoscopic and fluoroscopic techniques. In experienced hands, it can be performed safely with satisfactory outcomes and low morbidity.

Disclosure Statement

The authors declare no conflicts of interest.

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