Published in final edited form as:

Urol Pract. 2015 September ; 2(5): 244–249. doi:10.1016/j.urpr.2014.12.005.

Experience with 45 Consecutive Patients with Neobladders Undergoing Retrograde Ureteroscopy for Upper Tract Abnormalities

Nirmish Singla^{*,†}, James E. Montie[‡], Cheryl T. Lee[†], J. Stuart Wolf Jr.[§], Gary J. Faerber[†]

Department of Urology, University of Texas Southwestern Medical Center, Dallas, Texas (NS), and Department of Urology, University of Michigan, Ann Arbor, Michigan (JEM, CTL, JSW, GJF)

Abstract

Introduction: In this study we reviewed the feasibility, technique, complications and outcomes of retrograde ureteroscopy in patients with orthotopic neobladders.

Methods: We retrospectively reviewed our retrograde ureteroscopic experience in patients with orthotopic ileal neobladder diversions. Data were collected and analyzed regarding patient characteristics, indications, technique, success and complications of the procedure.

Results: Between 1995 and 2013, 45 patients with neobladders underwent 77 retrograde ureteroscopy sessions on 97 renal units for filling defects (47 cases), urothelial thickening (9), calculi (4), positive cytology (27) and/or positive fluorescence in situ hybridization (15) on followup. The ureter and renal pelvis were successfully instrumented in 78 of 97 units (80.4%), with 85.3% success in Hautmann-type neobladders (75 renal units attempted), 50% in Studer-type neobladders (8 renal units attempted) and 71.4% in unascertained-type neobladders (14 renal units attempted). Causes of failure involved the inability to locate the ureteral orifice (8 cases), to cannulate the orifice (6 cases) or to advance the ureteroscope due to tortuosity (5 cases). Among the successful attempts with appropriately documented findings 35.9% of cases with filling defects (39) were confirmed malignant and 61.5% were confirmed benign by ureteroscopy. All cases with a positive cytology (23) and 85.7% of cases with positive fluorescence in situ hybridization (14) were confirmed malignant by retrograde ureteroscopy, and 2 of the 4 cases of calculi were successfully managed retrogradely.

Conclusions: Retrograde ureteroscopic evaluation of upper tract abnormalities is feasible and practical in patients with orthotopic neobladders. Identification and cannulation of the ureteral orifice are challenging, particularly in tortuous situations, but difficulties can be overcome with fluoroscopic techniques. Retrograde ureteroscopy avoids the morbidity of percutaneous access with minimal complications.

[†]No direct or indirect commercial incentive associated with publishing this article.

[‡]Financial interest and/or other relationship with Histosonics.

[§]Financial interest and/or other relationship with Urology Times.

*Correspondence: Department of Urology, University of Texas Southwestern Medical Center, 5323 Harry Hines Blvd., Dallas, Texas 75390 (telephone: 248-761-2452; nirmish.singla@phhs.org).

Keywords

ureteroscopy; urinary diversion; carcinoma; transitional cell

Urinary diversion after cystectomy originated as early as 1852, when Simon performed the first ureterosigmoidostomy.¹ Since then, several approaches to diversion have emerged, including cutaneous conduits, continent cutaneous diversions and orthotopic neobladders. Since the 1970s various neobladder designs have been described, with the Studer pouch being the most commonly used type in the United States.^{2–5}

The evaluation and treatment of upper tract abnormalities in patients with neobladder reconstructions are complicated by difficult retrograde access to the upper collecting system. Retrograde access to the neobladder chimney as well as identification and cannulation of the ureteroneobladder orifice pose challenges when performing endoscopy. Percutaneous antegrade techniques or staged procedures involving an antegrade approach have traditionally been used to evaluate upper tract pathology in patients with neobladders.⁶ Nelson et al were the first to report success with retrograde ureteroscopy in a small cohort of patients with neobladders who were found to have upper tract abnormalities.⁷ In this study we further assessed the feasibility, technique, complications and outcomes of retrograde ureteroscopy in patients with orthotopic neobladders in an expanded patient cohort.

Materials and Methods

With approval from the University of Michigan medical institutional review board (IRB-Med #2000–0272), all patients were included in the study who had undergone cystectomy with orthotopic ileal neobladder due to abnormal imaging studies (calculi, filling defects, urothelial thickening), positive cytology or positive FISH detected on followup between 1995 and 2013 at the University of Michigan. No patients were excluded from attempted retrograde ureteroscopic access to address the underlying indication.

Retrograde ureteroscopy in all cases was performed with a standard technique previously described.⁷ Patient medical records were retrospectively reviewed and analyzed in terms of patient characteristics, indications for endoscopic evaluation, surgical technique, findings, complications and followup.

Results

Patient Characteristics

Overall 45 patients were included in the study (37 male and 8 female), who underwent 77 retrograde ureteroscopy sessions on 97 renal units after neobladder formation. Mean $\pm$ SD patient age was 64.4 ± 10.5 years (range 42 to 86). URS was performed at a mean of 52.2 ± 42.8 months (range 3 to 261) after cystectomy. Overall 33 patients received a Hautmann neobladder, 4 received a Studer neobladder and 8 underwent neobladder reconstruction in which the type remained unascertained based on missing or unclear operative reports.

Indications for URS included abnormal imaging on routine surveillance in 59 of 77 sessions (47 with upper tract filling defects, 9 with ureteral thickening and 4 with calculi), positive cytology in 27 of 56 sessions evaluated for cytology and positive FISH in 15 of 17 sessions evaluated for FISH. One patient presented with a filling defect of the left ureter and a stone. Of the 77 sessions 20 were bilateral, 30 were performed on the left renal unit alone and 27 were performed on the right renal unit alone. Patient characteristics are summarized in table 1.

Success Rates

The upper tracts were successfully accessed in 78 of 97 renal units attempted (80.4%), including 41 of 50 successful left side attempts (82%) and 37 of 47 successful right side attempts (78.7%). Of the 19 unsuccessful cases 10 were right-sided and 9 were left-sided. Causes of failure included the inability to localize the ureteral orifice (8 cases), inability to cannulate the ureteral orifice (6 cases) or inability to advance the ureteroscope due to tortuosity (5 cases). Overall 18 cases of failure occurred in males while failed cannulation of the left ureteral orifice accounted for the sole failure in a female. Mean patient age at time of failure was 60.5 ± 10.8 years (range 42 to 86). Mean time to failure after cystectomy was 38.5 ± 28.3 months (range 3 to 95). Failure rates are summarized in table 2.

In terms of neobladder type 75 of the 97 renal units attempted were performed in Hautmann neobladders, of which 64 cases were successful (85.3%). Of the attempted renal units 8 were in Studer neobladders, of which 4 cases were successful (50%). The remaining 14 attempted renal units were performed in unascertained type neobladders as described, with 10 successful cases (71.4%). Success rates are displayed in the figure.

Correlation of URS Findings with Abnormal Imaging

Table 3 summarizes ureteroscopic findings compared to indications for the procedure. Upper tract filling defects were present in 47 cases. Of these cases 30 were in the ureter, 15 were in the kidney, and 2 included the kidney and ureter. Ureteroscopic biopsy was positive for malignancy in 14 of the 39 cases performed successfully for filling defects (35.9%). Overall 24 cases revealed benign findings (61.5%), including reactive or inflammatory urothelial changes, extrinsic compression, nonspecific mucosal irregularities or ureteritis cystica. In 1 patient ureteroscopy revealed narrowing at the ureteral anastomosis yet the findings were equivocal. The patient subsequently underwent open surgery, which revealed recurrent invasive urothelial carcinoma (cT3NxMx) of the left ureter.

Of the 30 cases in which upper tract filling defects were localized to the ureter, retrograde ureteroscopy was unsuccessful in 4. Of the remaining 26 cases 9 (34.6%) were positive for malignancy while 16 (61.5%) were benign and 1 was equivocal as previously described. Of the 15 cases with filling defects localized to the kidney ureteroscopy was unsuccessful in 3 cases. Of the remaining 12 cases 4 were malignant (33.3%) while 8 were benign (66.7%). Of the 2 cases with filling defects in the kidney and ureter, 1 was positive for malignancy and the other was not accessed successfully with retrograde ureteroscopy.

Urothelial thickening of the ureter was noted on routine imaging in 9 cases. Retrograde ureteroscopy failed in 2 cases, revealed recurrent upper tract urothelial carcinoma (stage

cTa) in 1 case of the remaining 7 (14.3%) and demonstrated benign processes in 4 cases (57.1%). The remaining 2 cases revealed questionable mucosal irregularities that were suspicious for carcinoma or benign inflammation after ureteroscopic evaluation.

There were 4 cases in which ureteroscopy was performed for calculi. Stones were successfully localized, treated with laser lithotripsy and/or removed in 2 cases. In 1 of the 2 unsuccessful cases, retrograde ureteroscopy failed bilaterally because of the inability to cannulate the right ureteral anastomosis and the inability to advance the scope to the left renal pelvis due to narrowing of the proximal left ureter. In the second unsuccessful case, the patient was thought to have a stone in the distal ureter at the ureteroenteric anastomosis. In this case the ureteral orifice could not be successfully identified despite injection of indigo carmine dye. Antegrade ureteroscopy was performed percutaneously, revealing a large calculus associated with a staple in the afferent limb. Open cystolithotomy was performed and the stone was removed.

Correlation of URS Findings with Positive Cytology or FISH

Cytological evaluation was performed before 56 of the 77 ureteroscopy sessions. Cytology was abnormal in 27 cases, including 18 of urothelial carcinoma and 8 of atypical urothelial cells. Of 27 cases with positive cytology 23 had appropriately documented findings from retrograde ureteroscopy, and all 23 were confirmed malignant based on ureteroscopic biopsies and washings. Of the 29 cases with negative cytology, atypical urothelial cells were revealed in 9 after ureteroscopy, while 10 were confirmed negative for malignancy and 10 were not documented. Of the 21 cases in which cytologies were not obtained 2 were found to have atypical urothelial cells and 1 had confirmed urothelial carcinoma on retrograde biopsies and washings. There were 5 cases confirmed negative for malignancy while the remaining 13 were not documented.

FISH was also evaluated in 17 patients, of whom 15 had positive results. Cytology and FISH were positive in 13 patients, while 2 patients had negative cytologies with positive FISH results. The 2 patients with negative FISH studies had negative cytologies as well. There were no patients with positive cytologies and negative FISH. Of 15 patients with positive FISH 14 had appropriately documented ureteroscopic findings, with 12 of 14 (85.7%) revealing abnormal biopsies and washings (urothelial carcinoma in 10, atypical urothelial cells in 2). In 2 cases with positive FISH ureteroscopy was negative and 1 case was not documented. Of the 2 cases with negative FISH 1 was confirmed negative by ureteroscopy while the other was not documented. Results correlating ureteroscopy findings with cytologies and FISH studies are summarized in table 3.

Discussion

Urologists are increasingly faced with the challenge of evaluating and treating upper tract abnormalities in patients with orthotopic neobladders. In this study we assessed the feasibility, technique, complications and outcomes of retrograde ureteroscopy in patients with neobladders during 18 years at a single institution. We report an overall success rate of 80.4%, defined by localization and cannulation of the ureteral orifice and navigation of the scope to the lesion of interest. The majority of sessions were performed for filling defects,

although other indications included calculi, urothelial thickening, abnormal cytology and positive FISH. We found no effect of patient age or time since cystectomy on failure rates. Although not addressed in this study, the effect of patient comorbidities on failure may warrant consideration as well. We also observed no significant effect of laterality on failure rates.

While several groups have reported on the endourological management of lesions in patients with lower urinary tract reconstruction,^{6,8–15} retrograde access in orthotopic neobladders remains largely unreported in the literature.^{7,8,16} We improved by a margin of 3.5% over the pioneering report of Nelson et al in 2003, in which retrograde evaluation of upper tract abnormalities was 76.9% successful.⁷ In the present study we included 10 additional years of data since then, and expanded our cohort from 8 to 45 patients, 9 to 77 sessions and 13 to 97 attempted renal units. Chow also recently reported a case of successful management of a low grade ureteropelvic junction tumor in a patient with Studer pouch and solitary kidney using retrograde ureteroscopy.¹⁶

The difference in success rates between neobladder subtypes (Hautmann 85.3% vs Studer 50%) is curious. The majority of the neobladders constructed at the University of Michigan are of the Hautmann type, accounting for 33 patients in our cohort vs only 4 patients who received a Studer pouch, thereby limiting the power of our comparative analysis. Furthermore, attempts at ureteroscopy in Studer pouches were performed earlier in our retrograde experience in neobladders, while the majority of ureteroscopic attempts during the last 10 years have been in Hautmann neobladders. Thus, the effect of improved operator experience with time may further confound a comparative analysis of success rates between the 2 neobladder subtypes. Evaluation of a larger cohort of patients with Studer pouches is warranted, especially given that the majority of neobladder reconstructions in the United States remain the Studer type.^{2–4}

In our experience the most challenging aspect of retrograde access in neobladders is localization of the ureteral orifice, which accounted for 42.1% of failed cases in our cohort, followed by cannulation of the orifice (31.6% of failures) and anatomical tortuosity (26.3% of failures). In patients with ureters implanted into an afferent limb, identification of the limb is crucial yet difficult, given the lack of landmarks and movement from bowel peristalsis. Fluoroscopy can help identify the os of the afferent limb, and accessing the limb often entails retroflexion of a flexible cystoscope. We found this combination generally adequate in localizing the ureteral orifice. Administration of methylene blue or indigo carmine may conceivably provide further assistance in identifying the ureteral anastomosis. However, we found little value in either of these agents.

In 1975 Ponsky and King first described the use of India ink serosal tattoos of intestines to localize colonic lesions or facilitate orientation during gastrointestinal surgeries.¹⁷ Since then, India ink has been validated as a safe and effective tattooing agent for endoscopic and laparoscopic manipulation of the intestines, stomach and esophagus.^{18–24} As neobladders are constructed using intestinal segments, we propose that the usefulness of India ink tattooing may extend to provide further assistance in localizing the ureteral orifice during retrograde instrumentation. For example, tattooing the ileal portion of the ureteroenteric

anastomosis during neobladder creation would label the site of the neo-orifice to facilitate endoscopic orientation. As India ink is a carbon based product, such marking would be permanent and useful for repeat accesses.

With regard to cannulation of the ureteral orifice, a directional guide wire (Terumo stiff angled Glidewire®) was critical to engage the neo-orifice obliquely. We used a torque device to help advance the wire into the proximal collecting system under fluoroscopy. Chow reported the usefulness of an additional safety wire and ureteral access sheath to facilitate ureteroscopy.¹⁶ In contrast, we found these to be hindrances. While the safety wire may aid in reengaging the orifice, we found that an additional wire alongside the ureteroscope restricted advancement of the scope and loss of access was not a problem without it. We also encountered problems with the ureteral access sheath as the severe angulation at the efferent limb or ureteral neo-orifice often kinked the sheath and hindered our ability to advance the scope.

The refinement of minimally invasive techniques has popularized endoscopy as a safe means of managing upper tract lesions in patients with orthotopic neobladders. Furthermore, the grade of the endoscopic biopsy has been shown to correlate with the stage of upper tract tumors and, thus, may be useful for pathological assessment.^{25,26} Prior studies have demonstrated the prognostic role of abnormal urine cytologies in predicting tumor recurrence, grade and stage,^{26–28} which was reaffirmed by our ureteroscopic findings of malignancy in all documented cases with positive cytologies (table 3). Our results also support the role of FISH in the routine surveillance of this patient population, given the ureteroscopic confirmation of malignancy in 85.7% of patients with positive FISH at followup.

Retrograde access is the least invasive surgical approach for upper tract lesions and can be used to survey the entire collecting system.⁸ Compared to percutaneous access, retrograde ureteroscopy offers the advantage of reduced morbidity as an outpatient procedure. However, it carries a number of limitations. Retrograde instrumentation may be subject to staging errors or incomplete resection of larger or invasive lesions, which is of particular concern in higher risk patients, such as those with a history of bladder cancer.^{26,27} Failure to access the upper tract retrogradely subjects the patient to an additional surgery such as percutaneous antegrade ureteroscopy or open surgery. Furthermore, lower pole lesions may be more difficult to access.²⁹

Complications such as neobladder perforation, loss of continence, disruption of the ureteroenteric anastomosis, ureteral stricture or tumor propagation are additional concerns,^{8,30} although we did not encounter any such issues in our experience. Nonetheless all patients must be counseled about these potential risks along with the possibility of ureteroscopic failure, in which case definitive treatment via an antegrade percutaneous or open surgical approach may be necessary.

Conclusions

Retrograde ureteroscopic evaluation of upper tract abnormalities remains a feasible and practical approach in patients with orthotopic neobladders. Identification and cannulation of the ureteral orifice are challenging, particularly in tortuous situations, but difficulties can be overcome with a combination of endoscopic and fluoroscopic techniques. Retrograde ureteroscopy offers an advantage by avoiding the morbidity associated with antegrade percutaneous access while minimizing complications.

Abbreviations and Acronyms

FISH	fluorescence in situ hybridization
URS	ureteroscopy

References

1. Simon J: Extrophia vesicae (absence of the anterior walls of the bladder and pubic abdominal parietes); operation for directing the orifices of the ureters into the rectum; temporary success; subsequent death; autopsy. *Lancet* 1852; 2: 568.
2. Studer UE, Ackermann D, Casanova GA et al.: Three years' experience with an ileal low pressure bladder substitute. *Br J Urol* 1989; 63: 43. [PubMed: 2920259]
3. Studer UE, Burckard FC, Schumacher M et al.: Twenty years experience with an ileal orthotopic low pressure bladder substitute—lessons to be learned. *J Urol* 2006; 176: 161. [PubMed: 16753394]
4. Skinner EC, Skinner DG and Stein JP: Orthotopic urinary diversion In: Campbell's Urology, 9th ed. Edited by Wein AJ, Kavoussi LR, Novick AC et al. Philadelphia: WB Saunders Co. 2007; chapt 87, p 2479.
5. Stein JP, Dunn MD, Quek ML et al.: The orthotopic T pouch ileal neobladder: experience with 209 patients. *J Urol* 2004; 172: 584. [PubMed: 15247737]
6. Delvecchio FC, Kuo RL, Iselin CE et al.: Combined antegrade and retrograde endoscopic approach for the management of urinary diversion-associated pathology. *J Endourol* 2000; 14: 251. [PubMed: 10795614]
7. Nelson CP, Wolf JS, Montie JE et al.: Retrograde ureteroscopy in patients with orthotopic ileal neobladder urinary diversion. *J Urol* 2003; 170: 107. [PubMed: 12796657]
8. Tomaszewski JJ, Smaldone MC and Ost MC: The application of endoscopic techniques in the management of upper tract recurrence after cystectomy and urinary diversion. *J Endourol* 2009; 23: 1265. [PubMed: 19591622]
9. Wolf JS Jr, Elashry OM and Clayman RV: Long-term results of endoureterotomy for benign ureteral and ureteroenteric strictures. *J Urol* 1997; 158: 759. [PubMed: 9258075]
10. Gerber GS, Kuznetsov D, Leef JA et al.: YAG laser endoureterotomy in the treatment of ureteroenteric strictures following orthotopic urinary diversion. *Tech Urol* 1999; 5: 45. [PubMed: 10374795]
11. Cohen TD, Streem SB and Lammert GK: Long-term incidence and risks for recurrent stones following contemporary management of upper tract calculi in patients with a urinary diversion. *J Urol* 1996; 155: 62. [PubMed: 7490899]
12. Cohen TD, Streem SB and Lammert GK: Selective minimally invasive management of calculi in patients with urinary diversions. *J Urol* 1994; 152: 1091. [PubMed: 8072070]
13. Razvi HA, Martin TV, Sosa ER et al.: Endourologic management of complications of urinary intestinal diversion. *AUA Update Series* 1996; XV: lesson 22.
14. Beiko DT and Razvi HA: Stones in urinary diversion: update on medical and surgical issues. *Curr Opin Urol* 2002; 12: 297. [PubMed: 12072650]

15. el-Nahas AR, Eraky I, el-Assmy AM et al.: Percutaneous treatment of large upper tract stones after urinary diversion. *Urology* 2006; 68: 500. [PubMed: 16979745]
16. Chow GK: Ureteroscopic treatment of pelvic renal tumor in a solitary kidney with orthotopic neobladder. *J Endourol* 2008; 22: 2091. [PubMed: 18811552]
17. Ponsky JL and King JF: Endoscopic marking of colonic lesions. *Gastrointest Endosc* 1975; 22: 42. [PubMed: 1205106]
18. Ellis KK and Fennerty MB: Marking and identifying colon lesions. Tattoos, clips, and radiology in imaging the colon. *Gastrointest Endosc Clin N Am* 1997; 7: 401. [PubMed: 9177142]
19. Shaffer RT, Francis JM, Carrouger JG et al.: India ink tattooing in the esophagus. *Gastrointest Endosc* 1998; 47: 257. [PubMed: 9540879]
20. McArthur CS, Roayaie S and Wayne JD: Safety of preoperation endoscopic tattoo with india ink for identification of colonic lesions. *Surg Endosc* 1999; 13: 397. [PubMed: 10094755]
21. Price N, Gottfried MR, Clary E et al.: Safety and efficacy of India ink and indocyanine green as colonic tattooing agents. *Gastrointest Endosc* 2000; 51: 438. [PubMed: 10744816]
22. Beretvas RI and Ponsky J: Endoscopic marking: an adjunct to laparoscopic gastrointestinal surgery. *Surg Endosc* 2001; 15: 1202. [PubMed: 11727100]
23. Aboosy N, Mulder CJ, Berends FJ et al.: Endoscopic tattoo of the colon might be standardized to locate tumors intraoperatively. *Rom J Gastroenterol* 2005; 14: 245. [PubMed: 16200234]
24. Sun L, Si J, Chen S et al.: The establishment and clinical appliance of technique of mucosa marking targeting biopsy. *Hepatogastroenterology* 2009; 56: 59. [PubMed: 19453029]
25. Chen GL and Bagley DH: Ureteroscopic management of upper tract transitional cell carcinoma in patients with normal contra-lateral kidneys. *J Urol* 2000; 164: 1173. [PubMed: 10992360]
26. Keeley FX Jr, Bibbo M and Bagley DH: Ureteroscopic treatment and surveillance of upper urinary tract transitional cell carcinoma. *J Urol* 1997; 157: 1560. [PubMed: 9112476]
27. Boorjian S, Ng C, Munver R et al.: Abnormal selective cytology results predict recurrence of upper-tract transitional cell carcinoma treated with ureteroscopic laser ablation. *J Endourol* 2004; 18: 912. [PubMed: 15659932]
28. Igawa M, Urakami S, Shiina H et al.: Limitations of ureteroscopy in diagnosis of invasive upper tract urothelial cancer. *Urol Int* 1996; 56: 13.
29. Ost MC, Vanderbrink BA, Lee BR et al.: Endourologic treatment of upper urinary tract transitional cell carcinoma. *Nat Clin Pract Urol* 2005; 2: 376. [PubMed: 16474734]
30. Lam JS and Gupta M: Ureteroscopic management of upper tract transitional cell carcinoma. *Urol Clin North Am* 2004; 31: 115. [PubMed: 15040408]

Figure 1.
Success rates for retrograde ureteroscopy in neobladders

Table 1.

Patient characteristics

No. pts:	45	
Male	37	
Female	8	
Caucasian	44	
African-American	1	
No. URS sessions:	77	
Purely lt side	30	
Purely rt side	27	
Bilat	20	
No. attempted renal units:	97	
Total lt	50	
Total rt	47	
Mean $\pm$ SD age at URS (range)	64.4 $\pm$ 10.5	(42–86)
Mean $\pm$ SD mos from cystectomy to URS (range)	52.2 $\pm$ 42.8	(3–261)
No. pt neobladder type (No. attempted renal units):		
Hautmann	33	(75)
Studer	4	(8)
Unascertained	8	(14)

Table 2.**Ureteroscopy failures**

No. failed URS attempts:		
Total (M, F)	19	(18, 1)
Unable to locate ureteral orifice (rt, lt)	8	(5, 3)
Unable to cannulate ureteral orifice (rt, lt)	6	(3,3)
Unable to advance ureteroscope (rt, lt)	5	(2, 3)
No./total No. laterality (%):		
Lt side	9/50	(18)
Rt side	10/47	(21)
Mean $\pm$ SD pt age at failure (range)	60.5 $\pm$ 10.8	(42–86)
Mean $\pm$ SD mos to failure after cystectomy (range)	38.5 $\pm$ 28.3	(3–95)

Table 3.

Ureterscopy indications and findings

	No. Sessions Indicated	No. Successful Attempts with Documented Findings	No. Confirmed Malignant by Retrograde URS (%)	No. Confirmed Benign by Retrograde URS (%)	No. Unclear URS Findings or Not Documented
Abnormal imaging:	59 *	-	-	-	-
Filling defects:	47	39	14 (36)	24 (62)	1 (unclear)
Kidney	15	12	4 (33)	8 (67)	0
Ureter	30	26	9 (35)	16 (62)	1 (unclear)
Both	2	1	1 (100)	0 (0)	0
Urothelial thickening	9	7	1 (14)	4 (57)	2 (unclear)
Calculi	4	2	-	-	-
Pos cytology	27 (of 56 evaluated)	23	23 (100)	0 (0)	4 (not documented)
Neg cytology	29 (of 56 evaluated)	19	9 (47)	10 (53)	10 (not documented)
Pos FISH	15 (of 17 evaluated)	14	12 (86)	2 (14)	1 (not documented)
Neg FISH	2 (of 17 evaluated)	1	0 (0)	1 (100)	1 (not documented)

*There was 1 case with calculus and filling defect demonstrated on imaging at followup.