

Introduction

Long strictures of the mid- to proximal-ureter can pose a significant surgical challenge. Current accepted repair techniques include Psoas hitch +/- Boari flap, buccal mucosa onlay graft, and small bowel substitution. These methods, although successful, are associated with patient and donor site morbidities.

First reported in 1912¹, several studies have proposed use of appendiceal substitution in complex ureteral reconstruction²⁻⁴. Several small case series have shown this to be an effective means of ureteral reconstruction, although there are no large case series.

In this multi-institutional study, we aim to show that robotic appendiceal ureteroplasty has low morbidity and robust long-term outcomes.

Methods

- Between April 2016 and October 2019, we performed robotic appendiceal ureteroplasty on thirteen patients between two institutions. Either onlay flap or interposition was performed per operating surgeon's discretion. All repairs were right sided.
 - 8 ventral onlay
 - 5 interposition
- Demographics, etiology, and prior repair were evaluated and are summarized in Table 1.
- Primary outcomes was surgical success defined as the absence of flank pain without any hardware and ureteral patency on urographic imaging.

Results

Stricture Etiology

- radiation 4/13 (31%)
- iatrogenic 3/13 (23%)
- malignancy 2/13 (15%)
- idiopathic 2/13 (15%)
- obliterative fibroepithelioid polyp 1/13 (8%)
- impacted stone 1/13 (8%)

Intraoperative Outcomes

- Mean stricture length was 6.5 cm (2-11 cm)
- Mean operative time was 337 minutes
- mean estimated blood loss was 116 mL.

Operative Outcomes

- 92% (11/12) success at 13.5 month follow-up (range 1-42)
- One complication > Clavien 3 within 30 day post-operative period

Table 1 Demographics

Parameter	Result
Sex, n (%)	
Female (%)	7 (54%)
Male (%)	6 (46%)
Mean age, yr (range)	58.7 (19-77)
Mean body mass index, kg/m ² (range)	30.6 (18.1-63.3)
Stricture location, n (%)	
Proximal	2 (15%)
Middle	4 (31%)
Distal	5 (38%)
Middle to distal	1 (8%)
Panureteral	1 (8%)
Etiology, n (%)	
Radiation (%)	4 (31%)
Iatrogenic (%)	3 (23%)
Malignancy (%)	2 (15%)
Idiopathic (%)	2 (15%)
Fibroepithelial polyp (%)	1 (8%)
Urolithiasis (%)	1 (8%)
Previous surgical repair, n (%)	1 (8%)

Table 2 Intraoperative and Post-Operative Outcomes

Parameter	Result
Surgical technique, n (%)	
Incision and ventral onlay (%)	8 (62%)
Interposition (%)	5 (38%)
Mean operative time, min (range)	337 (206-583)
Mean estimated blood loss, ml (range)	116.2 (50-600)
Median length of stay, days (range)	3.5 (1-9)
Mean stricture length, cm (range)	6.5 (2-11)
Mean follow-up, months (range)	13.5 (1-42)
Stricture free at last follow-up, n (%)	11 (92%)
30 day complications (Clavien > 2), n (%)	1 (8%)

Figure 1 Appendiceal Onlay Post-op Nephrostogram

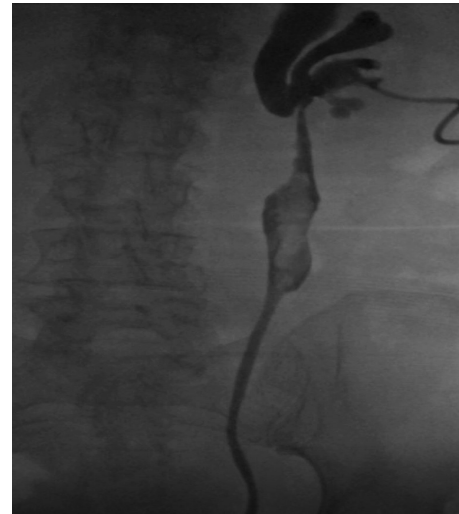
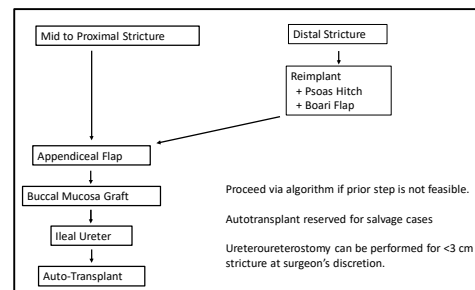


Figure 2 Algorithm for Ureteral Stricture Repair



Discussion

Appendiceal ureteroplasty has good long-term success and minimal morbidity. 11 of 12 patients (92%) were stricture free at a mean follow-up time of 13.5 months.

One Clavien Grade V mortality on post-op day 0 secondary to acute myocardial infarction; otherwise no major complications in the thirty day post-operative period.

Human vermiform appendix is ideal caliber and length for repair of 5-10 cm ureteral strictures and has minimal donor site morbidity. Use of appendix preserves bladder anatomy, does not require a small bowel anastomosis, and poses minimal risk for metabolic derangement and mucus production.

At our institutions, appendiceal flap is part of a ureteral reconstruction algorithm designed to optimize outcome while minimizing morbidity (see Figure 2).

Conclusion

Robotic appendiceal ureteroplasty provides an excellent means of reconstruction with good mid-term outcomes and minimal morbidity.

References

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