Urology Case Reports 21 (2018) 98–100

Contents lists available at ScienceDirect

Urology Case Reports

journal homepage: www.elsevier.com/locate/eucr

Pediatrics

Staged ureteral reconstruction using the appendix in a complex pediatric patient

Paulo Renato Marcelo Moscardi[a,*], Ruben Blachman-Braun[a], Andrew Labbie[b], Miguel Castellan[b]

[a] Children's Urology Associates, Miami, FL, USA
[b] Broward Health Salah Foundation Children's Hospital, Fort Lauderdale, Florida, USA

ARTICLE INFO

Keywords:
Ureterostomy
Appendix
Ureteral reconstruction

Introduction

An extensive range of techniques have been used to address ureteral loss/strictures with the ileal ureter being the most common.[1] However, the use of appendix to correct ureteral loss/injuries is a technique that has not been widespread, with only a few case reports or small series.[2–5] Additionally, reconstructive procedures for the upper urinary tract performed in critical scenarios are deprecated in favor of temporary solutions such as nephrostomies and/or ureterostomies. Herein, we present the first case in our knowledge of a staged ureteral reconstruction utilizing the appendix in a pediatric patient.

Case presentation

A previously healthy 6-month-old girl was admitted to PICU with sepsis due to MRSA peritonitis. She developed an abdominal compartment syndrome and during the next 4-weeks she had a cholecystostomy tube placement due to a necrotic gallbladder, abdominal washout, ileostomy, and abdominal wall closure. After that, she developed multiple colocutaneous and vesicocutaneous fistulas. Post closure abdominal ultrasound revealed an incidental SFU-3 grade right hydronephrosis. Subsequent MAG-3 diuretic renal scan showed a complete right ureteral obstruction with a differential renal function of right-44%/left-56%. Then, she underwent a retrograde pyelogram which revealed a complete right mid-ureteral obstruction. We were unable to introduce a right double-J stent, therefore, a nephrostomy was placed. At this point, she had 3 colocutaneous fistulas on the left abdominal side, and a vesicocutaneous fistula (functioning as a vesicostomy) on the right side.

At 1 year-of-age she was taken to the operating room with the intention of performing a temporary urinary diversion. Combined nephrostogram/retrograde ureterogram revealed a 6 cm right mid-ureteral gap (Fig. 1A). Due to comorbidities, and the extension of ureteral injury, the appendix was used and anastomosed to the proximal ureter and skin (cutaneous appendix-ureterostomy). Fortunately, her abdominal cavity despite previous peritonitis and multiple surgical procedures was not "frozen" with a lot of adhesions and the appendix could be mobilized without difficulties. This temporary diversion worked well, with good right kidney drainage and improvement of the hydronephrosis. A nephrostogram performed 3-weeks later showed good right kidney drainage (Fig. 1B).

At 18 months-of-age, she had a partial left colon resection and closure of vesico-cutaneous and colocutaneous fistulas. At 2 years-of-age, the appendix stoma was dissected from the skin and anastomosed to the distal end of the right ureter (Fig. 2). A right double-J stent was inserted, and ileostomy was closed.

Six weeks postoperatively her double-J stent was removed with a retrograde pyelogram showing good patency of the reconstructed ureter (Fig. 3A). A MAG-3 scan performed 4-months after surgery, showed good excretion with preserved renal function (right-44%/left-56%). Two years postoperatively, ultrasound showed stable mild right hydronephrosis and the MAG-3 scan revealed good excretion with preserved renal function (Fig. 3B). At the age of 4.5 years she is asymptomatic.

Discussion

Currently, there is no settlement regarding the ideal substitute to

* Corresponding author. 1120 NW 14th Street Suite 1551C, Miami, FL, 33136, USA.
E-mail address: moscardi.paulo@gmail.com (P.R.M. Moscardi).

https://doi.org/10.1016/j.eucr.2018.08.016
Received 2 June 2018; Received in revised form 11 August 2018; Accepted 22 August 2018
Available online 18 September 2018

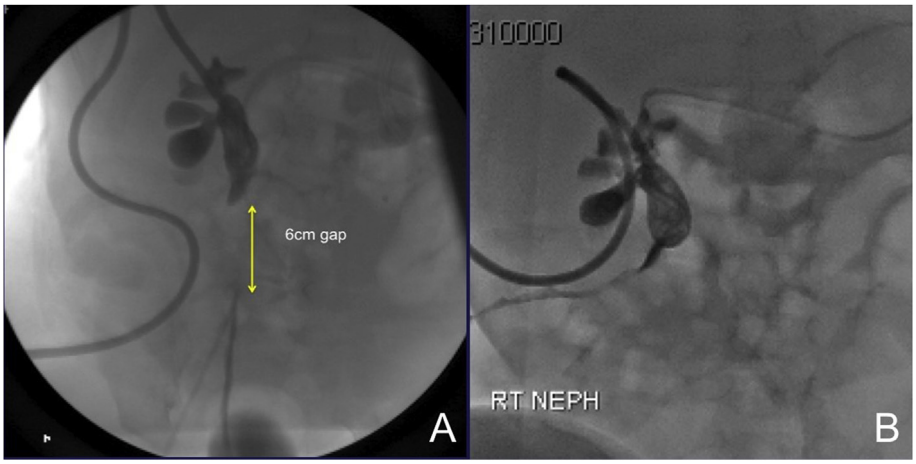

Fig. 1. A) Combined nephrostogram/retrograde ureterogram showing 6 cm ureteral gap. B) Nephrostogram 3-weeks after the cutaneous appendix-ureterostomy.

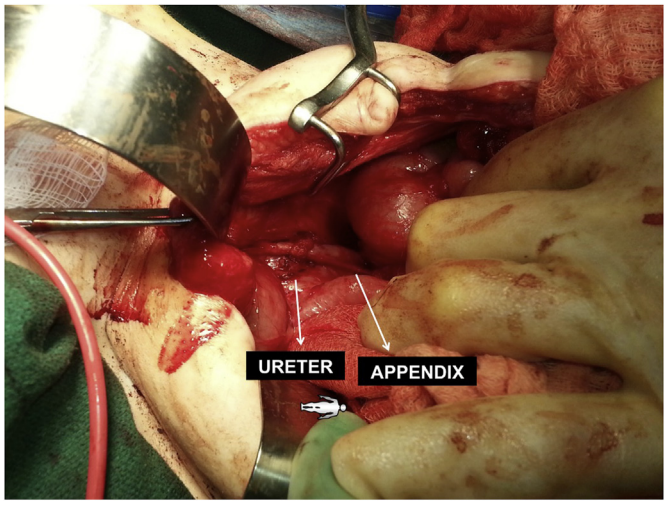

Fig. 2. End-to-end anastomosis of appendix to the distal right ureter.

replace the ureter.[2] An extensive range of techniques have been described to address ureteral loss/strictures including: ileal/colon, appendix interposition, fallopian tubes, psoas hitch, Boari-flap, *trans*-ureteroureterostomy, renal auto-transplantation and ultimately, nephrectomy. The use of the appendix to reestablish ureteral continuity has not been widely reported and few reports describe the use as a ureteric substitute in children, of which mainly used this approach as a permanent solution.[2,3] However, this report shows that in this case of stage ureteral reconstruction the appendix can offer a viable solution.

The rationale of using the appendix as a ureteral substitute lies in its location, which facilitates an easy mobilization through the right ureter and allows the anastomosis to be performed without tension and without compromising the blood supply.[5]

There are disadvantages of using the appendix as ureteral substitution, which included potential inherent problems of surgical anastomosis such as stenosis, fistulas, and total dehiscence. Thus, to minimize the risk of complications a tension-free end-to-end anastomosis should be performed, in addition, the peristaltic direction should be considered. Complete anastomosis disruption was found to be higher in isoperistaltic interposition, especially at the superior anastomosis. Although up to date no case has been reported an anastomotic breakdown when the appendix was interposed in an antiperistaltic manner.[2] Furthermore, Estevão-Costa[3] advocates that antiperistaltic interposition could have no functional impact, but it does hypothetically reduce torsion of the mesoappendix and thus prevents any further vascular compromise. In our case, the appendix was positioned in an isoperistaltic fashion. This choice was made based on the easiest and most natural position of the appendix (and its mesoappendix) in relation to the kidney and right ureter. Despite that, no issues have occurred after 2 years of follow-up.

Another interesting point, at the time of the cutaneous appendix-ureterostomy was fashioned, her collecting system was already drained by a nephrostomy making her renal pelvis not dilated and small, precluding a pyelostomy. Her proximal ureter was not an option due to not reach the skin to perform a ureterostomy. However, the present approach could be a viable alternative, especially for cases with significant loss of ureter that will further require a substitute for it. This approach "stages" the reestablishment of the collecting system in two procedures. This could have a theoretical advantage in the sense of decreasing the likelihood of complications related to performing two ureteral anastomoses (proximal and distal/vesical) at the same time. Especially when substituting the ureter with bowel (bowel/appendix) or other non-urinary substitutes (buccal mucosa).

It is noteworthy that most of these reports describe reconstructions using the appendix on clinically stable patients usually with chronic ureteral obstructions. Furthermore, this report brings a new insight on the management of urinary diversion and ureteral reconstruction, showing that the appendix is useful to create a temporary ostomy when adverse clinical circumstances superimpose, due to multiple previous procedures and unsettled issues with gastrointestinal reconstruction on an oncoming future or when the native ureter is short to perform a direct cutaneous ureterostomy.

Conclusion

Cutaneous appendix-ureterostomy is a simple solution for patients in critical conditions with ureteral injuries. This solution can temporarily solve the urinary tract drainage but also enables and facilitates the definitive reconstruction after stabilization is achieved.

Financial support and sponsorship

None.

Conflicts of interest

There are no conflicts of interest.

Funding sources

None.

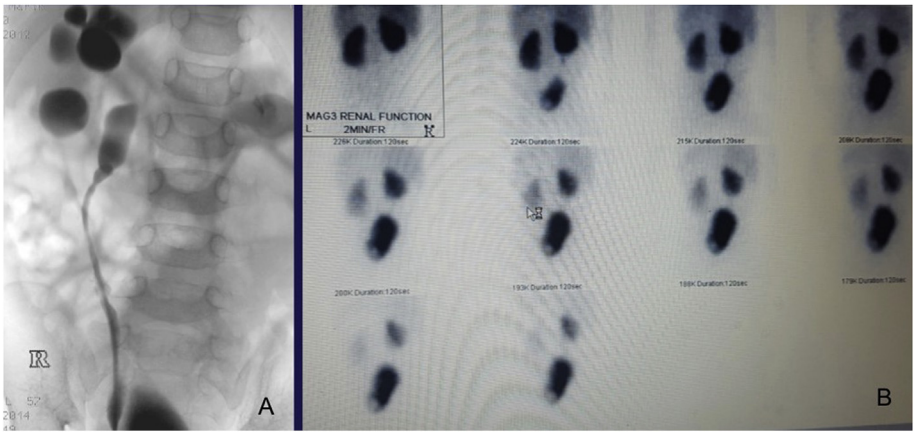

Fig. 3. A) Retrograde urethrogram 6-weeks postoperatively of ureteral-appendix reconstruction. B) MAG-3 scan 2 years postoperatively (right-51%/left-49%).

Acknowledgments

None.

References

1. Mattos RM, Smith 3rd JJ. Ileal ureter. *Urol Clin North Am.* 1997;24(4):813–825.
2. Dagash H, Sen S, Chacko J, et al. The appendix as ureteral substitute: a report of 10 cases. *J Pediatr Urol.* 2008;4(1):14–19.
3. Estevao-Costa J. Autotransplantation of the vermiform appendix for ureteral substitution. *J Pediatr Surg.* 1999;34(10):1521–1523.
4. Obaidah A, Mane SB, Dhende NP, et al. Our experience of ureteral substitution in pediatric age group. *Urology.* 2010;75(6):1476–1480.
5. Richter F, Stock JA, Hanna MK. The appendix as right ureteral substitute in children. *J Urol.* 2000;163(6):1908–1912.