

Female urethral avulsion and bladder neck closure: What now? Trigonal tubularization with placement of an artificial urinary sphincter

Martin Kivi^{a,1}, Armen Ahlberg^a, Rauno Okas^a, Jannik Stuehmeier^b, Marco Pedrini^b, Peter Rehder^{b,*}

^a East Tallinn Central Hospital, Department of Urology, Ravi 18, 10138, Tallinn, Estonia

^b Medical University Innsbruck, Department of Urology, 35 Anich Street, 6020, Innsbruck, Austria

ARTICLE INFO

Keywords:

Urethral avulsion and pelvic fracture
Artificial urinary sphincter
Trigonal tubularization
Urethral reconstruction

ABSTRACT

Bladder neck closure after severe polytrauma with an absent urethra poses a huge challenge for a young woman wanting to urinate normally. Considerations are reconstruction of a neourethra and operative means to gain continence. We describe a case of trigonal tubularization to function as a neourethra, together with the implantation of an artificial urinary sphincter. Eleven years after suffering from an open book pelvic rim fracture at 18 years, successful reconstruction of a trigonal neourethra enabled continence and residual-free spontaneous voiding at 29 years.

Introduction

A young woman suffers from severe pelvic trauma and complete urethral avulsion. A truck hit her while on a zebra crossing and crushed her pelvis. After stabilization and multiple operations, she survived. She suffered from total urinary incontinence. In the absence of the urethra, the bladder neck was closed three years after the trauma and a definitive suprapubic catheter placed. Eleven years after the trauma at age 29 years, she wanted to get rid of the suprapubic tube and void spontaneously. She just started a new private relationship, was working full-time and wanted to optimize her life circumstances.

Case presentation

At age 18 years this young woman suffered from a life threatening polytrauma including crush pelvic ring fractures involving both sacroiliac joints classified as grade IV WSES (World Society of Emergency Surgery).¹ (Fig. 1) Pelvis stabilization left her with one leg shorter than the other. This made walking very difficult. Her own initiative and fighting spirit led to difficult and successful orthopaedic corrections. In the process, the already healed pelvic rim had to be re-broken to correct the alignment with subsequent complete loss of the urethra. She now presented to us with the ability to walk, and a permanent suprapubic catheter to drain her bladder. She did not suffer from regular urinary

tract infections. Bowel functions were normal with no history of obstruction. Clinical investigation showed an absent urethral meatus, absent clitoris, asymmetric labia and a scarred lower abdomen and pelvis. Videourodynamics demonstrated a ~500ml bladder with good compliance and a hypocontractile detrusor without vesicoureteral reflux and bladder neck closure (Fig. 1). Outpatient cystoscopy through the opening of the suprapubic tube confirmed a non-scarred trigone, and complete closure at the level of the bladder neck. No urethra or sphincter were present. The patient expressed her wishes to get rid of the suprapubic catheter and to void normally. Informed consent included that there is no guarantee to successfully mobilize the bladder in the scarred pelvis, create a neourethra from the lower part of the bladder by wrapping it into a tube, placing a cuff around it and implant an artificial urinary sphincter (AUS) AMS 800 (Fig. 2). Bilateral ureteroneostomies would be necessary when the trigonal length is inadequate. A damaged or scarred bladder outlet might necessitate urinary diversion. Surgery was scheduled and done in the supine low lithotomy position. Access was gained by a liberal Pfannenstiel incision with excision of all previous scar tissues. Careful extraperitoneal and extravesical dissection allowed mobilization of the bladder behind the symphysis toward the lateral vaginal walls. Opening the bladder in the midline at the dome allowed inside inspection and placement of double-J ureteric stents (removed at end of surgery). The area of the bladder neck was pushed toward the vagina with a peanut swab on a straight clamp. Excision of a

* Corresponding author.

E-mail address: peter.rehder@i-med.ac.at (P. Rehder).

¹ Martin Kivi and Peter Rehder are equally contributing first authors.

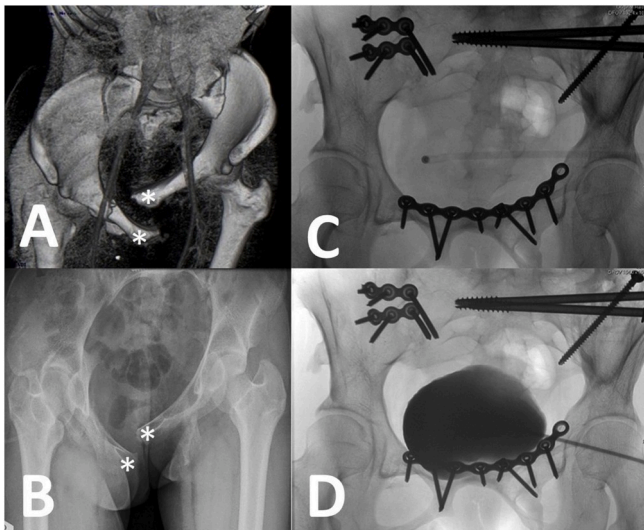


Fig. 1. A) 2008: 3-D-CT-reconstruction of pelvis and big vessels on admission to emergency room. Asterisks indicate extreme dislocation of symphysis, thus pelvic floor rupture and urethral avulsion from bladder neck. B) 2008: Widening of symphysis indicated by asterisks after sacral stabilization. C) 2018: Overview of pelvis at clinical presentation during consultation to “get rid of suprapubic tube”. D) 2019: X-ray during videourodynamics showing bladder with 500ml capacity. The suprapubic catheter is in-situ and the bladder neck closed without remaining urethral or sphincter structures.

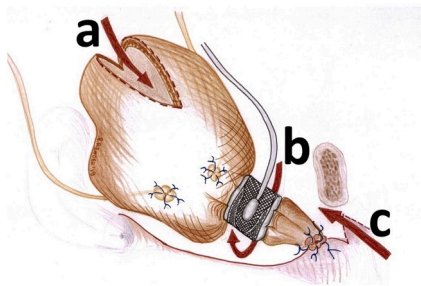


Fig. 2. Overview of surgery: a) arrow refers to elective opening of bladder at dome to allow inspection from inside, placement of double-J ureteric stents \pm facilitate bilateral ureteroneostomies as needed; b) access to dissect around trigone well above bladder neck on top of anterior vaginal wall; c) dissection only at upper edge of introitus underneath symphysis to leave the anterior vaginal wall intact.

round piece of full-thickness vaginal wall, allowed pull through of the bladder outlet to configure a neomeatus in a hypospadiac position (Fig. 3). With digital support by the left hand in the vagina, an angled clamp was passed between trigone and anterior vaginal wall. A measuring tape was placed around the trigone. Careful inspection showed no scars in this area, and a 9cm AMS 800 cuff placed. The remainder of the AUS followed with the pump in the right major labium, the 61-70 cmH₂O pressure-regulating balloon (filled with 25ml isotonic radio contrast solution) below the right rectus muscle extraperitoneal, and tube connectors above the rectus fascia within the subcutaneous tissues. Layered wound closure followed without placement of a wound drain. Bladder drainage was accomplished by transurethral (3 weeks) and suprapubic (6 weeks) catheters. AUS activation was done 8 weeks post-surgery after making sure that spontaneous voiding was possible and free of residual. At 10 months follow-up, the patient is continent, can void without residual, has no urinary tract infections with normal bowel functions and is able to have satisfactory intercourse.

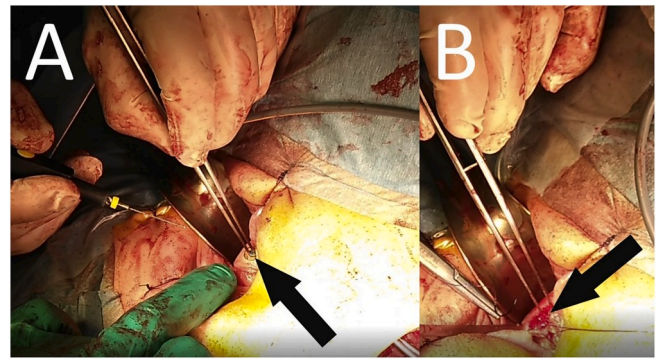


Fig. 3. Meatus of neourethra: A) Peanut swab on a straight clamp pushing bladder outlet from inside the bladder towards the anterior vaginal wall with excision of a small full-thickness round piece of vaginal wall (arrow). B) Bladder outlet opened and neourethral meatus sutured into position with interrupted dissolvable sutures (arrow).

Discussion

Various authors have described urethral reconstruction using flaps from bladder, bowel, vagina and labia. Anterior bladder flaps are described as rectangular with the base including the bladder neck, and flipped distally to reconstruct the urethra.² The anterior (Leadbetter) and posterior (Tanagho) bladder tubes leave suture lines exactly at the bladder outlet.³ An AUS cuff in this position would be liable to erode through the scar tissue. The normal AUS cuff placement in females is at the level of the bladder neck or urethrovesical junction.^{4,5} Traumatic avulsion of the complete urethra off the bladder neck and pelvic floor, compromises the blood and nerve supply of the bladder outlet. Reconstruction of a neourethra from an anterior bladder flap would need a wide-based flap extending well past the lateral borders of the bladder neck. These reconstructions would not be robust enough to allow AUS cuff placement, although it might be suitable for fascial slings. By wrapping the trigone into a tube, we could create a neourethra without any suture lines to accommodate an AUS cuff. The distal end of the neourethra was sutured into the anterior vaginal wall of the introitus. The cuff was placed well above the level of the bladder neck around the trigone.

Conclusion

Trigonal tubularization to create a neourethra in the absence of the urethra and sphincter is possible. AUS placement with a proximal cuff well above the bladder neck and around the “trigonal” neourethra, achieves continence whilst allowing spontaneous voiding.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declarations of competing interest

KV, AA, RO, MP, LAJ, AG, WH: no conflicts of interest, JS: Speaker for Boston Scientific, PR: Speaker for Boston Scientific.

Acknowledgements

Lukas Andrius Jelisejevas², Alexandra Gulacsi², Wolfgang Horninger² are acknowledged for contributing to the concept of the paper, editing and proofreading it.

References

1. Coccolini F, Stahel PF, Montori G, et al. Pelvic trauma: WSES classification and guidelines. *World J Emerg Surg.* 2017;12:5.
2. Mitsui T, Tanaka H, Moriya K, et al. Construction of neourethra using flipped anterior bladder wall tube in a prepubertal girl with complete disruption of urethra. *Urology.* 2010;76(1):112–114.
3. Tanagho EA. Bladder neck reconstruction for total urinary incontinence: 10 years experience. *J Urol.* 1981;125(3):321–326.
4. Peyronnet B, Capon G, Belas O, et al. Robot-assisted AMS-800 artificial urinary sphincter bladder neck implantation in female patients with stress urinary incontinence. *Eur Urol.* 2019;75(1):169–175.
5. Scott FB. The use of the artificial sphincter in the treatment of urinary incontinence in the female patient. *Urol Clin.* 1985;12(2):305–315.