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Use of Solovov–Badenoch principle in treating severe and recurrent vesico-urethral anastomosis stricture after radical retropubic prostatectomy: technique and long-term results

Alchiede Simonato, Andrea Gregori*, Andrea Lissiani†, Virginia Varca* and Giorgio Carmignani,

*'Luciano Giuliani' Department of Urology, University of Genoa, Genoa, *Department of Urologic Surgery, 'Luigi Sacco' University Medical Center, Milan, and Department of Urology, University of Trieste, Trieste, Italy*

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What's known on the subject? and What does the study add?
Many different approaches have been used to treat bladder neck strictures and urinary incontinence after radical prostatectomy in the past. Most techniques are highly invasive and carry a high risk of complications.

The present study describes the use of the Solovov–Badenoch 'pull-through urethroplasty' as well as artificial urinary sphincter implantation.

OBJECTIVE

- To report our experience in the management of patients with combined urinary incontinence and stricture after radical prostatectomy with a two-step approach: urethroplasty with a 'pull-through' technique after the Solovov–Badenoch principle; and artificial urinary sphincter (AUS) insertion after 8–10 months.

PATIENTS AND METHODS

- We retrospectively evaluated a cohort of 11 patients treated between September 2001 and January 2010.

RESULTS

- There were no intraoperative complications in either procedure.
- After urethroplasty one patient was unable to empty the bladder with complete urine retention without urethral stricture (treatment failure).
- At 6 months after the urethroplasty 10 patients were completely incontinent and received AUS.
- One previously irradiated patient developed urethral erosion 6 months after AUS implantation and underwent complete removal of the device.
- After a mean (range) follow-up of 65 (19–119) months, nine patients (81.8%) were continent with no post-void residual urine and a perfectly functioning AUS.

CONCLUSION

- Our experience with a two-step approach (combined suprapubic/transperineal redo anastomosis and AUS placement) shows that redo vesico-urethral anastomosis is easier than pure transperineal approaches with good results in restoring patency and that the transperineal step provides a dedicated operative field for AUS implantation with reduced risks of perioperative complications.

KEYWORDS

vesico-urethral anastomosis, artificial, bladder neck contracture, urinary incontinence, radical prostatectomy, urinary sphincter, stricture

INTRODUCTION

Urinary incontinence and iatrogenic bladder neck/urethral strictures are annoying complications of prostate surgery. There are many causes of urinary incontinence after radical prostatectomy (RP) ranging from variability in defining continence, the surgeon's experience and surgical technique, to patient selection and time of assessment relative to surgery [1]. However, persistent urinary incontinence at 1 year after RP affects 2–5% of patients [2].

The incidence of post-RP bladder neck strictures in contemporary series ranges from 7% to 9.4% [3,4].

Most strictures can be conservatively managed with dilatation or with endoscopic treatments, but if severe incontinence

	n or mean (range)
No of patients	11
Age, years	62 (58–73)
Previous treatments	
Retropubic RP	8
Laparoscopic RP	3
Adjuvant radiotherapy	2
Bladder neck incisions/resections	
Four to six operations	3
Six to eight operations	7
>Eight operations	1
Interval from RP to urethroplasty, months	22 (12–41)

TABLE 1
Patient characteristics

develops after incision of the stricture, it can be successfully handled with an artificial urinary sphincter (AUS) [5].

However, treatment of strictures in incontinent patients who cannot be managed successfully by transurethral procedures is controversial. Often, a permanent stent or a urinary diversion (with catheters or major surgery) is used without achieving an optimal functional result, which means a combination of lumen patency and urinary continence [6].

Some authors have advocated complex abdomino-perineal approaches to perform urethroplasty and AUS implantation in one or two stages [7], while others have performed a one- or two-stage prostatic stent and AUS implant [6,8]. Our group reported on transperineal end-to-end urethroplasty or anastomosis followed by transperineal AUS placement after 6 months [9].

In 1935 Solovov [10] described a method (invagination of the peripheral urethral stump into the paracentral stump) for treating post-traumatic posterior urethral strictures. In 1950 Solovov's operation was modified by Badenoch and it was known as the 'pull-through urethroplasty' [11], which is the intussusception of the distal normal urethra into the proximal scarred urethra and prostate. However, the technique was abandoned in the 1970s when transpubic approaches were preferred.

We report our experience managing patients with combined urinary incontinence and stricture after RP with a two-step approach: urethroplasty with a 'pull-through' technique following the Solovov–Badenoch principle; and AUS insertion after 8–10 months.

PATIENTS AND METHODS

Between September 2001 and January 2010, we observed 11 patients, aged 58–73 years, with a combination of anastomotic bladder neck contracture and urinary incontinence after RP for localized prostate cancer (Table 1).

All patients were evaluated with a physical examination, appropriate serum laboratory analysis and a complete diagnostic evaluation, including retrograde and voiding urethrogram, flexible urethroscopy and urodynamic investigations, according to the methodology and definitions of the International Continence Society guidelines [12], to exclude detrusor overactivity and compliance abnormalities.

Two patients had previously received adjuvant radiotherapy. All the patients had erectile dysfunction at the time of presentation. On flexible cystoscopic examination, all patients had a tight, pinpoint contracture at the vesico-urethral anastomosis.

Before definitive treatment, all the patients underwent four or more aggressive internal urethrotomies or resections with symptomatic recurrence of a tight contracture.

The first step in the two-step approach was the redo vesico-urethral anastomosis with the 'pull through technique'. The technique used was as follows. With the patient in the lithotomy position, a perineal reversed Y-shaped incision was made. Exposure of the bulbar urethra was achieved by separating the bulbospongiosus muscles. A vascular loop was passed around the bulbar urethra. The distal edge of the stricture was recognized and incised with the help of the Nelaton urethral sound (Fig. 1A).

The bladder was punctured suprapubically with a needle, a guidewire was passed through and the tract was coaxially dilated until a 26 Ch Amplatz sheath was positioned. A flexible cystoscope was introduced through the sheath and the hydrophilic angiographic guidewire was passed to the bladder neck through the stenosis and retrieved from the perineum. A 24 Ch Nelaton urethra sound was then passed suprapubically through the guidewire and introduced up to the bladder neck (Fig. 1B).

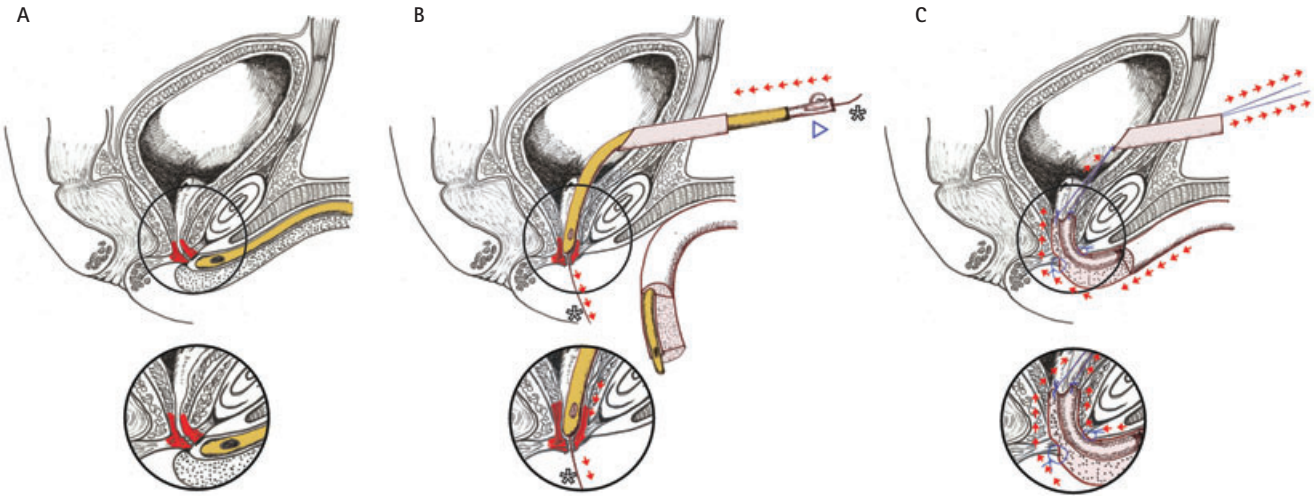
The stricture was proximally removed by pulling and following the guidewire and the 24 Ch catheter until healthy tissue was observed to obtain a large lumen of the vesico-urethral anastomosis (Fig. 1B). For a tension-free anastomosis, the anterior urethra was largely dissected from the corporal bodies and the intracrural space developed with a wide mobilization, starting from the bifurcation of the corporal bodies. The anterior urethra was dorsally spatulated. Interrupted polygalactic acid 3-0 sutures were placed on the proximal edges of the corpus spongiosus of the urethra to guarantee a good haemostasis.

Two monofilament 0-0 sutures were placed at the proximal edge of the urethra and the distal ends were carefully retrieved through the perineum into the bladder neck and the cystostomy to pull the proximal stump of the urethra inside the bladder through the bladder neck. A gently transperineal push of the urethra with the fingers helped to complete the manoeuvre successfully (Fig. 1C).

After placement of an 18 Ch catheter, interrupted polygalactic acid 3-0 sutures were then placed in the proximal segment of the urethra between the paraurethral fascia and the vesico-urethral anastomosis to achieve a watertight anastomosis.

Four more sutures were placed between the urethra and the corporal bodies to better guarantee the integrity of a

*FIG. 1. (**A**) The distal edge of the stricture is recognized with the help of a 24 Ch Nelaton urethral sound (yellow). The urethra is incised and the stricture is proximally removed following the guidewire and the 24 Ch catheter until healthy tissue is observed to obtain a large lumen of the vesico-urethral anastomosis. (**B**) The bladder is punctured suprapubically with a needle, and a guidewire is passed through and the tract is coaxially dilated until a 26 Ch Amplatz sheath is positioned. A flexible cystoscope is introduced through the sheath and a hydrophilic angiographic guidewire (denoted *) is retrieved through the cystostomy and fixed with another Nelaton sound through a blocking system (blue triangle). The sclerotic tissue is exposed with a traction of the guidewire and the Nelaton sound from the perineum and it is easily removed. (**C**) The urethra is gently tractioned into the bladder by suprapubically pulling two sutures. It is then sutured to the pelvic diaphragm with interrupted sutures. Sutures (blue marks) fix the periurethral and perineal fascia.*



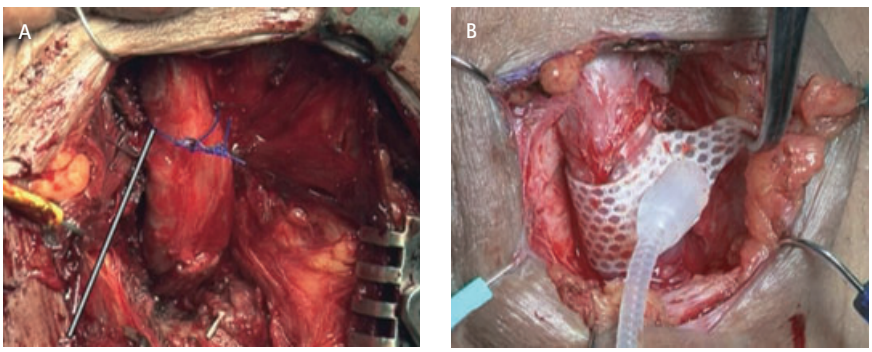
tension-free anastomosis. At this point the urethra was evaluated to find the right place to place the cuff of the AUS and a monofilament non-absorbable suture was passed as a future landmark (Fig. 2A). The bulbo-urethral muscles were reconstructed and the superficial perineal fascia was re-established. The incision was then closed in layers.

The two monofilament 0-0 sutures placed at the proximal edge of the urethra were simply removed pulling a distal tail, and a suprapubic 14 Ch catheter was positioned.

The urethral catheter was removed at postoperative day 10 after cystography and the suprapubic catheter was removed 3 days later.

All 11 patients who underwent the re-do anastomosis were evaluated with urine cultures after 1, 3 and 6 months. A flexible urethroscopy was performed after 6 months. If a complete incontinence and a stable patent urethral lumen were obtained, the patient was scheduled for AUS placement within 2–3 months. We therefore performed a transperineal AUS placement 8–10 months after redo vesico-urethral anastomosis.

*FIG. 2. (**A**) A monofilament non-absorbable suture is passed as a future landmark. (**B**) After 6–8 months the urethra is circumferentially dissected off the corporal bodies to accommodate the cuff of the AUS. The vitality of the tissue is clear from the image.*



The second step in the two-step approach was the transperineal AUS insertion. For this procedure, antibiotic i.v. prophylaxis with an aminoglycoside (gentamicin sulphate) plus the glycopeptide vancomycin was administered before surgery while the patient was on call to the operating room. Hair removal from the surgical field area was performed in the operating room just before surgery. Antibiotic solution was used to immerse the elements of the system, which was liberally irrigated throughout the procedure.

With the patient in the lithotomy position, a vertical midline perineal incision was made. The landmark suture placed in the previous operation was found. This marker is very useful for finding the plane between the urethra and the corporal bodies (Fig. 2A). The urethra was circumferentially dissected off the corporal bodies for a length of about 2 cm to accommodate the cuff of the AUS (Fig. 2B). The circumference of the urethra was measured for cuff size selection. A small incision in the right iliac region was then made, and a pocket was bluntly created

under the rectus muscle, extraperitoneally, to allow placement of the balloon reservoir. The reservoir tubing was brought out through a separate incision in the anterior rectus fascia. A long clamp was passed down over the pubis to the perineal incision in a plane superior to the fascia to avoid scrotal violations. The cuff tubing was grasped and guided up into the abdominal wound, passing through the bulbo-urethral muscles. A lateral subcutaneous hemiscrotal pouch was then created using sequential Hegar dilators. The pump was then placed in the pouch after accurate saline filling. All of the appropriate tubing connections were made, and the device could then be tested and deactivated. A 4–5 cm cuff at the bulbar urethra and a 61–70 cmH_2O pressure-regulating balloon were used. The incisions were then closed in layers. A 14-day course of antibacterial therapy was given as the oral fluoroquinolone levofloxacin. The device was activated at 4–6 weeks.

The postoperative evaluation after the AUS insertion included urine cultures, objective examination and post-void residual urine every 3 months.

RESULTS

There were no intraoperative complications in either procedure. After redo vesico-urethral anastomosis, one patient was unable to empty his bladder with complete urine retention without urethral stricture. This patient was easily treated with self-clean intermittent catheterization and did not receive AUS insertion. Therefore, we consider this case a complete treatment failure.

At 6 months after the urethroplasty 10 patients were completely incontinent. All the urine cultures were negative.

The diagnostic evaluation at 6 months after the urethroplasty showed an absence of urethral strictures and complete anastomotic healing in all patients. Therefore, 10 patients received AUS insertion at 8–10 months after urethroplasty.

One previously irradiated patient developed urethral erosion at 6 months after AUS implantation and underwent complete removal of the device. After a mean (range) follow-up of 65 (19–119) months, nine patients (81.8%) were continent with no post-void residual urine and with a perfectly functioning device.

DISCUSSION

The management of patients with combined urinary incontinence and posterior urethral stricture after RP is a great surgical challenge, especially after failure of endoscopic treatment of the stricture.

Luckily most strictures can be easily and conservatively managed with endoscopic treatment [13], while severe urinary incontinence can be managed with AUS placement, which is considered the gold standard with a continence rate of around 90% in both the short and long term [14].

Anastomotic strictures combined with urinary incontinence after failure of endoscopic treatment are not common. Therefore, treatment is still controversial and under debate. There are various procedures and approaches proposed in the literature to manage stricture and incontinence after RP.

Abdomino-perineal approaches to perform urethroplasty plus AUS in one or two stages are complex, invasive and potentially morbid procedures with a high perioperative complication rate [7,15,16]. This kind of approach should therefore be used if an abdominal procedure is needed (e.g. ileocystoplasty).

Prostatic stent implantation and AUS placement for anastomotic bladder neck contracture and urinary incontinence after RP is an alternative approach with acceptable outcomes [6,8]. However, this kind of management, although avoiding an open urethroplasty, should be used with caution. In fact, when prostatic stents are used for benign prostatic diseases [17,18] the complication rate is significant. Moreover, several well recognized complications can occur with stents (e.g. stent migration, encrustation and recurrent contracture) and the management of such cases with an AUS can be challenging.

The results of transperineal anastomotic posterior urethroplasty are excellent, with a 90% success rate [19]. The transperineal approach allows clear exposure and access to the bladder neck, as clearly shown in transperineal RP [20]. We previously obtained good results by performing a transperineal urethroplasty to obtain a lumen patency and waiting for a durable result before carrying out a definitive AUS implant [9].

When a lot of scar tissue is present and the angle between the two ischiopubic branches is tight, the vesico-urethral anastomosis can be difficult to perform, also with a 'push in' manoeuvre, as described by Barbaqli *et al.* [21]. The combined suprapubic/transperineal redo vesico-urethral anastomosis, which follows the 'pull-through urethroplasty' method originally described by Badenoch following the Solovov operation for treating post-traumatic posterior urethral strictures, always permitted a complete removal of the scar tissue, obtaining a large lumen and an easier anastomosis.

At a reasonable time after a successful anastomosis (about 6 months), an AUS implantation with a clean, dedicated operative field can be performed to achieve the complete urinary continence necessary for an optimal functional result. If the plane between the urethra and the corporal bodies is not easily developed, a transcorporeal cuff implantation can be performed, as described by Guaralnick *et al.* [22].

Ten of 11 patients from the present series underwent AUS implantation after a successful redo anastomosis, while one patient needed AUS explantation for erosion (81.8% success rate).

The two-step procedure is a reliable alternative to the previously reported approaches. It allows the success of the anastomosis to be evaluated after a reasonable time before AUS implantation. One disadvantage is the need for a second operation, but this strategy could maximize the potential healing for the patient.

In conclusion, treating a combined severe urinary incontinence with anastomotic bladder neck contracture after radical retropubic prostatectomy and failure of endoscopic treatments is a challenge for the urologist. A graded approach could be considered a safe method for successfully treating such difficult cases.

Our experience with a two-step approach (combined suprapubic/transperineal redo

anastomosis and AUS placement) shows that redo vesico-urethral anastomosis is easier than pure transperineal approaches with good results in restoring patency and that the second transperineal step provides a dedicated operative field for AUS implantation with reduced risks of perioperative complications.

CONFLICT OF INTEREST

None declared.

REFERENCES

1 **Cambio AJ, Evans CP.** Minimising postoperative incontinence following radical prostatectomy: considerations and evidence. *Eur Urol* 2006; **50**: 903–13

2 **Peyromaure M, Ravery V, Boccon-Gibod L.** The management of stress urinary incontinence after radical prostatectomy. *BJU Int* 2002; **90**: 155–61

3 **Popken G, Sommerkamp H, Schultze-Seemann W, Wetterauer U, Katzenwadel A.** Anastomotic stricture after radical prostatectomy. Incidence, findings and treatment. *Eur Urol* 1998; **33**: 382–6

4 **Besarani D, Amoroso P, Kirby R.** Bladder neck contracture after radical retropubic prostatectomy. *BJU Int* 2004; **94**: 1245–7

5 **Gousse AE, Tunuguntla HS, Leboeuf L.** Two-stage management of severe postprostatectomy bladder neck contracture associated with stress incontinence. *Urology* 2005; **65**: 316–9

6 **Elliott DS, Boone TB.** Combined stent and artificial urinary sphincter for management of severe recurrent bladder neck contracture and stress incontinence after prostatectomy: a long-term evaluation. *J Urol* 2001; **165**: 413–5

7 **Theodoros C, Katsifotis C, Stournaras P, Moutzouris G, Katsoulis A, Floratos D.** Abdomino-perineal repair of recurrent and complex bladder neck-prostatic urethra contractures. *Eur Urol* 2000; **38**: 734–40

8 **Anger JT, Raj GV, Delvecchio FC, Webster GD.** Anastomotic contracture and incontinence after radical prostatectomy: a graded approach to management. *J Urol* 2005; **173**: 1143–6

9 **Simonato A, Gregori A, Lissiani A, Carmignani G.** Two-stage transperineal management of posterior urethral strictures or bladder neck contractures associated with urinary incontinence after prostate surgery and endoscopic treatment failures. *Eur Urol* 2007; **52**: 1499–504

10 **Solovov PD.** Fracture of the pelvis with injury of bladder and urethra. *Vestn K Chir* 1935; **37**: 36–42

11 **Badenoch AW.** A pull-through operation for impassable traumatic stricture of the urethra. *Br J Urol* 1950; **22**: 404–9

12 **Abrams P, Cardozo L, Fall M *et al*.** The standardisation of terminology in lower urinary tract function: report from the standardisation sub-committee of the International Continence Society. *Urology* 2003; **61**: 37–49

13 **Pansadoro V, Emiliozzi P.** Iatrogenic prostatic urethral strictures: classification and endoscopic treatment. *Urology* 1999; **53**: 784–9

14 **Hussain M, Greenwell TJ, Venn SN, Mundy AR.** The current role of the artificial urinary sphincter for the treatment of urinary incontinence. *J Urol* 2005; **174**: 418–24

15 **Theodorou C, Moutzouris G, Floratos D, Plastiras D, Katsifotis C, Mertziotis N.** Incontinence after surgery for benign prostatic hypertrophy: the case for complex approach and treatment. *Eur Urol* 1998; **33**: 370–5

16 **Lieberman SF, Barry JM.** Retreat from transpubic urethroplasty for obliterated membranous urethral strictures. *J Urol* 1982; **128**: 379–81

17 **Ogiste JS, Cooper K, Kaplan SA.** Are stents still a useful therapy for benign prostatic hyperplasia? *Curr Opin Urol* 2003; **13**: 51–7

18 **Madersbacher S.** Stents for prostatic diseases: any progress after 25 years? *Eur Urol* 2006; **49**: 212–4

19 **Koraitim MM.** On the art of anastomotic posterior urethroplasty: a 27-year experience. *J Urol* 2005; **173**: 135–9

20 **Harris MJ.** Radical perineal prostatectomy: cost efficient, outcome effective, minimally invasive prostate cancer management. *Eur Urol* 2003; **44**: 303–8

21 **Barbagli G, Stomaci N, Delle Rose A, Selli C, Trippitelli A, Lenzi R.** Posterior urethroplasty in children. *Eur Urol* 1987; **13**: 110–5

22 **Guralnick ML, Miller E, Toh KL, Webster GD.** Transcorporal artificial urinary sphincter cuff placement in cases requiring revision for erosion and urethral atrophy. *J Urol* 2002; **167**: 2075–8

Correspondence: Alchiede Simonato, Ospedale San Martino, Clinica Urologica 'L. Giuliani', pad. 12, Università degli Studi di Genova, L.go Rosanna Benzi, 12, 16132 Genova, Italy.
e-mail: alchiede.simonato@unige.it>

Abbreviations: **AUS**, artificial urinary sphincter; **RP**, radical prostatectomy.