Repair of Bulbar Urethra Using the Barbagli Technique

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22.1 Introduction and Historical Background

The dorsal onlay graft urethroplasty, also named Barbagli technique, builds on previous steps in the urethral surgery:

- The principles of the buried skin strip as suggested by Denis Browne [1]
- The experimental and clinical studies on urethral regeneration according to Weaver, Schulte, and Moore [2–4]
- Urethral reconstruction using a free full-thickness skin graft as popularized by Devine [5]
- The dorsal approach to urethral lumen as suggested by Monseur [6]

22.2 Anatomical Remarks

In the bulbar urethra, the relationship between the spongiosum tissue and the mucosal membrane are quite different

from penile tract (■ Fig. 22.1A): the corpus spongiosum is thick in the ventral urethral surface, and thin in the dorsal urethral surface (■ Fig. 22.1B). Furthermore, the urethral lumen is located dorsally and not centrally (■ Fig. 22.1B). The bulbar urethra is easily freed from the underlying corpora cavernosa (■ Fig. 22.2D, E), and the lumen may be opened along its dorsal surface (■ Fig. 22.2F). In patients who have undergone repeated and deep internal urethrotomies at 12 o'clock, the urethral lumen is adherent and firmly fixed to the tunica albuginea, because the longitudinal internal cut involve the urethral mucosa, spongiosum tissue, and the tunica albuginea. The healing of this kind of urethrotomy and the urinary extravasation cause a scar that joins together the urethral mucosa and the tunica albuginea. Also, in patients with an indwelling urethral stent in place, it may be difficult to approach and to free the dorsal urethral lumen. In obese patient, its may be difficult to free the urethra from the corpora cavernosa, because these patients have a deep and flat perineum. In all these patients, a ventral or lateral approach to the urethral lumen for urethroplasty could be advisable.

■ Fig. 22.1A, B. Anatomy of penile (A) and bulbar urethra (B) [12, 13]

22.3 Step-by-Step Surgical Details

22.3.1 Preparation of the Bulbar Urethra

The patient is placed in simple lithotomy position, and a midline perineoscrotal incision is made overlying the stricture site (■ Fig. 22.2A). The bulbocavernous muscles are separated in the midline, and, in patients with proximal bulbar urethral stricture, the central tendon of perineum is dissected (■ Fig. 22.2B). The bulbar urethra is free from the bulbocavernous muscles for its entire length, and the muscles are fixed to a retractor using four

stitches (■ Fig. 22.2C). The bulbar urethra is dissected from the corpora cavernosa, starting from 2 cm *distally* (not proximally) to the stricture (■ Fig. 22.2D). In this tract (■ Fig. 22.2D), it is easier to free the urethra from the corpora cavernosa, because the urethra is thinner and not involved in the disease. Using a loop, the urethra is completely mobilized from the corpora cavernosa and rotated 180 degrees (■ Fig. 22.2E). The stricture portion is incised dorsally, starting over the urethral catheter (■ Fig. 22.2E), and extending the stricturotomy for 2 cm into the healthy urethra proximal and distal to the stricture. The strictured tract is dorsally opened for all its length (■ Fig. 22.2F).

■ Fig. 22.2A–F. Preparation of the bulbar urethra [12, 13]

22.3.2 Preparation and Suture of the Graft (Skin or Buccal Mucosa)

In patients with stricture shorter than 4 cm, an ovoid strip of ventral penile skin is outlined for harvesting (■ Fig. 22.2A). In patients with stricture longer than 4 cm, a double circumferential subcoronal incision is made for harvesting a longer preputial skin strip. When local epithelial foreskin is unavailable or the patient does not agree to harvesting from the prepuce, the buccal mucosa is preferred to other various types of extragenital free grafts, because of its qualities [7]. We chose the inner cheek over the inner lip as a donor site, because the width of the lip limits the size of the graft [7]. Moreover, the buccal mucosa is thicker and resistant in the cheek when compared

with the buccal mucosa from the lip. The buccal mucosa harvesting increases the operative time by 1 h.

Thus, a two-team approach may be used in which a perineal team exposes and calibrates the strictured tract, while another simultaneously harvests the graft from the mouth. This procedure also increases the sterilization of the surgical act. The reduced operative time has remarkable advantages and may prevent troublesome complications from prolonged lithotomy position [7].

The fenestrated ovoid preputial free skin or buccal mucosa graft is spread-fixed and quilted to the overlying tunica albuginea of the corporal bodies (■ Fig. 22.3A).

The right mucosal margin of the opened urethra is sutured to the right side of the patch graft, spreading open the strictured tract to the new roof, which is the flat,

■ Fig. 22.3A–E. Dorsal onlay urethroplasty using skin or buccal mucosa graft: standard technique [12, 13]

fixed graft (■ Fig. 22.3B). The urethra is rotated back to its original position (■ Fig. 22.3B). The left urethral margin is sutured to the left side of the patch graft and corporal bodies, and the grafted area is entirely covered by the urethral plate (■ Fig. 22.3C). The bulbocavernous muscles are approximated over the grafted area (■ Fig. 22.3D). A small suction drain is placed in the region of the repair, and an indwelling 16-Fr silicone Foley catheter is left in place (■ Fig. 22.3E). The suprapubic cystostomy is unnecessary.

In patients with stricture who require a complete removal of the strictured tract, the urethra is completely transected below the tip of the urethral catheter (■ Fig. 22.4A). The urethral scar or disease is removed, and the distal and proximal urethral edges are mobilized

from the underlying corpora cavernosa, using a gentle traction on the stitch fixed to the spongiosum tissue (■ Fig. 22.4B). The proximal mucosal edge is spatulated and spread over the corpora cavernosa, and the mobilized distal urethra is widely opened along its dorsal surface (■ Fig. 22.4C). The free skin or buccal mucosa graft is spread-fixed and quilted to the underlying corpora, and its lower margin is sutured to the proximal mucosal edge of the urethra (■ Fig. 22.4D). The left mucosal margin of the opened distal urethra is sutured to the left side of the graft (■ Fig. 22.4E). The urethra is rotated back over the grafted area and sutured to proximal mucosal edge and to the right corpora cavernosa (■ Fig. 22.4F). The bulbocavernous muscles are sutured over the bulbar urethra, and the perineal closure is made as previously described.

■ Fig. 22.4A–F. Augmented roof strip anastomotic urethroplasty [12, 13]

22.3.3 Preparation and Suture of the Flap

In patients with stricture that has recurred after urethroplasty, or with serious ischemic urethral disease or damage, it may be useful to use the pedicled flap so as to improve the graft take and neovascularization. A midline perineal incision is made and a longitudinal ventral penile skin island is outlined in the penile shaft (■ Fig. 22.5A). The bulbar urethra is circumferentially mobilized from the corpora cavernosa and rotated to 180 degrees (■ Fig. 22.5B). The longitudinal penile skin

island is carried on the ventral dartos fascial pedicle (■ Fig. 22.5B) [8]. The fascial pedicle is extensively dissected and mobilized to allow the transposition of the skin island into the perineum, using a finger-made tunnel (■ Fig. 22.5B, *arrow*). The bulbar urethra is opened along its dorsal surface; the skin island is sutured to the corpora cavernosa, without transecting the urethra (■ Fig. 22.5C) or transecting completely the urethra (■ Fig. 22.5D). The urethra is rotated back over the island flap (■ Fig. 22.5E), and the grafted area is covered with the healthy urethra (■ Fig. 22.5F).

■ Fig. 22.5A–F. Dorsal only urethroplasty using a ventral penile fascial flap with longitudinal skin island

22.3.4 Postoperative Course

The day after surgery, the drain is removed, and the patient is discharged from the hospital. Three weeks after surgery, the bladder is filled with contrast medium, the Foley catheter is removed, and a voiding cystourethrography is obtained. Uroflowmetry and urine culture are repeated every 4 months throughout year 1 and yearly thereafter. Radiological studies are repeated when uroflowmetry was less than 14 ml/s. Clinical outcome was considered a failure any time postoperative instrumentation was needed, including dilatation [7].

22.3.5 Intraoperative, Perioperative, and Postoperative Complications

In patients who have undergone repeated internal urethrotomies, it may be difficult or impossible separate the urethra from the corpora cavernosa, and the tunica albuginea may be opened or injured. In this case, it is important to realize that there is damage on the corpora cavernosa and the opening must be immediately repaired. If it is difficult to free the urethra from the corpora, one can make a lateral or ventral opening into the urethral lumen. In this case, it could be better to use buccal mucosa as graft and not preputial skin.

In patients who have undergone an augmentation urethroplasty for stricture longer than 6 cm, during the first radiological investigation, the presence of a urethral fistula or an extravasation of the contrast medium can be observed. In this case, leave in place a 14-Fr Foley silicone catheter, and perform a new radiological study 2 weeks later.

22.4 Long-Term Results and Attrition Rate of the Barbagli Procedures

In 1998, we reported the outcomes of dorsal onlay graft urethroplasty using penile skin or buccal mucosa in 37 bulbourethral strictures, with a mean follow-up of 21.5 months, 34 (92%) were classified as successes, and three (8%) as failures [7].

Recently, with a mean follow-up extended from 21.5 to 43 months, the success rate of dorsal onlay procedures in 40 patients decreased from 92% to 85% [9]. In this series of patients, we did not include patients who underwent dorsal onlay urethroplasty using a pedicled flap or buccal mucosa graft [9]. In fact, the pedicled flap urethroplasty was used in only five patients, and in patients who underwent a buccal mucosa graft repair the short follow-up is not available for evaluation over time.

In 1999, other authors reported good outcomes (97%) in 28 patients who underwent a dorsal onlay graft ure-

throplasty using preputial skin or buccal mucosa, with a mean follow-up of 19 months [10].

In 2000, other authors reported a favorable results (93%) in 29 patients, for a median follow-up of 28 months, using an augmented roof strip anastomotic urethroplasty [11].

22.5 Conclusions

The Barbagli technique urethroplasties are safe and versatile procedures, which may be combined with various substitute materials such as preputial or extragenital skin, a buccal mucosa graft, or a pedicled flap. Other substitute materials will be possible in the future.

The long-term outcomes of a wide series of patients, reported by different institutions, showed a final success rate from 85% to 97% [7, 9–11].

For substitute materials (buccal mucosa versus preputial or penile skin), a long-term follow-up is mandatory to establish whether buccal mucosa is superior to foreskin as urethral substitution. We currently use both according to patient preference, status of the genital tissues, or stricture characteristics.

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