

Keystone Flaps in Urethroplasty: Reconstruction in a Complex Case of Panurethral Stricture Disease

Sidhartha Kalra, Lalgudi Narayanan Dorairajan, Ketan Mehra, Ramanitharan Manikandan

Department of Urology, JIPMER, Puducherry, India

Abstract

Panurethral strictures are a surgical challenge for a reconstructive urologist more so in situations where local tissue for reconstruction is deficient. Two-stage urethroplasty is the preferred option in such cases. In some complex stricture diseases where patients are not willing for multiple procedures, permanent perineal urethrostomy can give a good functional outcome. Keystone flaps have been used as a simple and effective method of wound closure in other areas of the body that would otherwise have required complex flap closure and skin grafting. We describe, for the first time, a case of inflammatory panurethral stricture disease complicated by Fournier gangrene with extensive penile, scrotal, and perineal skin deficit managed with a perineal urethrostomy, with the help of keystone design perforator island flaps with successful outcome.

Keywords: Fournier gangrene, keystone flap, panurethral stricture, perineal urethrostomy, urethral stricture

INTRODUCTION

Panurethral strictures are a surgical challenge for a reconstructive urologist, especially in situations where enough local tissue for reconstruction is unavailable. These long strictures are mostly of inflammatory origin due to catheterization, instrumentation, or infection. Two-staged urethroplasty is usually indicated especially when adverse local conditions such as extensive scarring, fistulae, infection, or previous failed urethroplasty exist or there is a lack of usable local skin for flap or graft repair. The first stage is laying open the strictured urethral segment along with proximal urethrostomy. There should be adequate skin available for the second-stage reconstruction. This is usually achieved by using of local penile, perineal, and scrotal skin.¹ Sometimes, skin or buccal mucosal grafts are used either by choice or when adequate local skin is unavailable, but graft fixation requires a supply well-vascularized bed. However, in strictures associated with dense scarring and extensive scrotal and penile skin loss such as those complicated by Fournier gangrene, first-stage urethroplasty or even creating a perineal urethrostomy itself can be challenging.

We describe a case of complex panurethral stricture disease with extensive, scarred perineum, sequel to treated Fournier's gangrene managed by a perineal urethrostomy with the

help of bilateral perineal keystone design perforator island flaps (KDPIFs).

CASE REPORT

A 65-year-old male with diabetes mellitus was referred to our hospital for the management of urethral stricture disease. He had a history of voiding lower urinary tract symptoms for 6 months and subsequently developed periurethral abscess, went into acute urinary retention, and developed Fournier's gangrene. He was treated at that time with suprapubic cystostomy and debridement of the penile, scrotal, and some parts of perineal gangrenous skin and skin grafting of these areas. He presented to us 6 months later for urethral reconstruction. Local examination at presentation revealed meatal stenosis with balanitis xerotica obliterans changes and absent prepuce skin. The whole of the penile and scrotal skin had been replaced by adherent grafted skin. His testes were pulled up and lying at the superficial inguinal region due to scars and contractures [Figure 1]. Antegrade and retrograde urethrogram revealed extensive areas of narrowing

Address for correspondence: Dr. Ketan Mehra,
Department of Urology, JIPMER, Puducherry, India.
E-mail: drketanmehra@gmail.com

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in the penile and bulbar urethral regions [Figure 2]. Because of the complex urethral stricture, he was given the options of two-staged urethroplasty or a permanent perineal urethrostomy, seeing his age and comorbidities. The patient refused for the two-staged procedure and underwent a perineal urethrostomy fashioned with the help of an inverted “U-shaped” perineal skin flap and bilateral KDPIF. The procedure was performed under anesthesia with the patient placed in lithotomy position. Bulbar urethra was exposed with an inverted U-shaped perineal flap. The keystone flaps were designed with perpendicular incisions made at either angle of the lateral defects meeting the curvilinear incision marked parallel to the defects at a distance approximately twice the size of defects. Flaps were subsequently mobilized with the underlying subcutaneous tissue over the fascia and sutured into the original defect. The donor area was closed primarily over drains [Figure 3a and b]. The patient recovered uneventfully, and he voided well when the catheter was removed on the 7th postoperative day. Uroflowmetry showed a smooth bell-shaped curve with wave of 12 ml/s. He was satisfied with the outcome of his treatment.

DISCUSSION

Staged urethroplasty with perineal urethrostomy for panurethral stricture, although not very difficult, was



Figure 1: Picture showing patient’s scrotal, penile, and perineal skin replaced by contracted grafted skin

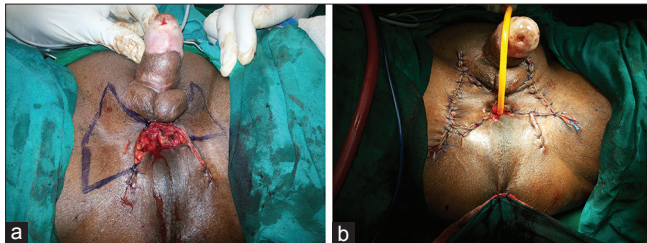


Figure 3: (a) Intraoperative photograph showing marking of bilateral keystone flaps which are subsequently mobilized to fill the lateral defects. (b) Final appearance after keystone flaps were mobilized and sutured into the lateral defects

particularly challenging in this particular case as the local skin had been completely replaced by grafted skin which was neither sufficient nor healthy for reconstruction. A posterior inverted U-shaped perineal skin flap for creation of perineal urethrostomy was available, but the lateral skin was falling short [Figure 4]. The bed of the tissue seemed poorly vascularized and densely scarred. Bilateral KDPIFs were, therefore, used to provide an adequate, durable, and esthetic closure of the lateral defect. KDPIF achieves closure of the primary defect using tissues immediately adjacent to it, along with primary closure of the secondary defect with acceptable outcome. The flap consists of two conjoint V-Y island flaps with closure of “V” as a “Y,” thus creating tissue laxity in the center of the flap at right angles to the “Y.” The flap is roughly trapezoidal in shape. The medial border is the interface between the flap and the defect while the lateral border is formed by a line parallel to the medial border at a distance roughly equal to or slightly larger than the width of the primary defect. Two more lines are then marked as



Figure 2: Retrograde urethrogram showing multiple long areas of narrowing in the anterior and posterior urethra



Figure 4: Figure depicting posterior inverted U-shaped perineal skin flap attached to posterior margin of urethra with the lateral skin falling short

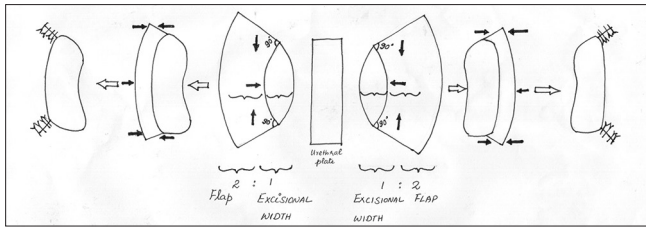


Figure 5: Schematic diagram of keystone flaps: An incision at 90° at either end of the defect meets the curvilinear line of the flap mark out. The width of the flap is approximately double the width of the defect. This curvature or keystone shape is then mobilized. Flap length is governed by the length of the elliptical excision

perpendiculars from the edge of the primary defect (medial border) which meets the lateral border. The flap is mobilized over fascia and sutured into the original defect and the donor area closed using standard technique [Figure 5]. These flaps are based on the concept of angiotome, a section of skin, and underlying tissue that can be islanded on its axial perforator vessels while the periphery of this flap is supplied by connecting linkage vessels. The KDPIF technique has been used for various perineal, vulval, and other reconstructions. Defects as large as 20 cm have been covered at various sites with an overall success rate of 96.36%.²⁻⁴ The other treatment options in this case could have been staged urethroplasty with split skin grafting for lateral skin defects or a single-stage urethral reconstruction with radial forearm skin-free flap. Skin grafting had the limitations of donor site morbidity, chances of graft loss, and poor-quality tissue for second-stage reconstruction. Single-staged repair with free flap would have increased the complexity of the procedure and the operating time. Further, it has been associated with complications such as urethrocutaneous fistula and donor-site morbidity.^{5,6} The KDPIF technique has an added advantage of not requiring extensive pre- and intra-operatively flap planning that is essential in a case of pedicled or free flap.

CONCLUSION

Keystone flaps are a simple and effective method of staged urethroplasty, particularly in patients with panurethral or extensive bulbar urethral stricture disease where there is scarcity of local scrotal and penile skin due to prior infection or surgery.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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