Arab Journal of Urology (2013) **11**, 267–271

Arab Journal of Urology
(Official Journal of the Arab Association of Urology)

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REVIEW

Penile reconstruction in the male

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Received 21 March 2013, Received in revised form 3 April 2013, Accepted 7 April 2013
Available online 13 June 2013

KEYWORDS

Glans reconstruction;
Shaft;
Lymphoedema;
Genitalia;
Scrotoplasty

ABBREVIATIONS

RAFF, radial artery-based forearm free flap;
STSG, split-thickness skin graft

Abstract We describe and review the most recent techniques of male genital reconstruction, identifying relevant material with an unstructured PubMed-based search of previous reports, using the keywords 'reconstruction', 'glans', 'shaft', 'lymphoedema', 'skin graft', 'scrotoplasty', 'urethroplasty', and 'penile prosthesis'. This search produced 22 reports that were analysed in this review. Split-thickness skin grafts are ideal for glans reconstruction, while full-thickness skin grafts should be used to cover defects on the shaft penis, as they tend to heal with less contracture. The radial artery-based free-flap phalloplasty is the technique of total phallic reconstruction associated with the highest satisfaction rates. Further research is required to identify an ideal reconstructive technique that would guarantee superior cosmetic and functional results, minimising donor site morbidity.

Introduction

Despite the continuous development of surgical devices and techniques over the past decades translating into a significant improvement in the outcome of male genital reconstruction, repairing and reconstructing the penis remains anatomically, functionally and aesthetically a great challenge. This is because the primary goal of penile reconstruction surgery is to achieve an adequate result in terms of cosmesis and function, with restoration of the capacity to void while standing from the tip of the phallus and, in the sexually active patient, to engage in penetrative intercourse with an adequate erogenous sensation.

As no other tissue in the body has the ideal characteristics in terms of colour, elasticity and texture to be used

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Peer review under responsibility of Arab Association of Urology.

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http://dx.doi.org/10.1016/j.aju.2013.04.003

for male genital reconstruction, preservation of as much viable tissue as possible is always advisable. Therefore, in male genital trauma, surgical repair should be immediate, to maximise the preservation of viable tissue. When genital tissue is not available for repair, skin grafts, and a variety of pedicled and free flaps, represent a viable option for genital reconstruction.

We identified relevant articles published in the last 15 years using an unstructured PubMed-based search, applying the keywords 'glans reconstruction', 'shaft reconstruction', 'lymphoedema of the genitalia', 'skin graft', 'scrotoplasty', 'phalloplasty', 'free flaps', 'urethroplasty', and 'penile prosthesis'.

Glans reconstruction

Reconstruction of the glans penis might be required in isolation, after traumatic amputation or surgical excision for benign and malignant conditions, or as part of a total phallic reconstruction.

Various genital conditions are managed with partial or complete excision of the glans penis, as reported in Table 1. Loss of genital tissue requiring glans reconstruction might also be secondary to traumatic amputation of the distal aspect of the penile shaft.

Glans resurfacing, which involves the partial or complete excision of the glans mucosa followed by repair with the use of a split-thickness skin graft (STSG) of non-genital skin, is indicated if the mucosa of the glans penis is affected by lichen sclerosus or carcinoma *in situ* [1,2].

To render the procedure easily reproducible and to facilitate the work of the histopathologist, the affected epithelium is initially marked in quadrants from the meatus to the coronal sulcus, and perimeatal and circumcoronal incisions made. The glans epithelium and subepithelial tissue are then completely peeled from the underlying spongiosum, using sharp dissection from the meatus to the coronal sulcus for each quadrant. A STSG, usually harvested from the thigh with an air dermatome, is used to cover the 'exposed' spongiosum. The graft thickness is usually 0.2–0.4 mm, to minimise donor-site morbidity and to guarantee adequate cosmetic and functional results. The graft is then quilted using several 5–0 interrupted polyglactin sutures to the spongiosum, to assure an adequate take, and the coronal sulcus is recreated to guarantee an adequate cosmetic result due the rich blood supply to the spongiosum, graft take tends to be complete in all patients. Therefore this technique yields excellent cosmetic and functional results in almost all patients. [2].

Glansectomy, which involves the complete dissection of the glans penis from the tip of the corpora cavernosa, is indicated for widespread pT1 and pT2 squamous cell carcinoma of the glans penis [3]. The procedure is usually carried out through a circumferential circumcising incision, which is made in the distal shaft skin down to Buck's fascia, and allows the surgeon to develop a plane between the spongiosum and the corporal heads. Once the glans penis is completely lifted up, the urethra is divided. Frozen sections are usually cut from tissue taken from the tunica albuginea and the distal urethral margin to confirm the complete clearance of the malignancy. The shaft skin is then sutured 2 cm proximally from the tip of the corporal heads, and a pseudo-glans is fashioned using a STSG, which is quilted on the corporal heads in an attempt to recreate the normal anatomical appearance of the organ.

If the frozen-section analysis is positive, a distal corporectomy is performed; the excision is progressively carried out more proximally until the tumour is completely cleared. The glans is then reconstructed using the same quilting technique as previously described after a glansectomy.

Glans reconstruction using a STSG, both after glansectomy or distal corporectomy, is simple and reproducible, and yields adequate cosmetic and functional results in almost 99% of patients [4].

Scrotal reconstruction

Contrarily to penile tissue loss, scrotal skin loss, which is usually secondary to Fournier's gangrene, trauma or after excision of bulky penile tumours, does not pose a great challenge for the reconstructive surgeon. This is due to the intrinsic laxity of the scrotal skin, which allows for primary closure even when the skin loss is up to half [5]. When, due to extensive tissue loss, a primary closure is not feasible, the scrotum can be reconstructed using a STSG or local flaps.

After a scrotal trauma with exposure of the testes, preservation of spermatogenesis is the first concern. Therefore the testes should be initially positioned in subcutaneous thigh pouches in preparation for scrotal reconstruction.

Relocation of the testes in the scrotum is supported by concerns about pain, adverse psychological outcomes

Table 1 Surgical procedures that require a partial or complete excision of the glans penis, and their indications.

Procedure	Indication
Glans resurfacing	Lichen sclerosus or carcinoma *in situ* of the glans penis
Partial glansectomy	Carcinoma of the penis affecting the glans
Total glansectomy	Carcinoma of the penis affecting the glans
Distal corporectomy	Carcinoma of the penis affecting the glans and infiltrating the distal aspect of the corpora cavernosa