



How I do it

Anatomical modeling of the foreskin for the reconstruction of glanular hypospadias



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Summary

The normal development of the glanular urethra is closely related to the normal development of the foreskin. A ventral deficit in the foreskin results with the failure to develop the septum glandis and frenulum, which also form the ventral wall of the glanular

and subcoronal urethra. Here we present the anatomical modeling of the foreskin in order to obtain a mucosal collar for the reconstruction of the glanular hypospadias with the GFC technique (Glanular-Frenular-Collar), which can also be used for various purposes to reconstruct the urethra in hypospadias.

Introduction

In hypospadias repair, the use of the foreskin as a well-vascularized flap to cover the neourethra or its tubularization to form the neourethra is a common surgical procedure [1,2]. It is known that not only their texture, but also the blood supply to the outer and inner foreskin is different in the normally developed

prepuce. The outer layer of the foreskin has a blood supply that runs from the penile shaft and gives cross-communicating branches to the inner layer. Even after the cut off the small cross-communicating branches, the inner foreskin remains well vascularized due to its blood supply from the glans (Fig. 1). In hypospadias, the dorsal part of the outer foreskin is confirmed to be relatively avascular

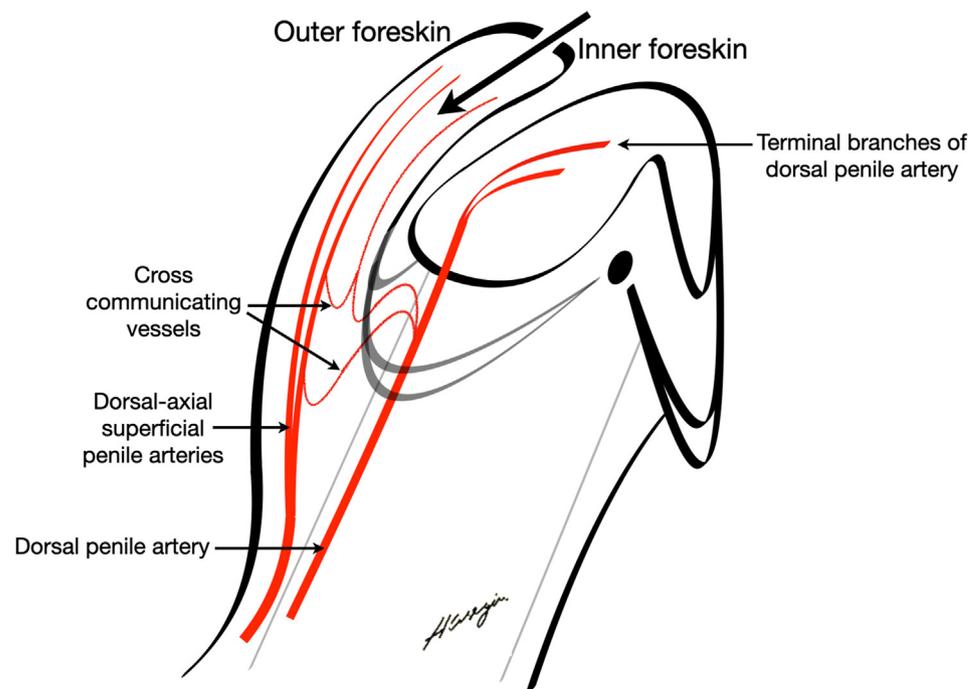


Fig. 1 Foreskin arterial blood supply. Arrow: entrance through the natural border between the outer and inner foreskin.

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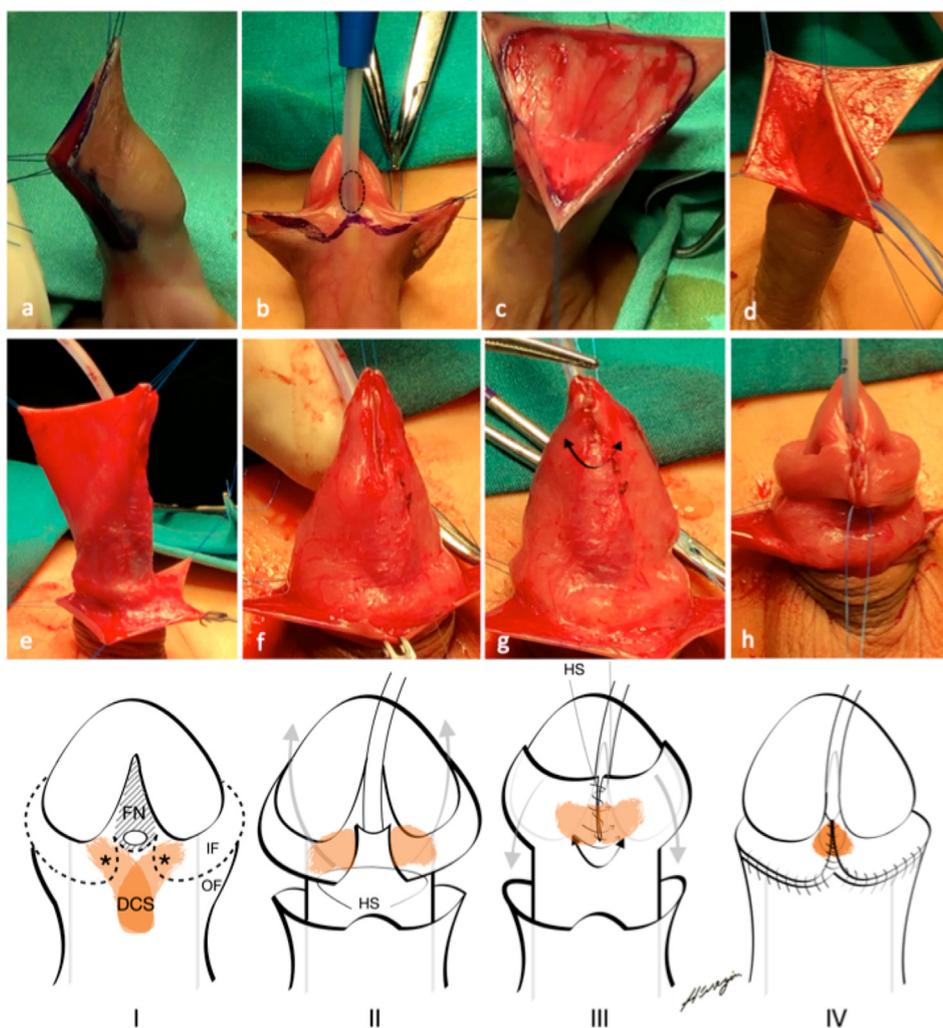


Fig. 2 Description of foreskin modeling, and its use in the GFC technique: 1- The foreskin is pulled over the glans with three holding sutures (4/0 prolene). The hypospadiac meatus is covered with the foreskin and a normal-looking penis is simulated with a preputial ring (Fig. 2a). Anatomical landmarks of the outer and inner foreskin as well as the glanular urethra (FN, dotted circle) are determined (Fig. 2b). 2- Opposite to the first three sutures, three additional holding sutures are placed on the inner foreskin to facilitate manipulation. The initial incision is made on the natural line between the inner and outer foreskin. By deepening the incision, the avascular space between the two layers is found. The incision is extended down on both sides to meet below the ectopic meatus. The fine mucosalized foreskin around the ventral surfaces of the glans wings is preserved to create the ventral wall of the glanular and subcoronal urethra (Fig. 2b). No incisions are made distal to the ectopic meatus and on the glans. 3- Outer and inner layers of the foreskin are separated by micro-dissection using needle-tipped monopolar electrocautery through the space where the cross-communicating vessels are located. Complete degloving is performed and the entire inner foreskin is designed as a symmetrical mucosal collar. It can be divided on the dorsal midline in order to facilitate subsequent ventral rotation if necessary (Fig. 2c–f). 4- A holding suture is placed to this mucosal collar approximately 10–15 mm from the ectopic meatus. This suture is pulled over the glans to expose the inner surface of the mucosal collar (Fig. 2f). The edges of the mucosal collar are sutured continuously along the midline with subepithelial (7/0 polydioxanone) sutures. The submucosal layers on both sides of the collar are sutured in the midline to form a dense mesenchymal tissue (septum glandis) and frenulum. The glans wings are approximated with a (5/0 polyglactin) suture from the inside of the mucosal collar (internal approximation) (Fig. 2g, double-headed arrow). The mucosal collar is brought down (Fig. 2h). (FN:fossa navicularis, DCS:diverted corpus spongiosum, IF:inner foreskin, OF:outer foreskin, HS:holding suture).

in the midline and rich in vascularity in dorsolateral aspects with axial pattern vessels [3,4].

Here we describe anatomical separation of the two layers of the foreskin, in which the inner foreskin is prepared as a well-vascularized mucosal collar.

Material and methods

Sixty-eight patients with glanular hypospadias were subjected to the anatomical modeling of the foreskin to obtain a mucosal collar. Average age at surgery was 14 months

(6–21 months). All patients were operated by HÖ. The surgical technique and the use of the mucosal collar in the GFC technique is described step by step in Fig. 2.

Discussion

The shape of the urethral orifice and glanular urethra depends on the formation of the preputial frenulum and the distal corpus spongiosum proximal to the terminal part of the urethra. The frustration of the distalward axial growth of the corpus spongiosum, frenulum and ventral foreskin over the urethral meatus results in hypospadias [5–7]. In normal human penis anatomy, the glans wings are separated by a thin fibrous tissue (septum glandis) and its epithelial extension (frenulum) establishes its connection with the foreskin. Consistent with these features of the glanular urethra, therefore, the use of a well-vascularized inner foreskin in an axial pattern to form a septum and frenulum is crucial in repairing glanular urethra. Following the natural border between the inner and outer foreskins allows entry into the relatively avascular space, and the two layers can be separated from one another while preserving their major vascular supplies. If the correct plane is maintained, only cross-communicating minor vessels are cut. Axial use of the inner foreskin enables the axial use of its sub-mucosal layer, which is supposed to contain the terminal extensions of the diverted corpus spongiosum. The incision and mucosal flaps in this technique differ significantly from the Firlit mucosal collar technique. The Firlit incision was described as a ‘chevron’ incision within the inner surface of the foreskin, fashioned below the complete glans approximation. In our technique, the incision follows the space between the inner and outer foreskin, and protects the vascular supply of the inner mucosal collar, which can be jeopardized with the chevron incision. The fine mucosalized inner foreskin around the ventral surfaces of the glans wings are used as a part of the collar to form the septum glandis and frenulum. In addition, our modeling enables the use of a suture for “internal approximation” (Fig. 2). In this way, the glans wings are approximated without incision and/or dissection and the anatomical integrity of the glans is preserved. The described operative technique is based on a Glanular-Frenular Collar (GFC) that was designed with an understanding of the abnormal development of the glanular urethra and foreskin in hypospadias.

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None.

Ethical approval

Not applicable.

Conflicts of interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpuro.2021.03.023>.