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Onlay foreskin flap anastomosed directly to the tunica albuginea: A short-term experimental study in rabbits

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Summary

Introduction
In severe hypospadias, urethral plate division is necessary for curvature correction. To configure the new urethra, an approach has been described using a foreskin flap directly anastomosed in an 'onlay' fashion to the tunica albuginea of the corpora cavernosa. Results suggest that it is possible to use the corpus cavernosum albuginea as the posterior wall of the neourethra without the need of a dorsal graft.

Objective
The present experimental study aimed to evaluate the histological characteristics and healing pattern of this procedure.

Study design
Sixteen New Zealand male rabbits were divided into two groups of eight animals. Eight animals underwent 1-cm longitudinal dorsal incision of the penile urethra and the edges were anastomosed to the tunica albuginea (Group 1). Eight other animals underwent complete excision of 1.0 cm of penile urethra. Urethroplasty was performed using a foreskin flap directly anastomosed as an onlay to the albuginea, as shown in the figure (Group 2). Sacrifice and histological assessment was performed 2, 4, 8 and 12 weeks postoperatively.

Results
In Group 1, a mild inflammatory process was noted that became almost imperceptible at 12 weeks. Fibrosis was mild at all stages in this group. Over time, a regenerative epithelium covered the corpus cavernosum. Immunohistochemistry using specific CK-7 and CK-20 confirmed the presence of urothelium. No complications were microscopically detected in this group. Group 2 presented with a more intense inflammatory infiltrate, which also resolved over time. Fibrosis was slightly more intense in this group, especially in animals that had urethral strictures. Group 2 presented with three fistulas, two were associated with urethral stricture. Histological evaluation showed the presence of epithelization over the albuginea, which turned out to be similar to the normal urothelium over time and was confirmed by immunohistochemistry. Non-keratinized stratified squamous epithelium of the foreskin flap showed good integration to the urethra.

Discussion
Microscopic analysis showed that inflammation, fibrosis and complications were similar to previous studies. At 12 weeks there was a well-developed epithelium similar to normal urethra, which was confirmed by immunohistochemistry; this was similar to what occurs in the TIP technique, as previously demonstrated. It was hypothesized that the epithelium regeneration developed from the urethral edges, as demonstrated in other experimental studies.

Conclusion
The albuginea was covered by mature urothelium after 12 weeks, which presumably grew from the urethral edges. The foreskin flap onlay that was directly anastomosed to the albuginea completely integrated and constituted the roof of the neourethra.

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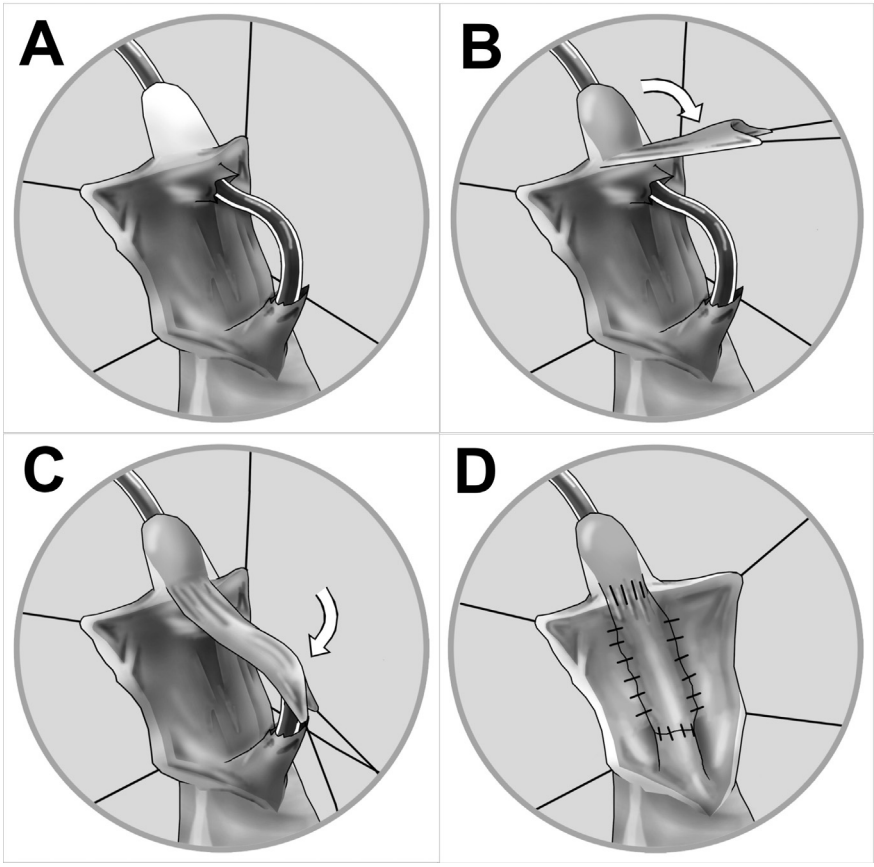

Figure Procedure in Group 2. (A) Construction of 1.0-cm long urethral defect; (B) delimitation of foreskin flap on the ventral penile surface; (C) flap rotation from distal to proximal to cover the urethral defect; (D) flap sutured to the corpus cavernosum.

Introduction

In recent decades, the treatment of proximal hypospadias has been an ongoing debate. Today, the consensus seems to be preservation of the urethral plate. However, in some patients with severe penile curvature, urethral plate division is necessary for curvature correction [1]. In these cases, a single procedure or staged strategy both remain controversial [2—4]. Most surgeons choose the technique based on personal experience and not on technical feasibility or literature results [2,4].

The correction with a single-stage procedure has proven to be safe and has long-term success rates up to 70% [5,6]. Two-stage techniques present complication rates of approximately 22%, but require at least three surgical procedures if a complication occurs [7].

Rigamonti and Castagnetti published an approach to configure the new urethra using a foreskin flap directly anastomosed in an onlay fashion to the tunica albuginea of the corpora cavernosa, and found a complication rate around 21% in a mean follow-up of 7 months [8]. This is conceptually very similar to the Monseur urethroplasty principle (1968) and its several variants, which described focusing on the urothelial lining of the tunica albuginea of the corpora cavernosa to complete the circumferential defect of the urethra [9].

These results suggest that it is possible to use the corpus cavernosum albuginea as the posterior wall of the neourethra without the need of a dorsal graft. The present experimental study aimed to evaluate the histological characteristics and healing pattern of this procedure.

Materials and methods

The Committee of Ethics in Research of the institution approved this study. A total of 16 New Zealand male rabbits were divided into two study groups of eight animals. The smallest estimated number of animals required to observe and analyze the results was used [10—15]. Animals were kept in a vivarium over a period of 3—7 days (induction period) prior to surgery.

Anesthesia was induced by a licensed veterinarian (JQ) and was initiated by the intramuscular (IM) administration of a solution of acepromazine 1 mg/kg and fentanyl hydrochloride 3 μg/kg, and then a solution of ketamine 30 mg/kg with xylazine 5 mg/kg. Epidural block with lidocaine 2% and bupivacaine 0.5% with epinephrine was also performed. The surgical procedure was performed using magnification loupes of 3.5×.

Initially, the urethra was catheterized with an 8-F catheter and then the fold between the penis and the