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Utility of tissue expansion in pediatric phallic reconstruction: a 10-year experience

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Abstract *Objective:* Boys with complex penile anomalies often undergo multiple operations, leaving a paucity of unscarred skin for further reconstructive procedures. Our objective was to evaluate the ability of tissue expansion to provide local skin for successful phallic reconstruction.
Materials and methods: Eighty boys (mean age of 11.9 years) with hypospadias ($n = 42$) or epispadias ($n = 38$) formed the study cohort. All patients had undergone at least one failed reconstructive operation. Indications for tissue expansion included scarcity of penile skin with urethral stenosis, urethrocutaneous fistula, chordee, and/or residual defect. One or two expanders were placed under the skin of the penile shaft and removed at the time of reconstruction.
Results: Average time between expander placement and reconstruction was 10.9 weeks. Mean follow-up time was 25.3 months. Complications during expansion occurred in 33 patients (41.3%). Twenty-two patients (27.5%) had at least one expander removed prematurely and 46.9% were replaced. Expansion yielded adequate tissue for reconstruction in 76 patients (95.0%). Successful outcomes were achieved in 39 patients after initial reconstruction and 25 patients after further intervention, yielding an overall success rate of 80.0%.
Conclusion: Tissue expansion is a useful tool with an acceptable rate of complications for phallic reconstruction in patients who have failed prior surgical reconstruction.

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Introduction

Reconstructive surgery for congenital penile defects, notably hypospadias and epispadias, is a common and evolving aspect of pediatric urology and plastic surgery. The principal goals of reconstruction include correction of penile chordee, advancement of the urethral meatus to the tip of the glans, restoration of normal urination, and provision of a functional and normal-appearing penis [1,2]. There are more than 300 techniques described for hypospadias correction, many involving multistaged algorithms, owing to the high rate of complication or failure to achieve optimal outcomes [3]. Complications associated with penile reconstruction include urethrocutaneous fistulae, urethral stenosis, penile scarring, persistence of chordee, and lack of skin and tissue for further reconstruction [4–6]. Urethral fistula is the most frequent complication, with an incidence of 5–44%, and an incidence of 60% in the initial postoperative period [7].

Concomitant with the development of complications is the need for recruitment of well-vascularized, supple tissue for secondary or tertiary reconstruction. Newer techniques for the reconstruction of the penis in the exstrophy/epispadias complex have been associated with glans and corporal loss, which can further increase the complexity of the reconstruction. Current solutions for skin coverage and urethroplasty include buccal mucosa, bladder mucosa, and/or full thickness skin grafts; acellular dermal matrix; and random local skin flaps [5]. The disadvantages of using extragenital skin or synthetic matrices include pigmentation mismatch, hair-bearing donor site, lack of sensation, questionable longevity of engineered constructs, and the propensity for complications when flaps are used. The use of expanded local genital tissue avoids these drawbacks by providing an abundance of well-vascularized skin for coverage, and the capsule of the expander adds an additional layer for coverage of the neourethra [8–12]. Furthermore, genital skin possesses similar amounts of androgen receptors, allowing the site to grow uniformly with adjacent tissue as the patient ages.

There are few reports in the literature regarding the use of tissue expansion in phallic reconstruction. Vordermark [8], Pascual et al. [9], and Mir et al. [10] reported good results with the use of tissue expansion in small cohorts of patients with hypospadias. Two larger studies involving 18 and 16 patients showed 47% and 81% success rates, respectively [11,12]. In this study, we report the largest clinical experience using tissue expansion for penile reconstruction in patients with congenital penile anomalies.

Methods

This study was approved by the Johns Hopkins Institutional Review Board.

We reviewed 80 consecutive patients who had undergone tissue expansion after having presented with multiple failed penile reconstructive procedures primarily for hypospadias or epispadias. Indications for tissue expansion included recurrent urethral stenoses, urethrocutaneous fistulae, residual hypospadias or epispadias, and chordee following previous reconstructive surgeries. On clinical examination, all 80 patients had a lack of tissue for reconstruction, defined as a scarcity of penile skin either to cover the defects from previous surgeries or to reconstruct the urethra after previously failed attempts. Some patients had received preoperative injections of testosterone enanthate in an attempt to obtain more penile skin, though tissue expansion was still required to generate sufficient skin for reconstruction in all cases. Among patients with a known surgical history, the average number of prior operations was 2.3. The mean age at the time of tissue expander implantation was 11.9 years (median 13.3, range 0.8–42.1).

The cohort included 42 patients with hypospadias and 38 with epispadias. Secondary diagnoses included 35 with bladder exstrophy, 20 with ambiguous genitalia, and one each with Prader–Willi, Y-chromosome microdeletion, and Smith–Lemly–Opitz. Within the hypospadias group, three patients had a urethral opening near the glans of the penis (coronal hypospadias), eight along the shaft (midshaft hypospadias), 16 near the junction of the penis and scrotum (penoscrotal or scrotal hypospadias), 13 in the perineum (perineal hypospadias), and two were unknown.

Tissue expander placement was based on the location of the desired tissue, as well as the malleability of the tissue. While supple, unscarred penile skin is preferred for expansion, some patients only had scarred tissue available for reconstruction. All patients received preoperative antibiotics (first-generation cephalosporin or clindamycin if allergic to penicillin). An incision was made through the penile skin and a subcutaneous pocket was created in the loose areolar tissue near the expected area of reconstruction (Fig. 1). Early in the series, the incision(s) was placed at the base of the penis, but we have since moved the incision to the junction between the shaft and glans. This has reduced our rate of infection and extrusion as it is easier to keep the site clean after surgery. A subcutaneous pocket between the skin and Dartos fascia was dissected and sized for subsequent expander insertion. Tissue expanders used were either 1.5 × 3.0 cm or customized size of 0.5 × 1.0 cm (PMT, Chanhassen, MN, USA). Fill volume for both expanders was 10 cm^3. During the initial experience, the number of tissue expanders implanted was based on the amount of skin required for reconstruction. All patients now have two expanders placed regardless of reconstructive needs. If one of the expanders becomes infected or extrudes and needs to be removed, the remaining expander frequently provides enough tissue to complete the reconstruction. Overall, 18 patients (22.5%) had a single tissue expander placed and 62 (77.5%) had two tissue expanders placed. Surgery for placement of the tissue expanders typically takes 60–75 min. The children are allowed to void normally after surgery and no urinary catheter is placed. For children in a diaper, the parents were asked to clean the incision sites with soap and water after each bowel movement for the first week.

The expanders were usually implanted laterally, but positioned dorsally or ventrally as needed based on urethral location. Using a separate incision, another subcutaneous pocket was dissected above the pubic bone region for placement of the buried expander port. A subcutaneous tunnel was created between the port and the expander for tubing placement. Incisions were closed with buried absorbable sutures.