Musculocutaneous latissimus dorsi free transfer flap for total phalloplasty in children

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Abstract Objective: Total phalloplasty is rarely performed in children due to the mutilation involved and the dilemma concerning neophallic size in children. We present a musculocutaneous latissimus dorsi free transfer flap for total phalloplasty in children with difficult psychological problems.

Materials and methods: Total phalloplasty was performed in eight boys aged between 10 and 15 years. Indications were small penis after failed epispadias repair (4), micropenis (3) and intersexuality (1). A musculocutaneous latissimus dorsi free flap was harvested with thoracodorsal artery, vein and nerve. The flap was transferred to the pubic region and anastomosed to the femoral artery, saphenous vein and ilioinguinal nerve. Two-staged urethroplasty was performed in five patients using buccal mucosa, while in the remaining three a Mitrofanoff channel had been created previously. An inflatable penile prosthesis was implanted in two cases after puberty.

Results: Follow-up was from 6 to 53 months (mean: 29 months). Penile size varied from 13 to 16 cm in length and from 10 to 12 cm in circumference. No flap necrosis, either partial or total, was noted. The donor site healed acceptably in four cases while in the remaining four moderate scarring occurred. Function of the penile prostheses is satisfactory. Psychological status is significantly improved in all children.

Conclusion: Phalloplasty in childhood is indicated to prevent profound psychological problems related to body dysmorphia. The musculocutaneous latissimus dorsi flap is a possible choice for phalloplasty in children that enables good neophallic size as in adults. We recommend this surgery to be performed before puberty to ensure optimal psychosexual pubertal development.

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Introduction

Phalloplasty is a surgical project posing considerable challenges. Although total phalloplasty in adults has been reported since the late 1930s, little has been written about phallic reconstruction in children [1–3]. The technical approach for children requiring phalloplasty is the same as for adults, but special consideration must be given to the sizing of the neophallus. The neophallus created from somatic tissue lacks androgen receptors and will grow linearly in comparison with the exponential growth of the normal penis. Several surgical techniques have been proposed for phallic reconstruction using either available local vascularized tissues or microvascular tissue transfer [4–6]. Microsurgical techniques have been successfully applied to prepubertal phalloplasty despite the great challenges of the pediatric population [1,2]. The musculocutaneous latissimus dorsi flap has a reliable and suitable anatomy (good size, volume and length of neurovascular pedicle) to meet the esthetic and functional requirements of phallic reconstruction. We present our results using this flap in children who had psychological problems due to inadequate penile size.

Material and methods

In the period April 2001 until February 2005, total phalloplasty using a musculocutaneous latissimus dorsi flap was performed in eight boys aged between 10 and 15 years (mean: 12 years). Indications were small penis after failed epispadias repair in four patients (Cantwell—Ransley in three and Mitchell repair in one, performed elsewhere), micropenis in three patients, and intersex in one patient. Compelling psychological reasons to proceed were evident in all the patients and their anxious parents.

Surgical technique

A latissimus dorsi musculocutaneous flap of the non-dominant side is designed and harvested with thoracodorsal artery, vein and nerve. The surface of the flap is templated in two parts: (1) a rectangular part for the neophallic shaft designed to be approximately 17 × 15 cm and (2) a circular component for glans reconstruction. The flap is completely elevated except for the neurovascular bundle, which was not transected until the recipient vessels and nerve had been prepared for microanastomosis. Latissimus muscle is fixed at several points to the edges of the skin to prevent layer separation during further dissection (Figs. 1 and 2). Simultaneously, another team dissects the recipient area together with femoral artery, saphenous vein and ilioinguinal nerve. After identifying all neurovascular structures at the recipient site, the thoracodorsal vessels and nerve are divided, the latissimus dorsi musculocutaneous flap is transferred to the pelvic region and a microsurgical vascular anastomosis is performed immediately. Muscle ischemia time was less than 35 min in all the patients. The flap is tubularized in the midline and its base fixed to the skin at the recipient site. The circularized end part is rotated back over the distal body and sutured to create a neoglans. The thoracodorsal nerve is anastomosed with a previously identified ilioinguinal nerve. The stabilizing recipient skin site is further approximated and closed (Fig. 3). The donor site following adjacent undermining is approximated with some tension, and healed acceptably in six patients (Fig. 4). In the two remaining patients a split-thickness skin graft taken from the thigh was required to complete closure. A Foley catheter is placed for 10 days. Specially constructed dressing is used to keep the neophallus in an elevated position for approximately 2 weeks. Three months later, a urethroplasty with an inlay of buccal mucosa graft is performed. The graft is tubularized 6 weeks after the initial procedure (Figs. 5 and 6). The corporeal bodies are freed from any overlying skin and incorporated into the neophallus. The glans with preserved

Figure 1 Flap is templated in two parts.
neurovascular bundle is placed at the base on the ventral side for better sensation. The normal urethra is advanced and sutured to the neourethra. In two cases, due to inability to directly close the ventral side of the neophallus, urethral coverage was provided by harvesting a well-vascularized scrotal flap. A suprapubic catheter is placed for 2 weeks. Three patients did not require urethroplasty since they had a previously created Mitrofanoff channel (Figs. 7 and 8).

An inflatable penile prosthesis was implanted in two patients after puberty. Corporeal remnants were recruited as support for the proximal cylinders. Cylinders were covered with vascular prostheses that imitate tunica albuginea, and additionally fixed to the periostium of the inferior pubic rami (Figs. 9 and 10).

**Results**

Postoperative period ranged between 6 and 53 months (mean: 29 months). Average hospital stay ranged from 7 to 16 days (mean: 9 days). No free-flap failure was encountered intra- or postoperatively. Wound healing at the recipient as well as donor sites proceeded without complications in all
cases. Penile size varies from 13 to 16 cm in length and from 10 to 12 cm in circumference (Fig. 8). There were neither partial nor total flap necroses. Good vascularization of the musculocutaneous flap was confirmed by Doppler ultrasonography at 1, 3 and 6 months after surgery. In three patients, a urethral fistula occurred and was repaired with local anesthesia 3 months after urethroplasty. Donor-site appearance was acceptable in four cases while in the remaining four a moderate scar occurred. None of the patients reported any muscular deficits at the donor site. Function of implanted penile prostheses was satisfactory (Fig. 10). All the remaining patients are awaiting for penile prosthesis implantation, planned for late adolescence. Psychological status significantly improved in all children and their parents (Table 1).

Discussion

Many different surgical techniques for phallic reconstruction have been reported using either available local vascularized tissues or microvascular tissue transfer [4–7]. However, there are almost no data concerning total phalloplasty in young patients. Gilbert et al. [1,2] reported very good results with microvascular tissue transfers and confirmed that microsurgical techniques can be successfully applied to prepubertal phalloplasty.

Phalloplasty in children generates certain questions about indications, age, size of the neophallus and, especially neophallic growth during puberty. The indications for phallic reconstruction were initially limited to trauma victims who required surgery to restore their male anatomy. Today, surgical indications are expanded to many other
disorders such as penile agenesis, micropenis, intersex conditions, epispadias and hypospadias. Distressful psychological reactions are an indication for phalloplasty in young patients.

In our opinion, the most favorable time for surgery is during the age range of 10–14 years [3]. Performing genital reconstruction in this period is important to minimize any psychological impact of this surgery. The protocols for early genital reconstruction are already established for genital malformations and sexual ambiguity conditions detected prenatally or at birth; however, it is difficult to define the best time for surgery in this critical group of patients, as they are far away from the ‘optimal period’ for genital reconstruction and usually seen for the first time after previously failed genital surgery, at preschool or school age. It is also difficult to judge, especially from the surgical point of view, if they have already developed castration anxiety considering the fact that they were already operated on several times. Since genitals have an important role in creating body image and, without any doubt, determine future mental image, we assumed that phalloplasty with normal-looking external genitalia and physical appearance before the delicate period of puberty is of utmost importance in order to avoid psychological stress related to genital inadequacy. Furthermore, it provides a good basis for a stable masculine identity in adolescence and adulthood.

Based on favorable experimental and clinical experiences [8,9] we started to use the musculocutaneous latissimus dorsi flap for total phalloplasty. Due to its workable size, ease of identification, long neurovascular pedicle and minimal functional loss after removal, the latissimus dorsi flap has been used for a variety of reconstructions [10]. This flap showed many advantages in phallic reconstruction. It has provided excellent length and circumference, but children and parents must be counseled to expect a phallus of near adult-sized proportions. Neophallus size follows somatic growth patterns and is not influenced by pubertal hormonal effects. Neophallus retraction with muscle-based grafts seems less likely to occur than with use of a fasciocutaneous forearm flap, since denervated well-vascularized muscle is less prone than connective tissue to contract. A clear disadvantage is poor sensation of the flap, but...
the glans with preserved neurovascular bundle placed at the base of the neophallus provides better erogenous sensitivity.

The issue of sexual function in the neophallus remains problematic. Penile prosthesis implantation presents an ideal option, but its usage has frequently been associated with complications sometimes in as many as 50% of cases [11]. Penile prosthesis implantation is, however, technically easier and better tolerated in a muscular bed. Corpora cavernosa remnants are recruited as a support for the proximal cylinders that have to be covered with vascular prostheses that imitate tunica albuginea. Fixation of the cylinder bases to the periostium of the inferior pubic rami stabilizes the prosthesis and discourages cylinder protrusion through the neoglans.

**Conclusion**

The goals in neophallic reconstruction are functional repair, normal physical appearance and development of mental image expected for gender. The musculocutaneous latissimus dorsi flap is an acceptable choice for phalloplasty in children. We recommend this surgery before puberty to ensure better psychosexual development.

**Table 1** Phalloplasty: indications and results

<table>
<thead>
<tr>
<th>Pt</th>
<th>Indications</th>
<th>Age (years)</th>
<th>Size of stretched penis (cm)</th>
<th>Neophallic size (cm)</th>
<th>Follow-up (months)</th>
<th>Donor-site appearance</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Failed C–R epispadias repair</td>
<td>11</td>
<td>4.4</td>
<td>13.7</td>
<td>11</td>
<td>Moderate scar</td>
<td>Good</td>
</tr>
<tr>
<td>2</td>
<td>Failed C–R epispadias repair</td>
<td>14</td>
<td>7.9</td>
<td>15.4</td>
<td>29</td>
<td>—</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>Micropenis</td>
<td>12</td>
<td>4.7</td>
<td>14.2</td>
<td>17</td>
<td>Moderate scar</td>
<td>Good</td>
</tr>
<tr>
<td>4</td>
<td>Intersex</td>
<td>12</td>
<td>4.2</td>
<td>13.0</td>
<td>37</td>
<td>—</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>Failed C–R epispadias repair</td>
<td>15</td>
<td>8.6</td>
<td>16.0</td>
<td>39</td>
<td>—</td>
<td>Good</td>
</tr>
<tr>
<td>6</td>
<td>Failed Mitchell epispadias repair</td>
<td>12</td>
<td>5.3</td>
<td>14.8</td>
<td>28</td>
<td>Moderate scar</td>
<td>Good</td>
</tr>
<tr>
<td>7</td>
<td>Micropenis</td>
<td>14</td>
<td>9.1</td>
<td>14.3</td>
<td>53</td>
<td>—</td>
<td>Good</td>
</tr>
<tr>
<td>8</td>
<td>Micropenis</td>
<td>10</td>
<td>2.3</td>
<td>14.6</td>
<td>6</td>
<td>Moderate scar</td>
<td>Good</td>
</tr>
</tbody>
</table>

C–R = Cantwell–Ransley.
References


