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Reinforcing the ventral penile shaft with pedicled fat/connective tissues before urethroplasty lowers the risk for post-urethroplasty complications in hypospadias

Ryo Sueyoshi *, Shogo Seo, Takanori Ochi, Hiroshi Murakami, Yuta Yazaki, Masahiro Takeda, Hiroki Nakamura, Geoffrey J. Lane, Atsuyuki Yamataka

Department of Pediatric General and Urogenital Surgery, Juntendo University School of Medicine, Tokyo, Japan

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ABSTRACT

Purpose: CHARGE is our technique for reinforcing the ventral penile shaft with pedicled pericordal/scrotal fat, pedicled perimeatal connective tissue, or a combination of these at the time of initial hypospadias surgery. Such pedicled grafts "charge" poorly developed urethral plates and thin ventral foreskin prior to urethroplasty to improve compromised vascular perfusion that could prevent post-urethroplasty complications (post-UPC).
Methods: We reviewed post-UPC in 179 staged hypospadias repair patients (1997–2015). CHARGE, adopted routinely in 2010 was used in 39 patients (C-group), not indicated in 7 because ventral connective tissue was thick, and not used in 133 (NC-group). Initial hypospadias surgery included foreskin degloving with or without chordectomy, dorsal plication, tunica albuginea incision, or a combination of these.
Results: Subject demographics were similar. NC had significantly more post-UPC than C (25 versus 0; $p < .01$) comprising stenosis (n = 14), fistula (n = 7), diverticulum (n = 2), and wound infection (n = 2) that developed after a mean of 0.7 ± 0.2 years (range: 1 day–2.8 years). Extra time taken for CHARGE was less than 15 minutes in all cases. Mean follow-up after urethroplasty (years) was significantly shorter in C (1.5 ± 1.0 versus 5.7 ± 3.8) ($p < .01$), but almost double the time taken to develop post-UPC.
Conclusion: CHARGE would appear to prevent post-UPC.
Level of evidence: Retrospective Comparative Study – Level III

Several tissues such as foreskin connective tissue, pedicled external spermatic fascia, and tunica vaginalis flap have been applied for reinforcing the neourethra during both primary and staged repair of hypospadias [1,2]. However, if the urethral plate is poorly developed or the subcutaneous tissue of the ventral penile shaft is thin, urethroplasty during primary and staged repair is challenging because the vascular supply to the neourethra will be poor, leading to post-urethroplasty complications (post-UPC) such as fistula or diverticulum formation.

To the best of our knowledge, there are no reports about reinforcing the sides of a poorly developed urethral plate or the subcutaneous tissue of the ventral penile shaft prior to urethroplasty to prevent post-UPC. We call our novel technique for achieving this using pedicled pericordal fat (Fig. 1), pedicled scrotal fat, pedicled perimeatal connective tissue, or a combination of these, CHARGE, because the pedicled grafts act to "charge" vascular perfusion. Techniques for harvesting pedicled pericordal fat and pedicled scrotal fat may be found elsewhere [2].

1. Materials and methods

The medical records of 179 cases of staged hypospadias repair performed at our institution from 1997 to 2015 were reviewed retrospectively to collate data for operative time, complications, and types of repair performed.

CHARGE, commenced in 2010, was used in 39 cases (C-group) with the pedicled grafts reaching the subcoronal area of the penile shaft or at least the distal 1/3 of the penile shaft in all cases. CHARGE was not indicated in 7 cases because the subcutaneous tissues of the skin of the ventral penile shaft were thick enough to be used for Byars' flaps as they were, or the native urethral plate was well developed (NIC-group). CHARGE was not used in 133 cases (NC-group) because CHARGE had yet to be adopted (n = 129) or because the pedicled grafts harvested were either too short to reach to the distal 1/3 of the penile shaft or the harvested tissue itself was of poor quality, or previous bilateral orchidopexy prevented harvesting (n = 4). Primary urethroplasty and re-do cases were excluded from this study.

Our standard repair of hypospadias involves insertion of a 6 or 8 French urethral stent into the native urethral meatus in all cases. Curvature is assessed using induced artificial erection before and after degloving the foreskin and is defined as being mild (less than 30°),

* Corresponding author at: Department of Pediatric General and Urogenital Surgery, Juntendo University School of Medicine, 2-1-1 Hongo, Bunkyo-ku, Tokyo 113-8421, Japan. Tel.: +81 3 3813 3111; fax: +81 3 5802 2033.
E-mail address: rsueyo@juntendo.ac.jp (R. Sueyoshi).

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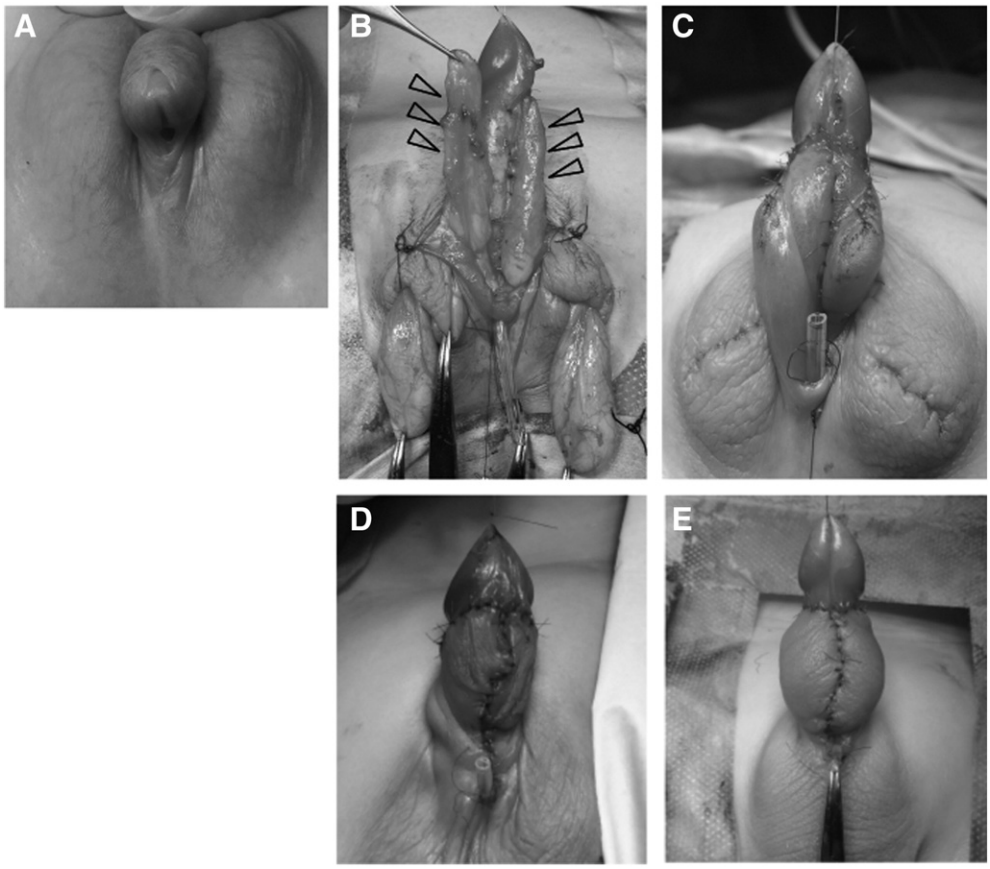

Fig. 1. A comparison of subcutaneous tissue thicknesses of ventral penile shaft skin with respect to CHARGE. C-group: (A, B, C) NC-group: (D) NIC-group: (E) (A) Preoperative appearance in a C case. (B) Appearance at the time of CHARGE using a pedicled pericordal fat graft (arrowheads) in a C case (same patient as A). (C) Appearance after completion of Byars' flap in a C case (same patient as A), showing thick subcutaneous tissue in the ventral penile shaft skin. (D) Appearance after completion of Byars' flap in an NC case, showing ventral penile shaft skin with thin subcutaneous tissue. (E) Appearance after completion of Byars' flap in an NIC case, showing thick subcutaneous tissue under the ventral penile shaft skin.

moderate (between 30° and 45°), or severe (more than 45°). Initial surgical intervention performed prior to urethroplasty includes foreskin degloving alone, degloving with chordectomy, dorsal plication, tunica albuginea incision, or a combination of these. If curvature is only mild, ventral penile elongation is unnecessary, and dorsal plication alone is used to correct curvature if required. If curvature is severe, the ventral aspect of the penis is elongated by incising the tunica albuginea [3,4], and the penile shaft is covered with foreskin (Byars' flaps). If curvature is moderate, the technique for curvature correction depends on the length of the penile shaft; dorsal plication is performed if the shaft is long enough, but if the ventral penile shaft is already short, then TAI is used. During TAI, the urethral plate is transected. After degloving the foreskin, the development of the urethral plate and the thickness of the subcutaneous tissues of the foreskin are assessed to determine if CHARGE is indicated for improving the urethral plate and the thickness of the subcutaneous tissue of the ventral penile shaft skin (Fig. 1). The urethral stent is removed the day after initial hypospadias surgery with or without CHARGE. Six to twelve months later, urethroplasty is performed using tubularized incised plate urethroplasty or Thiersch-Duply procedure with a midline skin incision of the ventral penile shaft [5].

Statistical analysis was performed using GraphPad Prism version 6 (GraphPad Software, San Diego, CA). Bivariate analysis was performed using the Mann–Whitney U (Wilcoxon rank-sum) test for continuous variables with nonparametric distribution. For analysis of complication rates, the Chi-squared test was used. A p value of .05 or less was considered statistically significant.

This study was approved by the Juntendo University School of Medicine Institutional Review Board and complies with the Helsinki Declaration of 1975 (revised 1983).

2. Results

Types of hypospadias, initial surgical intervention before urethroplasty, and mean ages at initial surgery and urethroplasty were similar for both the C- and NC-groups as shown in Tables 1 and 2. Tissues used for CHARGE were pedicled pericordal fat (n = 19, 48.7%), pedicled

Table 1
Mean age at initial surgery/urethroplasty according to type of hypospadias.

Type	C (n = 39)	NC (n = 133)	NIC (n = 7)
Distal	1 (3%)	10 (7%)	Nil
Midshaft	7 (18%)	41 (32%)	2 (29%)
Penoscrotal	14 (36%)	59 (44%)	4 (57%)
Scrotal	9 (23%)	12 (9%)	Nil
Perineal	8 (20%)	11 (8%)	1 (14%)
Mean age at IS [years]	1.5 ± 0.8	1.8 ± 1.0	2.0 ± 1.3
Mean age at UP [years]	2.8 ± 1.0	3.2 ± 1.3	Nil

C: CHARGE
NC: no CHARGE
NIC: not indicated for CHARGE
IS: initial surgery
UP: urethroplasty