

A Novel Skin Management Scheme in Surgery of Epispadias Undergoing Cantwell-Ransley Repair: A Technique to Improve the Aesthetics and Minimize Complications

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OBJECTIVE	To describe a new scheme of skin cover in epispadias repair to improve the aesthetic results and minimize complications.
PATIENTS AND METHODS	In the last 4 years, 7 male continent epispadias (aged 2-5 years) undergoing Cantwell-Ransley repair received a new technique of skin cover. After a U-shaped incision along the margin of urethral plate, a transverse incision beginning at the margin of urethral plate 7-10 mm proximal to the corona was carried along the prepuccial edge upto the corresponding point at urethral plate margin on the other side. The prepuce was split into a dorsal flap attached to the corona and a ventral flap continuous with penile skin. After subdartos degloving, incision through median raphe upto penoscrotal junction bifurcated the penile skin-dartos complex. After Cantwell-Ransley repair, reverse advancement of inner prepuccial flap provided skin cover to most of the ventral aspect of penile shaft. Dorsal midline union of bifurcated penile skin-dartos flaps provided dorsolateral cover. At ventral midline, limited joining of penile skin-dartos flaps at penoscrotal junction and anchoring to corpus spongiosum created penoscrotal angle with shaft cover at penoscrotal junction. Lateral margins of dorsal and ventral skin cover were joined.
RESULTS	There was no flap necrosis, penile rotation, or recurrent chordee. Symmetrical distribution of skin and automatic creation of partial prepuccial hood provided gratifying aesthetic appearance. One coronal sulcus fistula was repaired.
CONCLUSION	This simple and reproducible skin management scheme in epispadias repair helps in providing aesthetically pleasing skin cover, penoscrotal angle, penopubic angle, and prepuccial hood with minimum complications. UROLOGY 82: 1400–1404, 2013. © 2013 Elsevier Inc.

With the goal of conversion of anomaly into normal looking penis, various components of epispadias repair include reconstruction of adequate caliber straight urethra upto the tip of glans, ventral translocation of urethra with meatus, glansplasty, chordee correction, corporoplasty, and provision of skin cover with creation of penoscrotal and penopubic angles. Modified Cantwell-Ransley repair^{1,2} and Mitchell repair³ have addressed numerous technical aspects of these goals. In an endeavor to improve the quality of aesthetics and repair, techniques of skin cover have been described by Pippi Salle et al, Khoury et al, Thomalla et al, and Montart et al.⁴⁻⁷ In the authors' opinion, these techniques involve creation and rotation of pedicled flaps. Therefore, these techniques, to a variable extent, carry

the risk of loss of vascularity of skin flaps⁵ with additional risk of causing iatrogenic rotational defect after repair.⁴ In this article, we report a simpler, therefore easily reproducible technique of skin cover in epispadias repair, which is based on the axial pattern blood supply of penile skin-dartos complex and additional blood supply of inner prepuccial skin through the collaterals from the glanular branches of dorsal artery of penis.^{8,9}

PATIENTS AND METHODS

In designing the technique, studies of surgical anatomy of epispadias with particular reference to axial pattern blood supply of skin-dartos complex via superficial dorsal vessels on the ventrolateral aspect of epispadiac penis coming from external pudendal vessels with relative avascularity at median raphe were taken into consideration.⁹ The fact that prepuce receives additional supply from the terminal branches of dorsal penile artery, branching at coronal sulcus, was also exploited to split inner prepuccial skin off the outer prepuccial skin and dartos.^{8,9}

Seven patients of continent epispadias who underwent modified Cantwell-Ransley repair in the last 4 years received

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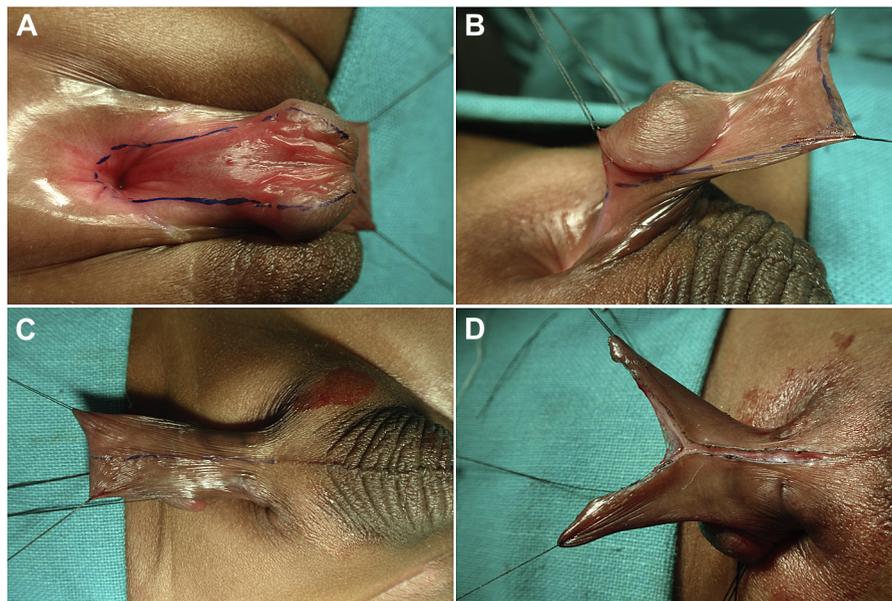


Figure 1. (A) Penopubic epispadias dorsal view showing the first incision line along the margin of the urethral plate upto the tip of glans distally and proximally encircling the epispadiac meatus. Ventral prepuce is held in stay sutures. (B) Right oblique lateral view of figure 1A to show the plan of the second incision line along the margin of stretched prepuce. Incision is continued upto the edge of urethral plate 7-10 mm proximal to corona. (C) Ventral view of figure 1A to show the third incision line on median raphe from the edge of stretched prepuce upto the penoscrotal junction. (D) Ultrafine needle tip cautery is used to incise skin dartos ensuring bloodless field for unmistakable identification of tissue planes. (Color version available online.)

skin cover with the new method. The age of patients ranged from 2 to 5 years. There were 5 proximal penile epispadias and 2 penopubic epispadias. This technique was used only in those patients in whom the prepuce was adequate to provide skin cover to most of the ventral penile shaft. Two patients of continent proximal penile epispadias with short sessile and edematous prepuce were not selected for this technique.

Surgical Technique

The glans was stabilized with stay sutures and the prepuce was held stretched between 2 additional stay sutures. A U-shaped incision line was marked along the margin of urethral plate upto the tip of glans distally and encircling the epispadiac meatus proximally (Fig. 1A). Beginning at the margin of the urethral plate on one side and leaving a 7-10 mm subcoronal skin collar, a transversely oriented incision line was carried along the margin of prepuce held in stay sutures right upto the corresponding point at the margin of urethral plate on the other side (Fig. 1B). The third incision line was drawn vertically in midline along the median raphe of penile shaft from the edge of prepuce upto the penoscrotal junction (Fig. 1C). Along the marked incision lines, using ultrafine needle tip cautery, the skin was incised (Fig. 1D). With Reynauld's scissors, inner prepuce skin flap was dissected off the outer prepuce and dartos in a plane between the lamina propria of inner prepuce and the prepuce dartos attached to outer prepuce skin. Dissection was continued upto the Buck's fascia over the ventral aspect of the corpora cavernosa (Fig. 2A). In the subdartos plane, penis was degloved upto the penopubic and penoscrotal junctions. A tongue-shaped flap of inner prepuce was left attached to the corona. Penile skin-dartos complex was bifurcated upto the penoscrotal junction through the midline incision along the median raphe (Fig. 2B). Three flaps, thus, were created. One

inner prepuce skin flap supplied by the collaterals from dorsal artery of penis through its terminal branches and the glanular vascular arcade. Two lateral flaps of penile skin-dartos having axial pattern blood supply from the penile branches of superficial external pudendal vessels.^{8,9} Using the principle of Cantwell-Ransley repair, urethroplasty, glansplasty, and corporoplasty were completed without cavernocavernostomy (Fig. 2C, D). Bifurcated flaps of penile skin-dartos complex were shifted to the dorsal aspect and joined in midline with 6-0 interrupted sutures with Z-plasty proximal to penopubic junction (Fig. 3A). Distally, these flaps were joined to the edge of dorsal subcoronal skin collar, already fashioned at dorsal midline during glansplasty. This maneuver provided adequate skin cover to dorso-lateral aspect of the penile shaft with tension-free dorsal suture line eliminating the chance of recurrent dorsal chordee because of skin shortage. The ventral defect was covered with reverse advancement of inner prepuce flap upto the proximal penile shaft or penoscrotal junction (Fig. 3B). Lateral margins of inner prepuce flap were sutured to the corresponding lateral margins of the flaps covering the dorso-lateral penile shaft upto the proximal penile shaft (Fig. 3C, D). Thus, 3 suture lines, at 12-o'clock, 8-o'clock, and 4-o'clock positions were created. At the root of penis, undersurfaces of penile shaft skin were anchored to the corpus spongiosum to create penoscrotal angle and to corpora cavernosa for penopubic angle.

Patients were kept on catheter drainage for 10 days in post-operative period with antibiotics as dictated by our routine microbiology surveillance services. No dressing was applied.

Outcome was measured in terms of complications and aesthetic appearance on a scale of 0-10 after 1 year of repair. Zero score was assigned to appearance similar to epispadiac penis, and a score of 10 was assigned to appearance similar to a normal circumcised penis.

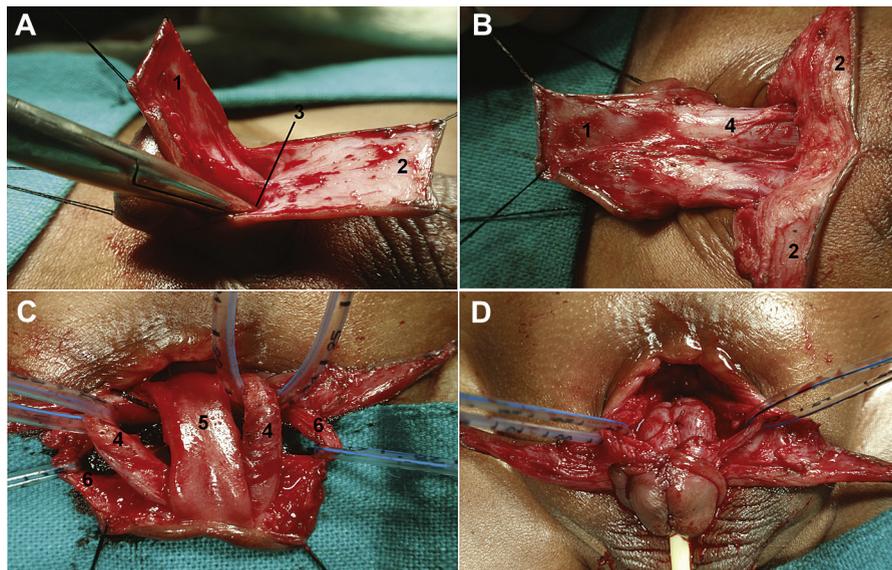


Figure 2. (A) Right oblique view of penopubic epispadias showing splitting of the inner prepuce off the outer prepuce and dartos layer upto the Buck's fascia of the corpora. (1) Inner prepuce, (2) outer prepuce with dartos, (3) artery forceps creating plane in subdartos space. (B) After degloving, skin-dartos complex (2) has been bifurcated along the median raphe upto the penoscrotal junction. (1) Tongue-shaped flap of the inner prepuce skin attached to the corona and glans is held in stay sutures. (4) Corpora cavernosa and neurovascular bundles are seen under the Buck's fascia. (C) Using the Cantwell-Ransley technique, (4) corpora cavernosa has been separated off the (5) midline urethral plate. (6) Neurovascular bundles have been separated off the corpora. (D) Urethroplasty, glansplasty, ventral translocation of urethra with meatus and corporoplasty are completed without cavernocavernostomy. Neurovascular bundles are held in a loop. Bifurcated flaps of penile skin-dartos are also seen. (Color version available online.)

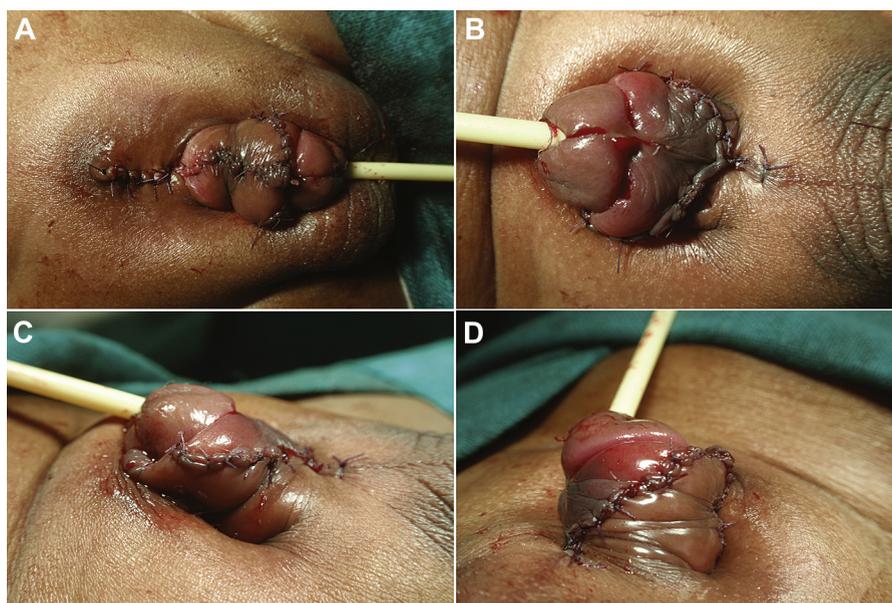


Figure 3. (A) Dorsal view showing the scheme of flap approximation and suturing. Bifurcated flaps of ventrolateral penile skin are shifted dorsally and joined in midline. Its distal edge is sutured to the edge of dorsal subcoronal skin collar. Laterally, part of suture line joining the lateral margin of skin-dartos flap to the edge of inner prepuce flap is visible. (B) Ventral view to show the scheme of flap approximation. Most proximal and ventral edge of penile skin-dartos flaps is joined in midline ventrally and anchored to the wedge of corpus spongiosum creating the penoscrotal angle. Inner prepuce flap is advanced toward the penoscrotal junction to provide the ventral cover. (C, D) The suture line between inner prepuce flap and penile skin-dartos flaps is shown. A partial hood is automatically formed on dorsum of glans corona. (Color version available online.)

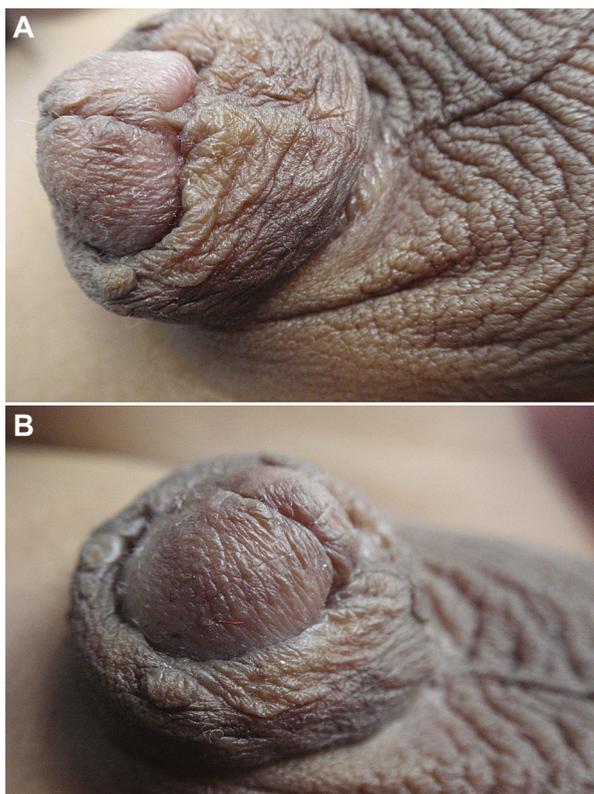


Figure 4. Aesthetic appearance after skin management with the described technique. (Color version available online.)

RESULTS

Complications

Postoperative edema of skin flaps persisted for 3-4 weeks but subsequently resolved in all. Wound healing was excellent in all except in one who had superficial wound infection, but improved on conservative treatment. There was no repair dehiscence and no flap necrosis. One patient had minute coronal sulcus fistula that was repaired later.

Aesthetic Appearance

Aesthetic appearance was satisfactory with aesthetic score ranging between 7 and 8 in all. Symmetrical distribution of shaft skin was achieved with the creation of penoscrotal angle, penopubic angle, and automatic creation of partial prepuccial hood in all (Fig. 4A, B). Skin cover was normal in all without skin tethering, redundancy, or grotesque folded appearance in any of the patients. On follow-up (1-4 years after repair), there was no rotational defect or recurrent dorsal chordee. Dorsal and lateral suture lines were hardly visible (Fig. 4A, B).

COMMENT

Restoration of adequate penile skin cover with satisfactory aesthetic appearance is as important as correction of chordee and urethroplasty in epispadias repair. For restoration of adequate penile skin coverage, various techniques have been described in published data to

improve the aesthetic results.⁴⁻⁷ Thomalla and Mitchell⁶ described the use of transverse island pedicle flaps on the basis of the ventral prepuce for urethral reconstruction and dorsal skin coverage to improve the outcome of epispadias repair. However, viability of the pedicled prepuccial flap might be at risk, as the principle arterial supply is diverted during dissection. Furthermore, this prepuccial flap might result in redundant appearance of penile skin cover. The use of hair-bearing scrotal skin to cover the dorsal penile skin defect has also been described, but it achieves a less than ideal cosmetic result.¹⁰ Pippi Salle et al⁴ had described the use of ventral penile skin for restoration of skin cover in epispadias to achieve improved cosmesis after epispadias repair. However, it requires extensive dissection of the vascular pedicle to achieve satisfactory rotational mobility, which might not be reproducible. Aggressive and extensive mobilization or rotation of flap might result in vascular damage and skin ischemia. Besides this, excessive rotation might cause penile rotational defect in some cases.⁴ Khoury et al⁵ described restoration of penile skin cover by creation of a ventral prepuccial transverse island flap rotated dorsally to cover the dorsal aspect of the penile shaft and an advancement flap from the patch of skin present between the penis and scrotum in epispadias. However, ischemic change to prepuccial flap might occur because of vascular damage during rotation as reported in his series.

With our skin management scheme in epispadias repair, 3 well-vascularized skin flaps are created having their own blood supply, as our technique is based on unique vascular anatomy of the inner prepuccial skin and penile skin in epispadias.⁹ Two lateral penile skin flaps providing symmetrical tension-free dorsolateral cover receive blood supply from the branches of superficial external pudendal arteries supplying the skin-dartos complex. Inner prepuccial skin flap providing tension-free and symmetrical ventral cover is perfused with the collaterals from the coronal arcade formed by the blood supply of the glans and terminal branches of dorsal penile artery.⁹ We observed that even a thin inner prepuccial flap with intact lamina propria, devoid of dartos fascia but attached to coronal sulcus, maintains good vascularity and almost always remains viable. Thus, our technique has the advantage of being simple and reproducible, as it does not involve complex maneuvers for harvesting of skin flaps to provide penile skin cover. Therefore, there is no risk of penile rotation or flap necrosis as might occur with other techniques involving complex harvesting of skin flaps. In our technique, all 3 skin flaps together provide symmetrical penile skin cover along with the creation of penoscrotal angle and penopubic angle with automatic creation of dorsal prepuccial hood. Recently, we have extended the use of this technique in exstrophy-epispadias complex with very encouraging outcomes, which will be subsequently reported.

The only disadvantage of the technique is that it creates a dorsal midline and 2 lateral suture lines. But in our experience, it has not created any problem because of

tension-free skin cover on dorsum except 1 coronal sulcus fistula that was repaired later. On follow-up, these suture lines are hardly visible (Fig. 4A, B). The other limitation is that the technique is not applicable in patients with short, sessile, or oedematous prepuce.

CONCLUSION

The technique described in this article for skin management in epispadias is simple and easily reproducible without significant complications. With the provision of symmetrical skin cover, creation of partial prepuccial hood, penoscrotal, and penopubic angles, gratifying aesthetic results are achieved.

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