



ORIGINAL ARTICLE

# Therapeutic effects of modified Devine surgery for concealed penis in children

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## KEYWORDS

Concealed penis;  
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**Summary Objective:** Considerable controversy exists regarding the surgical indications for a concealed penis. We herein describe a modified technique for correction of a concealed penis. The superfluous inner plate is resected to accelerate the disappearance of the postoperative lymphedema, and the skin between the penis and scrotum is trimmed to recover the penoscrotal angle.

**Methods:** From January 2014 to October 2017, 79 patients with a concealed penis underwent our modified Devine penoplasty procedure. We measured the penile length preoperatively and postoperatively to confirm the improvement. A questionnaire was administered to the patients' parents to assess satisfaction regarding penile size, morphology, voiding status, and hygiene.

**Results:** The perpendicular penile length was  $1.88 \pm 0.76$  cm preoperatively and  $4.42 \pm 0.48$  cm postoperatively, representing a significant improvement ( $p < 0.05$ ). The parents' satisfaction grades for penile size, morphology, voiding status, and hygiene were significantly improved postoperatively ( $p < 0.05$ ). Almost every patient had postoperative penile lymphedema; however, this symptom had spontaneously resolved by 6 weeks. No other complications occurred, such as skin necrosis, tissue contracture, or wound infection.

**Conclusion:** The herein-described modified repair technique for a concealed penis was technically feasible and safe, and excellent postoperative satisfaction was achieved. Additionally, the postoperative penis exhibited a good cosmetic appearance. Because of the successful

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outcomes with few complications, we believe that this surgical method for selected patients with a concealed penis is more effective than the traditional method.

*Level of evidence:* Level IV, therapeutic study.

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## 1. Introduction

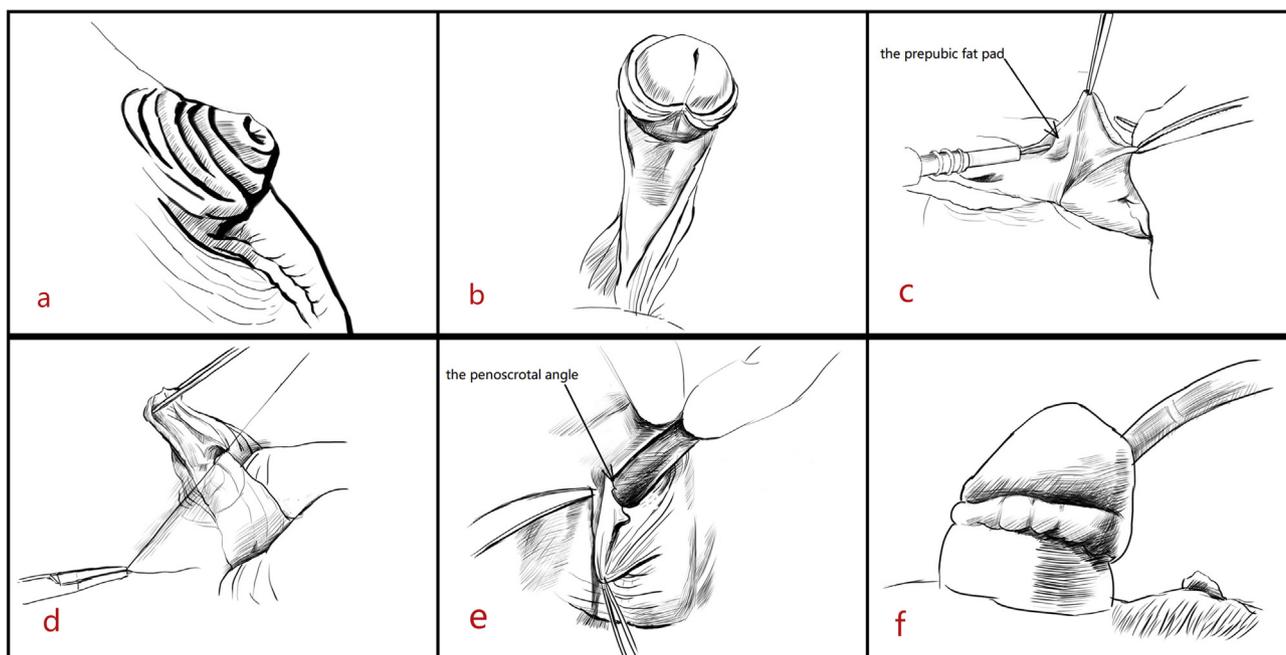
A concealed penis (CP) is a congenital anomaly that affects the appearance and impairs the function of the external genitalia in males. This congenital anomaly is characterized by an insufficiency of the outer penile skin and an inadequate subcutaneous attachment to Buck's fascia. A CP can result in phimosis, balanitis, hygiene and voiding difficulties, and psychological trauma. During a physical examination of such patients, the penis is found to be hidden under the exterior aspect of the prepubic skin; however, the penis can be palpated and visualized by exerting pressure on the opposite side of the shaft base. Animal studies of CP have shown that long-term penile concealment may detrimentally affect structure and function.<sup>1</sup> Early surgical treatment is therefore necessary for affected patients and has been extensively promoted by pediatric urologists. Considerable numbers of surgical techniques have been applied to correction of this anomaly.<sup>2</sup> However, a single universally adopted surgical method for all CP repairs has not been established. Therefore, this study was performed

to introduce a modified Devine surgery for CP repair and evaluate the therapeutic effects of the procedure.

## 2. Methods

### 2.1. Subjects and study design

From January 2014 to October 2017, 79 patients with a CP underwent our modified Devine penoplasty procedure (Fig. 1). During the preoperative physical examination, all patients had a flat or beak-shaped penis with minimal penile shaft skin, and the normal penile shaft could be palpated while applying pressure on the opposite side of the shaft base. All patients were scheduled for regular follow-up visits at 6, 12, and 24 weeks postoperatively. Data were collected and analyzed on the patients' age, preoperative penile length, postoperative penile length, operative time, and postoperative complications and the parents' satisfaction grade.



**Figure 1** The simple technique of modified Devine penoplasty. (a) The foreskin looked like the mouth of a bird. (b) A longitudinal skin incision was made at the mid-ventral aspect of the preputial opening to release the stenotic ring. (c) The prepubic fat pad was excised. (d) At the penopubic junction, the dermal tissue of the middle dorsal outer prepuce was fixed at the corpus cavernosum of the proximal phallus. (e) The skin between the penis and scrotum was trimmed to recover the penoscrotal angle. (g) The postoperative appearance of the penis was satisfactory.

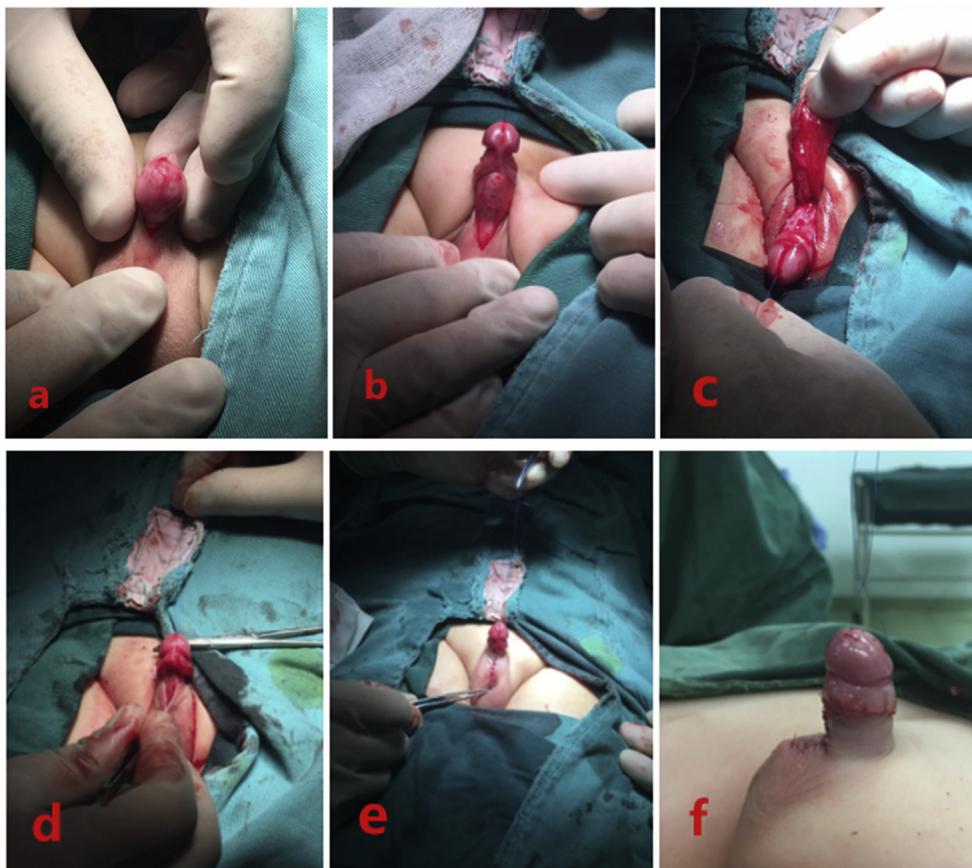
## 2.2. Follow-up visits

During the follow-up visits, a questionnaire was administered to evaluate the parents' satisfaction regarding penile size, morphology, voiding status, and hygiene. The degree of satisfaction was determined based on the following scale: I, very unsatisfactory; II, unsatisfactory; III, neither satisfactory nor unsatisfactory; IV, satisfactory; and V, very satisfactory.

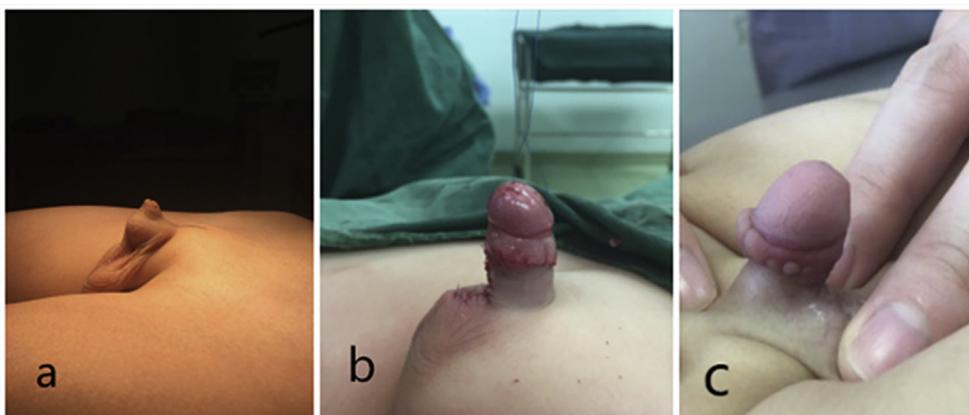
## 2.3. Surgical technique

All patients were positioned supine on the operating table and anesthetized using general endotracheal anesthesia. The key steps were as follows. First, a longitudinal skin incision was performed at the mid-ventral aspect of the preputial opening to release the stenotic ring (Fig. 2a). The prepuce was then evaginated. At a distance of about 0.5 cm from the coronary sulcus, we performed a circumcision at the inner prepuce. We then dissected the superficial layer of the deep fascia to release the penis from its deep tetherings to the penile base. During this process, we ensured that the

dorsal parts of the penis reached the pubic level and that the ventral side of the penis reached the borderline between the penis and scrotum. Radical excision of the contractual tissue around the penis was essential to fully [http://fanyi.baidu.com/?aldtype=85&keyfrom=alading-zh/en/javascript:void\(0\);](http://fanyi.baidu.com/?aldtype=85&keyfrom=alading-zh/en/javascript:void(0);) loosen the penis body. The penile shaft was then elongated and the prepubic fat pad excised (Fig. 2b). At the penopubic junction, the dermal tissue of the middle dorsal outer prepuce was fixed at the corpus cavernosum of the proximal phallus. We performed the operation very carefully to avoid damaging the neurovascular bundle (Fig. 2c). The superfluous inner plate of the penis was resected. We then trimmed the skin between the penis and scrotum to recover the penoscrotal angle (Fig. 2d and e). As shown in Fig. 2f, the postoperative appearance of the penis was satisfactory. All patients underwent postoperative management using the same protocol. First, we packaged the penile shaft with 3M pad pasting. During this process, close attention to the blood flow of the glans was required. We then retent the catheter in all patients. On day 6 postoperatively, the dressing was removed and the transurethral catheter was withdrawn (Fig. 4).



**Figure 2** Operative steps. (1) A longitudinal skin incision was made at the mid-ventral aspect of the preputial opening to release the stenotic ring (a). (2) We performed a circumcision at the inner prepuce to free the penis. The penile shaft became elongated. The prepubic fat pad was then excised (b). (3) At the penopubic junction, the dermal tissue of the middle dorsal outer prepuce was fixed at the corpus cavernosum of the proximal phallus (c). (4) The superfluous inner plate of the penis was resected, and the skin between the penis and scrotum was trimmed. The penoscrotal angle was recovered (d,e). (5) Postoperative appearance (f).



**Figure 3** Preoperative and postoperative appearance. (a) Typical preoperative appearance of a concealed penis. (b) Postoperative appearance. (c) Six weeks after the operation.

#### 2.4. Statistical analysis

SPSS for Windows 19.0 software (IBM Corp., Armonk, NY, USA) was employed for all statistical analyses. We compared the preoperative and postoperative satisfaction grades with a  $p$  value of 0.00; we also compared the preoperative satisfaction grades with those at 6, 12, and 24 weeks postoperatively by the  $t$  test. A  $p$ -value of  $<0.05$  was considered statistically significant.



**Figure 4** Postoperative dressing of penis.

#### 3. Results

The mean age of the patients in this study was  $97.50 \pm 69.50$  months (range, 28–167 months), and the mean follow-up period was  $27.52 \pm 12.50$  months. The mean operative time was  $87.50 \pm 62.50$  min. The perpendicular penile length was  $1.88 \pm 0.76$  cm preoperatively and  $4.42 \pm 0.48$  cm postoperatively ( $p < 0.05$ ). Analysis of the penile size, morphology, voiding status, and hygiene revealed that the parents' satisfaction grades improved from the preoperative to postoperative period. These improvements became more remarkable after 6 weeks and stabilized after 24 weeks of follow-up (Table 1). Seventy-nine patients had postoperative penile lymphedema, but it resolved within 6 weeks (Fig. 3c). No other complications occurred, such as skin necrosis, penile shaft contracture, wound infection, voiding difficulty, or erection difficulties.

#### 4. Discussion

A small penis is a common clinical finding in pediatric patients. During the physical examination, however, a penis of normal size can be palpated in most of these boys. Some reports have described several conditions that impair the appearance of the penis, including an inconspicuous penis,<sup>3</sup> hidden penis, buried penis,<sup>4</sup> CP, trapped penis, and other abnormalities.<sup>5</sup> A literature review indicates that various classifications have also been reported.<sup>6</sup> Crawford<sup>7</sup> described a classification system in 1977 comprising the terms CP, partially and completely buried penis, and penoscrotal webs. Maizels et al<sup>16</sup> described the terms concealed (before circumcision), trapped (after circumcision and cicatricial scar), and buried (associated with adolescence and obesity), thus establishing a further classification. In the present study, we focused on the problems associated with a CP, especially in relation to the modified surgical technique.

A CP is a congenital malformation, and diverse causes of CP have been explored, including scarce outer penile skin, dartos tethering, poor skin fixation at the penile base, dysgenetic dartos fascia, and inelastic fibrous bands.<sup>8,9</sup>

**Table 1** Parents'satisfaction.

	Pre-OP	Post-Op	6 weeks	12 weeks	24 weeks	p-value
Penile size	1.43 ± 0.50	3.67 ± 0.48	4.75 ± 0.44	4.67 ± 0.49	4.74 ± 0.43	0.000
Morphology	1.33 ± 0.47	3.92 ± 0.28	4.67 ± 0.48	4.42 ± 0.50	4.41 ± 0.50	0.000
Voiding status	1.83 ± 0.72	4.00 ± 0.43	4.39 ± 0.50	4.44 ± 0.51	4.41 ± 0.49	0.000
Hygiene	1.43 ± 0.32	3.35 ± 0.40	4.38 ± 0.38	4.73 ± 0.51	4.74 ± 0.41	0.000

Excessive suprapubic fat was also considered to be the cause of a CP in some patients. Dysgenetic dartos fascia results in tethering of the penile shaft skin to the abdominal wall, preventing the penis from being exposed and leaving merely enough prepuce to cover the penile shaft, thus causing the CP to resemble the mouth of a bird (Fig. 3a).

Considerable controversy exists regarding the surgical indications for a CP. A major source of controversy is whether early surgery should be performed in childhood. Borsellino et al<sup>10</sup> considered that early surgical intervention can avoid a detrimental impact of the CP on sexual psychological development. Children with a CP may develop balanitis, urinary tract infections, urination disorders, difficult hygiene, cosmetic anxiety, and erectile dysfunction. Thus, many pediatric urologists believe that surgery should be performed soon after confirming the diagnosis. Another source of controversy is whether to perform the operation after successful weight loss in obese children with a buried penis. The penis may gradually return to normal after weight loss. No consensus regarding the selection of surgical methods has been reached. In choosing the most appropriate surgical techniques, simple and wrong circumcision should not be applied to a CP; this will result in preputial shortness or absence, detrimentally affecting penile development. Various surgical methods involving subsequent modifications have been described for correcting a CP: degloving the penis, fixation of skin to the penile shaft, lipectomy or liposuction of prepubic fat in a modified Devine's operation,<sup>11</sup> modified Shiraki's operation,<sup>2</sup> Johnston's operation,<sup>12</sup> multiple Z-plasties,<sup>13</sup> scrotal skin flaps,<sup>14</sup> Shaeer's technique,<sup>15</sup> split-thickness skin grafting,<sup>1</sup> and other procedures have been applied in the clinical setting.<sup>15–18</sup> Four key points in the procedure described in the present report are as follows. (1) The penis must be elongated and degloved completely from its base, (2) the dermis and dartos fascia must be stitched to Buck's fascia at the base of the penis, (3) the penopubic and penoscrotal angles must be reconstructed, and (4) the preputial skin must be reestablished to provide skin cover.<sup>19</sup> There are some shortcomings in the traditional operation for CP repair, such as failed release of the dartos fascia, free flap necrosis, unsatisfactory cosmesis, and lack of fixation of the penile base. Devine's technique<sup>20</sup> mainly includes the following components: a longitudinal incision of the outer and inner dorsal prepuce, degloving of the prepuce at its base, excision of scar tissue, exposure of the penis, excision of the prepubic fat pad, and immobilization of the root of the penis. In some cases, the postoperative penis appearance and postoperative penis remain unsatisfactory. Therefore, various modified surgical methods have been developed to improve the postoperative

satisfaction with CP repair and reduce the complications during the past few decades. We made the following changes to our modified surgical procedure. First, we made a longitudinal incision at the mid-ventral aspect of the prepuce to sufficiently loosen and straighten the penile shaft. Second, to reduce the postoperative skin tag and improve the lymphedema, the superfluous inner plate of the penis was completely resected and the skin of the foreskin outer plate was retained after fixing the dermal tissue. Finally, we reconstructed the penoscrotal angle, which can considerably improve the cosmetic appearance.

Although a CP can lead to hygiene deficiencies, voiding difficulties, and embarrassment among peers, it is not a fatal disease. Therefore, the success or failure of the operation depends on the satisfaction of the patients and their families, and their satisfaction is based on the cosmetic appearance. A previous study demonstrated that patients and their families are commonly pleased with the postoperative results.<sup>21</sup> After follow-up, we found that the parents were satisfied with the size, morphology, voiding status, and hygiene. The postoperative satisfaction was significantly better than the preoperative satisfaction. Various complications, including lymphedema, skin necrosis, tissue contracture, and wound infection, may reportedly occur in some patients. In our study, postoperative lymphedema occurred in all patients. However, it spontaneously resolved within 6 weeks postoperatively, which may have been due to the resection of the superfluous inner plate.

Our modified technique has some advantages. First, we make a ventral incision in the narrow ring, which maintains the integrity of the dorsal skin and protects the blood supply of the dorsal circumcision. Second, we trim the skin between the penis and scrotum to recover the penoscrotal angle. Thus, the postoperative appearance of the penis is satisfactory without a webbed structure. Third, we resect the superfluous inner plate to accelerate the disappearance of postoperative lymphedema. Ultimately, the parents' satisfaction was considerably improved after the operation.

## 5. Conclusions

Our modified repair technique for CP was technically feasible and safe, and excellent postoperative satisfaction was achieved. Additionally, the penis had a good cosmetic appearance postoperatively. Because of the successful outcomes without complications, we believe that this surgical method is more effective than the traditional method for selected patients with CP.

## Authors' contributions

J.W. designed the study, W.L.G. and C.Y.H. performed the modified Devine surgery, X.Z. and Y.Z.X. collected the clinical data and evaluated the parents' satisfaction grades, W.L.G. and X.Z. drafted the manuscript, and J.W. supervised the study. All authors read and approved the final manuscript.

## Conflict of interest

None.

## Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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## Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.asjsur.2018.06.007>.

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