

The modified Devine's procedure for the management of concealed penis in children: an experience of 131 cases

H.-K. CHEN¹, Y.-S. CHU², Y.-F. HU¹

¹Department of Pediatric Surgery, Zaozhuang Municipal Hospital, Zaozhuang, Shandong Province, China

²Zaozhuang Yicheng District People's Hospital, Shandong Province, China

Abstract. – **OBJECTIVE:** With the current study, we aimed at describing our experience of surgical management of concealed penis using the modified Devine's procedure.

PATIENTS AND METHODS: Medical records of all patients undergoing surgical management of concealed penis using the modified Devine's procedure from January 2019 to June 2021 were retrieved. Penile length was measured before and after the procedure. Parental satisfaction on the penile size, morphology, voiding status and hygiene was measured using a 5-point Likert's scale.

RESULTS: A total of 131 patients were included. The mean age of the patients was 8.56 ± 2.75 years. The mean BMI of the patients was 24.17 ± 1.78 kg/m². The patients were followed up to a mean of 15 ± 3 months. The duration of the surgery was 89.93 ± 16.85 minutes. There was a statistically significant increase in penile length from 1.8 ± 0.64 cm to 5.02 ± 1.11 cm after the procedure ($p < 0.01$). There was a statistically significant improvement in satisfaction status of all domains at 6, 12 and 24 weeks as compared to pre-operative levels.

CONCLUSIONS: The modified Devine's technique is a simple and effective surgical technique for management of concealed penis in children producing predictable results and excellent parental satisfaction. The low rate of complications and good cosmetic outcomes lend support to its use in clinical practice.

Key Words:

Buried penis, Surgery, Complication, Concealed penis, Satisfaction grade.

Introduction

“Concealed penis” is a congenital deformity characterized by concealment of the penis under the subcutaneous tissue. The anomaly is specif-

ically associated with a lack of adequate outer penile skin and inadequate subcutaneous attachment to the Buck's fascia due to which the penis seems to be fused with the scrotum¹. On a clinical examination, the shaft of the penis is submerged under the pre-pubic skin but can be easily seen and palpated after applying pressure to the base of the shaft. Indeed, the presence of this deformity can be the cause of phimosis and balanitis which lead to difficulties in voiding and hygiene maintenance². The reduced length of penile tissue is also a major cause of psychological trauma in adolescents and adults³.

The deformity does not resolve spontaneously and needs surgical correction. Furthermore, animal studies have demonstrated that prolonged penile concealment can significantly impact the structure and function of the organ⁴. Hence, early surgical correction of concealed penis is an important operation performed by urologists all over the world. There are numerous surgical techniques to correct a concealed penis described in literature; however, no single method has been universally adopted^{1,5,6}. We hereby describe our experience of correcting concealed penises by means of modified Devine's flap.

Patients and Methods

Patients

We retrospectively reviewed the medical records of all patients undergoing concealed penis correction surgery using the modified Devine's flap at our Institute between January 2019 and June 2021.

All patients undergoing the procedure were diagnosed with concealed penis deformity, with

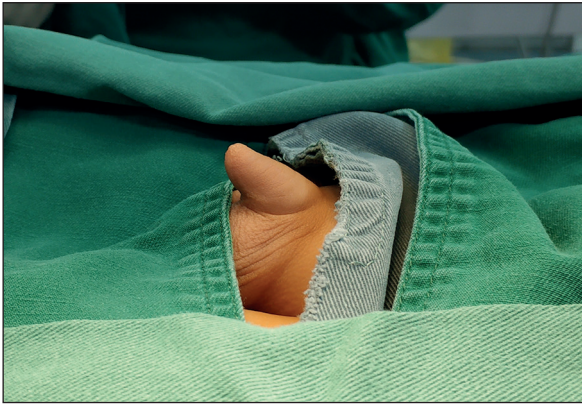


Figure 1. Pre-operative picture of concealed penis.

flat or beak-shaped penises and reduced appearance of penile length. However, the penile shaft was palpable on preoperative examination on application of pressure on both sides of the shaft base.

Surgical Technique

All surgical procedures were carried out by a single senior urologist. The procedures were conducted under general anesthesia with patients in supine position (Figure 1). The key surgical steps were as follows. The mid-dorsal and mid-ventral aspect of the preputial opening were longitudinally incised to release the skin tension. The frenulum was preserved for around 1.0 cm. The ventral portion was incised to the midline of the scrotum. Adhesion to the head was released exposing the glans penis. The foreskin was incised 1.0 cm from the coronary sulcus; thus, the glans was lifted, and the penis was pulled free. The foreskin was detached from the superficial surface of the tunica albuginea to the root, and the penis was fully stretched. The dorsal blood vessels and nerves of the penis were protected. The dorsal penile dysplastic sarcolemma and cord-like tissue were as much as possible removed. The tunica albuginea at the root of the penis and the flesh membrane at the root of the foreskin were sutured and fixed. The excess inner plate of the foreskin was then excised on the dorsal side of the penis; thus, the dorsal foreskin was pulled and sutured. The ventral foreskin was lifted, the inner plate of the foreskin was sutured in a circular manner, and the penis root was cut obliquely on both sides. The scrotal skin and subcutaneous tissue were then opened, the scrotal skin flap was advanced

to the root of the penis, the subcutaneous tissue on both sides was sutured with the ventral tunica albuginea at the root of the penis. The angle at the penis-scrotum junction was reconstructed (Figure 2). The suture site was externally coated with erythromycin eye ointment, fixed with mesh elastic gauze, and a urinary catheter was placed.

Data Collection

Baseline data collection included the patient's age, body mass index (BMI), and penile length which was measured from the base of the penis to the tip perpendicularly in the flaccid state. Patients were recalled at 6 weeks, 12 weeks and 24 weeks post-surgery for follow-up visits. Questionnaires were administered to the parents pre-operatively, right after surgery and during the follow-up visits to assess the satisfaction about the penile size, morphology, voiding status and hygiene. This was done using a 5-point Likert scale where 1 corresponded to "very unsatisfactory"; 2 for "unsatisfactory"; 3 for "neither satisfactory nor unsatisfactory"; 4 for "satisfactory"; and 5 corresponded to "very satisfactory". We also assessed and recorded any complications occurring in the immediate post-operative period and at the follow-up visits.

Statistical Analysis

Shapiro-Wilk test was used to examine the normality of data. All continuous data were presented as mean \pm standard deviation. Post-operative data were compared with pre-operative values using the Student's *t*-test. *p*-values lower than 0.05 were considered statistically significant. All statistical analysis were performed using SPSS for Windows 19.0 software (IBM Corp., Armonk, NY, USA).



Figure 2. Final post-operative picture.

Results

A total of 131 patients underwent the modified Devine's flap for concealed penis in our Institute during the study period. The mean age of the patients was 8.56 ± 2.75 years. The mean BMI of the patients was 24.17 ± 1.78 kg/m². The patients were followed up to a mean of 15 ± 3 months. The duration of the surgery was 89.93 ± 16.85 minutes. There was a statistically significant increase in penile length from 1.8 ± 0.64 cm to 5.02 ± 1.11 cm after the procedure ($p < 0.01$). The average blood loss was minimal (4.05 ± 1.53 ml). Data on the parent's satisfaction on penile size, morphology, voiding status and hygiene are presented in Table I. There was a statistically significant improvement in satisfaction status of all domains at 6, 12 and 24 weeks after surgery, as compared to pre-operative levels.

Complications were noted in 7 patients and consisted of infection and dehiscence of skin on the ventral side of the penis (3 patients), development of a narrow ring at the base of the penis (2 patients), unsatisfactory bloated appearance of the penis (1 patient) and foreskin edema (1 patient).

Discussion

Parents complaining about the small appearance of their child's penis is not an uncommon presenting problem for urologists or pediatric surgeons around the world. In most cases, the small size of the penis is only on appearance since the shaft is actually buried under the subcutaneous skin and is very much normal in length⁵. A number of terms have been used in literature to describe the conditions that can result in small appearance of the penis, namely: "buried penis",

"trapped penis", "hidden penis", "inconspicuous penis" and "concealed penis"⁷. In a classification system proposed by Maizels et al⁸, small penis was classified into four groups based on the concealment. Cases due to poor skin suspension in children or excess prepubic fat in adolescent were classified as buried penis; those due to penoscrotal web were grouped as webbed penis; those trapped under the scar skin post-circumcision were classified as trapped penis while the last ones were micropenis, which are normal penis but < 2 standard deviations below mean length when stretched. Another classification by Jung et al⁹ classifies a small penis as webbed, buried, entrapped and concealed. Webbed penis is the one wherein the ventral skin fold fixes the distal shaft to the scrotum, thereby obscuring the penoscrotal angle. Buried penis is caused by deficient penile skin at the shaft base or disproportionate suprapubic fat while entrapped penis is the one trapped by scar caused by the circumcision. The last one, the concealed penis, is due to deficient outer penile skin or lack of elasticity of dartos fascia or abnormal attachment of inelastic fibrous bands. In our study, we focused on surgically treated cases of concealed penis.

Management of concealed penis is fraught with several controversies. Firstly, the timing of surgery. A research¹⁰ suggests that prompt surgical correction can minimize the psychosocial impact of small penis on the child and aid in normal sexual development. Furthermore, early surgical intervention can also minimize the development of symptoms like infections, poor hygiene, balanitis, anxiety of appearance, and erectile dysfunctions. Since the deformity does not correct spontaneously, most surgeons are of the opinion that these cases should be surgically corrected as soon as possible. Secondly, the impact of weight loss in obese children with buried penis⁶. It is

Table I. Post-operative outcomes.

Variable	Pre-operative value	Immediate post-operative	6 weeks after	12 weeks after	24 weeks after
Penile size	1.43 ± 0.56	3.46 ± 0.60	4.70 ± 0.59	4.79 ± 0.45	4.66 ± 0.59
<i>p</i> -value	-	< 0.01	< 0.01	< 0.01	< 0.01
Morphology	1.31 ± 0.46	3.22 ± 0.68	4.53 ± 0.57	4.78 ± 0.42	4.74 ± 0.55
<i>p</i> -value	-	< 0.01	< 0.01	< 0.01	< 0.01
Voiding status	1.79 ± 0.41	3.94 ± 0.37	4.15 ± 0.50	4.26 ± 0.47	4.47 ± 0.50
<i>p</i> -value	-	< 0.01	< 0.01	< 0.01	< 0.01
Hygiene	1.38 ± 0.49	3.14 ± 0.44	4.05 ± 0.60	4.39 ± 0.52	4.70 ± 0.47
<i>p</i> -value	-	< 0.01	< 0.01	< 0.01	< 0.01

p-values as compared to pre-operative data.

unclear if the surgery should be performed before or after successful weight loss in such patients. Lastly, there has been no agreement in literature on what constitutes the best surgical technique to manage cases of concealed penis¹¹.

The following procedures have been described in literature¹²⁻¹⁶ to manage these cases, namely: "degloving the penis", "removal of prepubic fat", "skin fixation at the penile shaft", "modified Shiraki's procedure", "Johnston's procedure", "Shaeer's procedure", "modified Devine's procedure", "Z-plasty", "scrotal skin flaps" and "split-thickness skin grafting". The motive of all these procedures is more or less the same, consisting of dealing with the dysgenetic dartos fascia and its abnormal attachment to Buck fascia *via* inelastic fibrous bands and the disproportionate suprapubic fat. In our case series of 131 children, we used the modified Devine's procedure to achieve good results in all our patients. There was a statistically significant increase in the mean penile length, as well as significant improvement in the parent's satisfaction for penile size, morphology, voiding status and hygiene. The fact that results were achieved with minimal risk of complications is noteworthy. Our results concur with the previous study of Ge et al⁶ who used the same technique in 79 patients. In their study, the mean penile length increased from 1.88 ± 0.76 cm preoperatively to 4.42 ± 0.48 cm postoperatively. They also noted a statistically significant improvement in the parent's satisfaction for penile size, morphology, voiding status and hygiene in their cohort at all follow-up time points. It should be noted that concealed penis is more than a cosmetic deformity and not a life-threatening or morbid illness and hence the parent's satisfaction levels is the most important outcome of the surgical procedure.

The traditional surgery for concealed penis has some limitations, like poor release of the dartos fascia, chances of flap necrosis, poor esthetic results and lack of fixation at the penile base. The original Devine's operation involved the following steps: vertical incisions on the inner and outer dorsal prepuce, prepuce degloving from the base, removal of scar tissue, penile shaft exposure, removal of pubic fat and lastly fixation of the penile root¹⁷. In their original study, Zhang et al¹⁷, using the Devine's procedure, noted statistically significant improvement in mean penile length 3 months after surgery with the average length of 2.35 ± 0.35 cm. However, there have been concerns regarding the cosmetic results of the technique which may be unsatisfactory in some

cases⁶. In order to improve esthetics, the modified Devine's technique has been proposed, which includes the following changes⁶: firstly, the vertical incision is made on the mid-portion of the ventral prepuce to aid in loosening and straightening of the penile shaft. Secondly, the superfluous inner penile plate is completely removed, while the skin of the foreskin outer plate is preserved after dermal tissue fixation. Lastly, the penoscrotal angle is reconstructed to improve the esthetic appearance.

The complication rate in our case series was 5% only. In three patients, infection and skin dehiscence on the ventral aspect were detected, probably due to the cutting of skin on the ventral aspect which increased the skin tension during suturing; however, this was resolved in all cases after repeated dressings. The narrow ring at the base of the penis was noted in two patients due to tight suturing at the penoscrotal angle; however, this was also resolved in six months. In one case, foreskin edema was detected, probably due to the disruption of its blood supply during the procedure. However, as soon as the blood supply was reestablished, after some time the edema resolved.

Our study has some strengths. It presents the largest case series of the modified Devine's procedure for surgical treatment of concealed penis in literature. The excellent results and satisfaction grades obtained with the technique lend support to its routine use. The limitations include the retrospective and non-comparative nature of our study. Future comparative clinical trials are needed in order to assess the best surgical technique for concealed penis' management. Secondly, the duration of follow-up was not long enough, and the satisfaction levels were measured by simple non-validated questionnaires.

Conclusions

The modified Devine's technique is a simple and effective surgical technique for management of concealed penis in children producing predictable results and excellent parental satisfaction. The low rate of complications and good cosmetic outcomes lend support to its use in clinical practice.

Conflict of Interest

The Authors declare that they have no conflict of interests.

Funding

Not applicable.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Authors' Contribution

H.-K. Chen conceived and designed the study. H.-K. Chen and Y.-S. Chu collected the data and performed the analysis. H.-K. Chen and Y.-F. Hu was involved in the writing of the manuscript and is responsible for the integrity of the study. All authors contributed to the article and approved the submitted version.

ORCID ID

H.-K. Chen: 0000-0001-8724-4785; Y.-S. Chu: 0000-0002-0918-0752; Y.-F. Hu: 0000-0002-7746-6648.

Informed Consent

Written informed consent was obtained from the patients' guardians for the surgical procedure.

Ethical Approval

The Institutional Ethical Committee of Zaozhuang Municipal Hospital approved the conduct of the study (No.: LL22041502).

References

- 1) Chen C, Li N, Luo YG, Wang H, Tang XM, Chen JB, Dong CQ, Liu Q, Dong K, Su C, Yang TQ. Effects of modified penoplasty for concealed penis in children. *Int Urol Nephrol* 2016; 48: 1559-1563.
- 2) Chan IH, Wong KK. Common urological problems in children: prepuce, phimosis, and buried penis. *Hong Kong Med J* 2016; 22: 263-269.
- 3) Voznesensky MA, Lawrence WT, Keith JN, Erickson BA. Patient-Reported Social, Psychological, and Urologic Outcomes After Adult Buried Penis Repair. *Urology* 2017; 103: 240-244.
- 4) Cheng F, Yu WM, Xia Y, Zhang X Bin, Yang SX, Ge MH. Effects of buried penis on the structure and function of corpus cavernosum in a rat model. *Chin Med J (Engl)* 2010; 123: 1736-1740.
- 5) Han DS, Jang H, Youn CS, Yuk SM. A new surgical technique for concealed penis using an advanced musculocutaneous scrotal flap. *BMC Urol* 2015; 15: 54.
- 6) Ge W, Zhu X, Xu Y, Chen Y, Wang J. Therapeutic effects of modified Devine surgery for concealed penis in children. *Asian J Surg* 2019; 42: 356-361.
- 7) Ngaage LM, Lopez J, Wu Y, Nam A, Boyle K, Rasko Y, Goldberg N. Uncovering the Hidden Penis: A Nomenclature and Classification System. *Ann Plast Surg* 2021; 86: 444-449.
- 8) Maizels M, Zaontz M, Donovan J, Bushnick PN, Firlit CF. Surgical correction of the buried penis: description of a classification system and a technique to correct the disorder. *J Urol* 1986; 136: 268-271.
- 9) Jung EH, Son JH, Jang SH, Lee JW. Simple anchoring of the penopubic skin to the prepubic deep fascia in surgical correction of buried penis. *Korean J Urol* 2011; 52: 787-791.
- 10) Borsellino A, Spagnoli A, Vallasciani S, Martini L, Ferro F. Surgical approach to concealed penis: technical refinements and outcome. *Urology* 2007; 69: 1195-1198.
- 11) Cimador M, Catalano P, Ortolano R, Giuffrè M. The inconspicuous penis in children. *Nat Rev Urol* 2015; 12: 205-215.
- 12) Zaki Shaeer OK. Shaeer's Technique: A Minimally Invasive Procedure for Monsplasty and Revealing the Concealed Penis. *Plast Reconstr Surgery Glob Open* 2016; 4: e1019.
- 13) Ericsson NO. Problems in paediatric urology. *Ann Chir Gynaecol* 1974; 63: 173-174.
- 14) Saylor L, Bernard S, Vinaja X, Loukas M, Schober J. Anatomy of genital reaffirmation surgery (male-to-female): Vaginoplasty using penile skin graft with scrotal flaps. *Clin Anat* 2018; 31: 140-144.
- 15) Alter GJ, Ehrlich RM. A new technique for correction of the hidden penis in children and adults. *J Urol* 1999; 161: 455-459.
- 16) Qu CB, Xue WY, Wang XL, Zhang FX, Kang CS. Correction of pediatric concealed penis by using a modified Devine's technique. *Zhonghua Zheng Xing Wai Ke Za Zhi* 2006; 22: 342-343.
- 17) Zhang XS, Liu SX, Xiang XY, Zhang WG, Tang DX. Management of moderate to severe pediatric concealed penis in children by Devine's technique via incision between the penis and scrotum. *Zhonghua Nan Ke Xue* 2014; 20: 338-341.