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Original article

Update in Management of Congenital Penile Curvature complex [CPCC]

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ABSTRACT

Background: Congenital curvature of the penis results from abnormal efflorescence of the tunica albuginea of the corpora cavernosa and not accompanied with urethral anomaly. Complex Congenital curvature of the penis has two abnormal elements: mal-rotation either clockwise or anti clockwise and curvature of the penis either dorsal or ventral.

Aim of the work: To present update in management of congenital curvature complex of the penis.

Patients and Methods: This prospective study done at Al-Azhar University Hospital in Damietta. Fifteen patients [15] with congenital curvature complex of the penis were evaluated and corrected from June. 2019 to January 2020, their mean age was 5.1 ± 2.34 years [range 2–10 year]. The direction of torsion was anticlockwise in 12 patients and in 3 patients was clockwise. Four patients had dorsal curvature and Eight patients had ventral curvature, while three patients had lateral curvature. All patients treated at first by modified Nesbit's procedure for correction of curvature, then dorsal flap of dartos layer for correction of penile torsion in one stage.

Results: All cases with congenital curvature complex of the penis corrected in one-set surgery, which is simple, familiar and safe procedure with high successful rate. There were only a few transient complications, such as edema, mild bleeding, and penile hematoma resolved spontaneously. No recurrence of mal-rotation or curvature reported.

Conclusion: Congenital Penile Curvature Complex can be treated in single-stage surgery with excellent functional and cosmetic outcomes by combination of modified Nesbit's procedure with dorsal flap of dartos layer.

Keywords: Congenital; Penile curvature; Penile mal-rotation; Surgery; Dorsal flap.

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* Main subject and any subcategories have been classified according to the research topic.

INTRODUCTION

Ideally, a penis must be straight; i.e., the corpora straight, the skin sufficiently lax to avert traction, and the glans with no element of torsion. Penile curvature complex can be found in boys with or without hypospadias. Recent studies have furthered our understanding of the possible etiology and previously proposed explanations have been revised, which largely resulted in changes in surgical strategies. Current surgical techniques are widely successful in correcting the penile curvature [1].

Congenital penile curvature [CPC] is a relatively frequent anomaly that may be found in infants, late adolescent or early adult life [2]. According to some recent studies, significant curvatures were estimated to occur in [3–5%] of the general population, but the incidence of clinically significant curvature is much lower, as the degree of curvature and sexual dysfunction varies widely [3]. Congenital curvature of the penis is due to asymmetry in the compliance of the tunica albuginea of the corporal bodies as a result of developmental arrest during embryogenesis [4]. The repair of penile curvature has evolved over time. Initially, complex urethral mobilization surgery was advocated but is now accepted as being unnecessary in this population. Since then, a number of modifications have been made in attempt to improve outcomes and minimize surgical risks. Besides, grafting mechanisms have been studied in this setting where penile length preservation is a concern, but are not currently considered to be standard of care in repair of CPC [5].

Penile mal-rotation is an anomaly of the penile shaft. Surgical techniques for correction of penile mal-rotation vary from degloving the penis and repositioning of the skin to more complex procedures involving the corporal bodies [6].

Few authors have reported their trials in treating congenital penile curvature complex. As the most effective way of treating congenital penile curvature complex, we suggest correcting the curvature first by modified Nesbit's procedure [combined plication-incision], and then correcting the remaining mal-rotation by dorsal flap of dartos layer, which is a simple, familiar and safe procedure with high successful rate.

AIM OF THE WORK

To present update in management of congenital curvature complex of the penis.

PATIENTS AND METHODS

Fifteen patients [15] with CPCC were evaluated and corrected from June 2019 to January 2020 at the Pediatric Surgery Unit [Al-Azhar University hospital, New Damietta], Their mean age was 5.1 ± 2.34 years [range 2–10 years].

The Inclusion criteria: Boys [2-10] years. All of them had a Congenital Penile Curvature complex with normal urethral meatus. The Various degrees of penile curvature were ranged between [30–90°] associated with [30- 90°] penile mal-rotation

The Exclusion criteria: Boys with CPCC with abnormal urethral meatus as hypospadias or epispadias, or with the range of angle degree of penile curvature less than 30° associated with less than 30° penile mal-rotation or with acquired penile curvature or having an isolated lesion.

Ethical considerations: The study protocol had been approved by local research and ethics committee of Al-Azhar Faculty of Medicine; the study protocol was explained to all herdsman and their informed consents for involvement in the study had been obtained. Confidentiality and the right to fall back from the study at any time were guaranteed.

Each patient included in the study subjected to: 1- Full history taking. 2- Clinical examination [General & Local] through assessment of angle of curvature and torsion, examination of inguino-scrotal region for any associated abnormalities and urine stream assessment. 3- Laboratory investigations which included [complete blood count [CBC], bleeding time, clotting time, urine analysis, and serum creatinine. 4- Radiological assessment through abdominal and pelvic ultrasound for any associated anomalies.

Pre-operative preparation: Children underwent a nursing evaluation of functional health status and a preoperative evaluation by an anesthesiologist & pediatrician then the angle of penile rotation was measured on the photograph, using Millen Med DICOM viewer program for image analysis, based on the orientation of the urethral meatus relative to the vertical position [Fig.1].

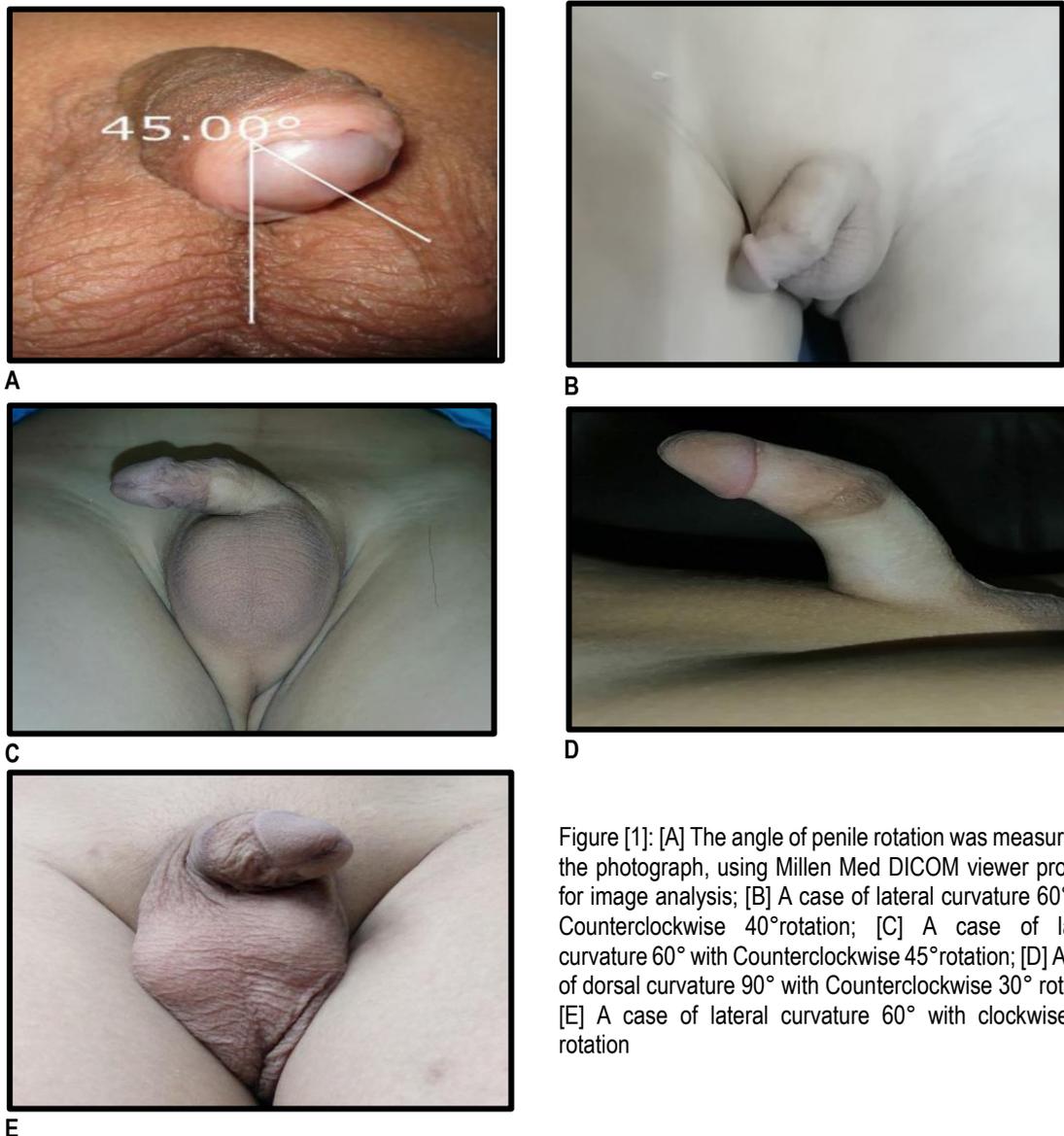


Figure [1]: [A] The angle of penile rotation was measured on the photograph, using Millen Med DICOM viewer program for image analysis; [B] A case of lateral curvature 60° with Counterclockwise 40° rotation; [C] A case of lateral curvature 60° with Counterclockwise 45° rotation; [D] A case of dorsal curvature 90° with Counterclockwise 30° rotation; [E] A case of lateral curvature 60° with clockwise 30° rotation

The direction of penile torsion was anticlockwise in 12 patients and clockwise in 3 patients. Eight cases had ventral curvature; 4 cases had dorsal curvature while 3 cases had lateral curvature. All patients with CPCC were corrected in one stage by modified Nesbit's technique for correcting curvature, followed by dorsal flap of dartos layer for correcting torsion. All cases were followed up for a mean follow up period of 4 months [range 3-6] for functional impairment, Aesthetic impairment, Residual curvature and residual mal-rotation.

Operative technique: A sub-coronal circular incision of the prepuce first performed and the penile shaft skin degloved. The overlying skin was retracted toward the base of penis in standard way by separation of the adhesions along the entire penile shaft. After tying of the base of the penis with rubber

band, the correction was demonstrated after induction of an artificial erection by injection of normal saline through needle which previously inserted into the penile shaft or glans penis. Penile deformity inspected carefully [Figure 2A]. Penile curvature identified and the orientation of the urethral meatus used as a reference to locate the direction and to determine the degree of penile mal-rotation. Using Babcock forceps, parts of the tunica albuginea at the convex aspects of the ventral, dorsal or lateral curvatures were clamped to temporarily achieve a correction of the deformities. We applied incisional corporoplasty [Modified Nesbit's technique] for correction of penile curvature in all cases [Figure 2B].

Provided the desired result, the tunica albuginea at those locations incised and sutured transversally with polydioxanone [PDS] 3/0 suture and the knots

inverted inside the incisions. An artificial erection done again to ensure complete correction of curvature. If the torsion persists, additional plicating sutures may be added. The sutures will last long enough for scarring to take place before the sutures will lose their tension. The neurovascular bundle complex and urethra must be preserved and avoided from iatrogenic injury. The dorsal flap of dartos layer, after its dissection from the dorsal penile skin, rotated around the side of the penile shaft opposite to the direction of mal-rotation and sutured to its ventral aspect. This creates a rotational force that counter-balances that of penile mal-rotation [Figure 2C]. Skin repositioning done to bring the twisted median raphe to its normal direction. Finally, the residual rotation of the urethral meatus, if present, was further corrected by reattaching the prepuce.

The wound closed with 5-0 vicryl, and the penis wrapped for 3 days. Examination for palpable suture knots along the shaft of the penis was performed by a doctor who knew nothing about the operative procedure. Moreover, the patient questioned about sensation of a knot and if it bothers him. However, we decided to rely on the patient words for assortment of cases positive for palpable suture knot.

Statistical Analysis: Parametric data were summarized by mean, standard deviation and sometimes minimum and maximum; while categorical data were expressed as frequency and percentages [%]. All were determined by Microsoft® Excel software computer package [Version 2019]

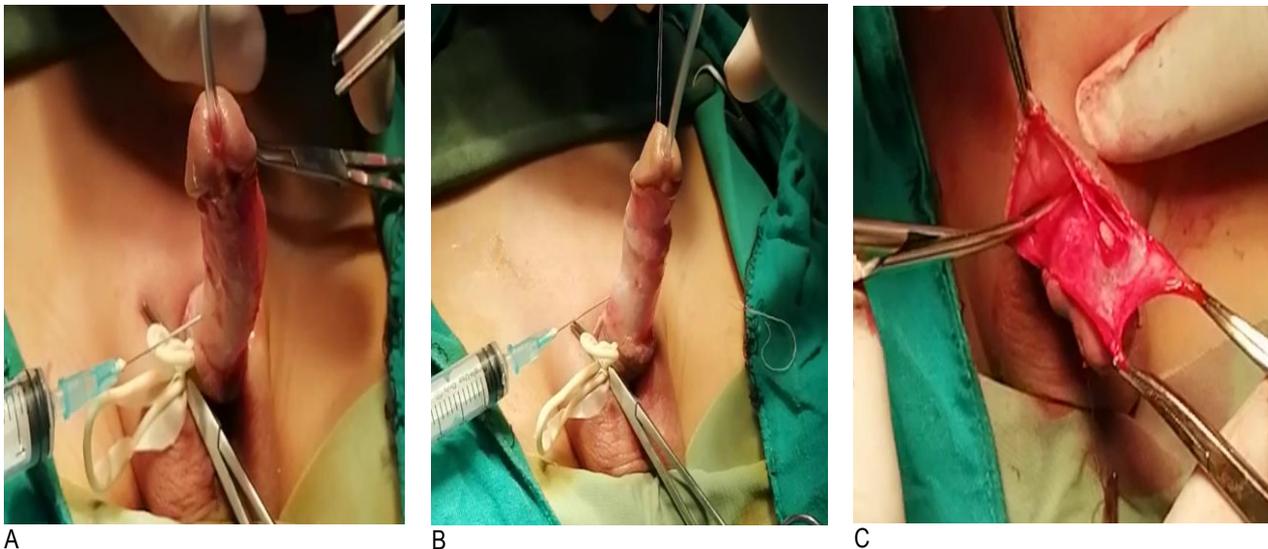


Figure [2]: [A] Penile curvature was identified after an artificial erection; [B] An artificial erection after Modified Nesbit's technique [C] Dorsal dartos flap prepared for rotation around the side of penile shaft opposite to the direction of penile torsion.

RESULTS

A total of fifteen patients with CPCC were subjected to combination of modified Nesbit's procedure with dorsal flap of dartos layer. All cases underwent one-stage surgical correction through a modified Nesbit's procedure for correcting curvature followed by dorsal flap of dartos layer for correcting mal-rotation. The direction of mal-rotation was anticlockwise in 12 patients and clockwise in 3 patients. Eight cases had ventral curvature; 4 cases had dorsal curvature while 3 cases had lateral curvature [Table 1]. The mean operative time was 35 ± 17 [range 27-52] minutes. Dressing of two patients [13.3%] was soaked with blood that stopped

spontaneously within 24 hours. The post-operative hospital stay was 4 ± 1.8 [range 3-7] days relying on the age of the patient and penile edema [Table 2]. All patients photographically recorded before and after surgery for follow-up and cosmetic evaluation. After surgical correction, all patients had straightened erect penis with wonderful cosmetic results and mild accepted penile edema [Fig. 3]. One patient [6.6%] had hematoma that conservatively treated and two patients had soaked dressing with blood. The remaining angles of penile torsion and curvature were less than 10° . No recurrence of curvature or torsion reported [Table 3]. The mean post-operative period of follow-up was 4 months; [range 3-6].



Figure [3]: Early post-operative excellent straight penis & vertical midline slit-like urethral meatus.

Table [1]: Patient characteristics in the studied population

Parameters		No. of cases	Percentage
Penile rotation	Anticlockwise	12	80 %
	Clockwise	3	20 %
Penile curvature	Ventral Curvature	8	53.33 %
	Lateral Curvature	3	20 %
	Dorsal Curvature	4	26.67 %

Table [2]: Perioperative parameters in the studied population

Parameters	Minimum	Maximum	Mean \pm SD
Mean age [years]	2	10	5.067 \pm 2.337
Operative time [minutes]	27	52	35 \pm 17
Mean postoperative hospital stay [days]	3	7	4 \pm 1.8
Mean follow-up [months]	3	6	4.5 \pm 0.85

Table [3]: Post-operative complications

Complications	No. of patients.	Percentage
Functional impairment	0	0%
Aesthetic impairment	0	0%
Residual curvature > 10°	0	0%
Residual mal-rotation > 10°	0	0%
Skin ischemia	0	0%
Hematoma	1	6.60%
Dressing soaked with blood	2	13.33%

DISCUSSION

Congenital complex curvature of the penis is a relatively infrequent condition that combines two deformities: torsion and curvature of the shaft of the penis^[7,8]. The clinical presentation of CPCC varies depending on the degree of curvature/torsion and its functional and psychological consequences. Surgical correction of CPCC is indicated in severe cases resulting in cosmetic distortion, psychological distress, abnormal direction of urinary stream, or sexual dysfunction [2]. Several surgical procedures have been described for correcting either congenital

curvature or torsion of the penis. However, a few studies addressed the treatment of CPCC particularly in single-set surgery^[8].

In this study, the authors described their experience with a one-stage surgical correction of CPCC. The ventral curvature had been reported among 53.33%, lateral curvature among 20.0% and dorsal curvature among 26.67%. Among the 114 patients with congenital penile curvature in **Hsieh et al.** ^[9] study, 69 [60.5%] has ventral, 31 [27.2%] with lateral, 3 [2.6%] with dorsal, and 11 [9.6%] with combined directions. In **Basiri et al.** ^[10] study on 35

patients with congenital curvature, there were 22 [62.8%] cases with ventral, 10 [28.6%] with lateral, and 3 [8.6%] with dorsal curvature.

In this study, the direction of penile mal-rotation was counterclockwise in [80%] and clockwise in [20%]. This is in accordance with other studies. For example, in **Aldaquadossi et al.**^[11] study, the direction of rotation was counterclockwise in 16 out of 17 included cases with congenital penile torsion.

In the present study, we captured a pre-operative photograph of the erect penis, and a viewer program was used to measure the angle of penile rotation based on the orientation of the urethral meatus relative to the vertical position. Proper photographic evaluation and documentation of deviation direction and angle are important for operative planning as well as post-operative follow up^[12]. Most studies reported the use the orientation of the urethral meatus as a reference to determine the direction and degree of penile torsion ^[11,13]. However, **Aykaç et al.**^[14] evaluated penile torsion based on the course of median raphe on penile corpora and glans. The angle of both penile curvature and rotation in this study ranged between 30° and 90°. The angle of the curvature may range from minimal to very severe deviation. In published studies, most operated patients had a curvature angle between 30° and 90° ^[9,15]. Studies showed that patients with curvature ≥ 30° will eventually seek repair ^[16].

All patients with CPCC in the present study underwent a one-stage surgical correction through a combination of modified Nesbit's procedure for correction of penile curvature followed by dorsal dartos flap, after complete degloving of penis, for correction of penile malrotation. The modified Nesbit technique used in our study consists of an incision in the tunica albuginea on the greater curvature with a transverse closure.

Making a longitudinal, compared with transverse incision over the corpora markedly decreases the risk of injury to the neurovascular bundle and shorten the surgical procedure by minimizing the need for more extensive lateral dissection^[16].

Correcting ventral penile deviation represents a particular challenge and confers a higher risk of post-operative sensory loss. Ventral penile deviation requires surgical intervention on the dorsal side of the penis, which demands special care during

dissection of the neurovascular bundle^[16]. Incision-less plication of the tunica albuginea is another surgical technique for correcting congenital penile curvature. This procedure is evidently less complex and requires less operative time. In addition, it minimizes the risk of injury to neurovascular bundles^[12]. In **Leonardo et al.**^[17] study on 31 patients with congenital penile curvature followed up for about three years, there was equal satisfaction in patients underwent Nesbit and plication procedures. Shortening of penis was less reported in Nesbit group [50%] compared with plication group [75%]. None in Nesbit group reported discomfort with sutures compared with 21% in the plication group. However, paresthesia of the glans was more reported in the Nesbit group [75%] compared with plication group [37%].

Considering published studies, the risk of recurrence seems lower after Nesbit/modified Nesbit procedure compared with plication procedure. However, the risk of postoperative complications, particularly sensory loss, appears to be lower after the plication procedure compared with Nesbit/modified Nesbit procedure. The outcome looks generally better in patients with congenital penile curvature treated by Nesbit or modified Nesbit technique ^[2,12,17].

In the present study, penile torsion of all 15 included patients was corrected by dorsal dartos flap after complete degloving of penis. To date, there has been no clear consensus on the best surgical treatment of penile torsion ^[14]. Several surgical techniques have been reported for correcting penile torsion. These include penile degloving^[18], suturing of pubic periosteum^[19], urethral mobilization^[20], and untwisting plication sutures^[13]. Diagonal corporal plication sutures were also reported^[21].

Surgical techniques for correcting penile torsion have potential complications, such as bleeding, neurovascular injury, and penile shortening^[14]. In a comparative study on patients with penile torsion who underwent dorsal dartos flap rotation or suturing tunica albuginea to the pubic periosteum, successful results were obtained by both techniques. However, the preparation of dartos flap was easier and shorter procedure ^[11]. In a study on five patients with penile torsion, penile degloving was sufficient corrective technique in three cases with torsion less than 45°, while two cases with more severe torsion required

penile degloving and dorsal dartos flap rotation technique, yielding satisfactory results. Moreover, dorsal dartos flap is a relatively easy procedure with minimal risk of complications compared with other techniques [14].

As discussed above, there are several studies on the correction of congenital penile curvature or torsion in isolation. However, a few reports have addressed the one-stage surgery in the management of CPCC [8]. **Belgrano et al.** [22] illustrated an asymmetrical, racket-shape tunica albuginea excision in the management of CPCC using two different sizes of Allis clamps on the longer portion of the tunica albuginea to delineate the maximum area for excision. However, it is difficult, from a practical viewpoint, to estimate the proper area for resection. **Hsieh et al.** [13] illustrated the plications of the tunica albuginea in the treatment of five cases with CPCC. In four cases, the penile torsion was corrected first followed by the curvature, and the sequence is reversed in one case. A follow up for 14 months showed satisfactory results.

In the present study, there were a few post-operative complications. The dressing of two cases [13.3%] was soaked with blood that stopped spontaneously within 24 hours, and one case suffered from penile hematoma that responded to conservative treatment. All cases in the present study were followed-up for approximately four months. All parents were generally satisfied with excellent functional and cosmetic results. There was no functional impairment, aesthetic problems, skin ischemia, or residual curvature/malrotation > 10°. No recurrence of curvature or mal-rotation was reported.

The incidence of postoperative complications varies between studies. Patients were generally satisfied after repair in 71% to 100% of cases [2,16,17].

Residual curvature requiring reoperation or recurrence rate differs according to the used method of repair, ranging between 0 % to 48 % [16]. **Leonardo et al.** [17] performed a follow-up study on operated patients with congenital penile curvature. Among 19 patients who had plication corporoplasty, three [15.8%] had a recurrence of curvature within three months after surgery, which required re-operation. Re-absorbable sutures were used for tunica albuginea plication in these patients. In addition, six [36.8%] cases had minimal persistent deviation and seven had minimal hyposensitivity of

glans and prepuce.

In the same study, no recurrence occurred in the 12 patients who underwent a traditional Nesbit technique with excision of small parts of tunica albuginea. However, six [50%] cases had minimal persistent deviation and nine [75%] cases had minimal hyposensitivity of glans and prepuce [17].

Conclusion: The one-stage surgical correction of CPCC using a combination of modified Nesbit's procedure for correction of penile curvature and dorsal dartos flap for correction of penile mal-rotation yielded excellent results with minimal post-operative complications without significant residual deviation or recurrence of curvature/mal-rotation that recommended it as the surgical method of choice in correcting CPCC.

Financial and Non-Financial Relationships and Activities of Interest

None

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