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Complete penile disassembly in epispadias repair

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Abstract

Purpose To report current results of complete penile disassembly technique in epispadias repair.

Methods In ten years, we have preformed 31 complete penile disassembly for proximal epispadias repair. Twenty-four patients had epispadias after primary repair of bladder exstrophy and 7 isolated penopubic epispadias. The age of the patients ranged from 10 months to 6 years (median 3 years).

Results The shortening of urethral plate was found in 30 patients (97% of cases), and this shortening varied between 6 and 16 mm. However, in one patient we found a lengthening of the urethral plate of 8 mm. The narrowing of urethral plate was found in all patients, and this narrowing varied between 30 and 50% of the width of the plate. Postoperative complications encountered in our patients were dominated by fistulas and dehiscence, particularly in patients who had bladder exstrophy–epispadias complex. After dehiscence and fistulas repair, the cosmetic results were satisfying in 25 patients (80.5% of cases) with conical glans and meatus in orthotopic position without any necrosis of the glans. However, the urinary continence ≥ 1 h was observed in 6 patients (19% of cases) and only 3 patients (9.7% of cases) had a urinary continence ≥ 3 h. The mean follow-up was 61 months.

Conclusions The complete penile disassembly remains one of the best techniques for epispadias repair. However, we noticed a reappearance of the dorsal curvature of the penis in a large number of patients treated for isolated epispadias and the impact of this technique on urinary incontinence remains uncertain.

Keywords Bladder exstrophy · Urinary continence · Epispadias · Complete penile disassembly · Mitchell's technique

Introduction

Epispadias (isolated or with bladder exstrophy closed) is a rare malformation. It is characterized by ectopia of urethral meatus (this meatus is located on the dorsal side of the penis), abnormal position of the urethra (above the corpus cavernosum), dorsal curvature of the penis, and urinary incontinence in the proximal forms. Thus, the goals of the surgical correction of this urogenital malformation are to provide a good cosmetic appearance of the penis with meatus in its anatomical position (at the apex of the glans) and satisfactory urinary continence.

Tubularization of the urethral plate was described by Thiersch in 1869 for epispadias repair [1]. Five years later, this technique was adapted by Duplay for the repair of proximal hypospadias [2]. Since then, several procedures have been described, such as Young technique [3], Cantwell procedure [4] modified by Ransley (who added the incision of the corpora cavernosa and their anastomosis above the urethra) [5], the complete mobilization of soft tissue proposed by Kelly [6, 7], and the Mitchell technique [8] which is characterized by complete disassembly of the penis in three parts: the urethral plate and the right and left corporeal-glandular bodies.

This study report the current results of complete penile disassembly technique in epispadias repair, as well as the evaluation of the shortening of the urethral plate which has never been assessed accurately.

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Materials and methods

During 10 years (from January 2009 to December 2018), we performed 31 complete penile disassembly for epispadias repair. This procedure was reserved initially for epispadias with bladder exstrophy. Then, from March 2013, we have extended the use of this surgical technique to the isolated penopubic epispadias. Twenty-four patients had bladder exstrophy–epispadias complex (requiring three to eight operations) and 7 had an isolated penopubic epispadias.

The age of the patients at surgery ranged from 10 to 74 months (median 34 months), and the delay of the surgical repair encountered in some patients was due to the rarity of centers which treat this type of pathology. The age was different in patients with isolated epispadias (from 10 to 20 months) and patients treated for bladder exstrophy–epispadias complex (from 2 to 6 years). The median follow-up was 5 years (ranged from 1 month to 10 years).

In all patients, we performed the technique described by Mitchell and Bägli [8]. This technique is characterized by complete disassembly of the penis (Fig. 1): two traction sutures are placed through the glans, and a circumferential incision was made 2 mm proximal to the epispadiac meatus and extended distally by two parallel incisions in the skin and the glans (U-shaped incision). This incision isolates the urethral plate. To avoid injuring the dorsal neurovascular bundle which nourishes the glans, the incision must be made at the 12-o'clock position in each corpus cavernosum (mid-dorsal) and the dissection must be meticulous. This is often difficult in patients already operated for bladder exstrophy. After completely dissecting the skin, fine scissors were slipped under the urethral plate to lift it up from corpora cavernosa. The dissection of the urethral plate should be extended proximally and distally to mobilize it completely from corpora cavernosa and the glans. At the apex of the glans, this plate was transected. Then, both corpora cavernosa are separated from each other. This separation was extended forward by a median incision of the glans providing two hemiglans. The urethral plate was tubularized on a feeding tube using 6/0 or 5/0 polyglactin interrupted sutures. Sometimes, this suture was reinforced by continued suture. Thus, the neourethra can be easily transposed in its normal anatomical position, under corpora cavernosa, which were sutured above the neourethra using 4/0 polyglactin interrupted sutures. The glansplasty was obtained by suture of the glans on the neourethra [9]. None of them had undergone pelvic osteotomy.

The urethral plate was measured by a ruler before and after its release. We also measured the length of the neourethra, the length of both corpus cavernosum, and the length of the penis at the end of the operation.

A feeding tube (6F, 8F, or 10F) was maintained into the bladder for 2–8 days, and antibiotic prophylaxis with a combination of two antibiotics: Cefazolin (50 mg/kg in 24 h) given intravenously for 2 days and orally, Triméthoprime-sulfaméthoxazole (0.2 ml/kg in two times) was used postoperatively for 8 days. The first postoperative follow-up examination was made after 1 week, and then every month during the year and later every 6 months.

The cosmetic outcome was evaluated by four parameters: the length and diameter of the penis, the state of the skin, and the appearance of the glans. However, the urinary continence was assessed by the length of the time of dry intervals during the day: < 1 h, 1–3 h, and ≥ 3 h which is defined as a social continence.

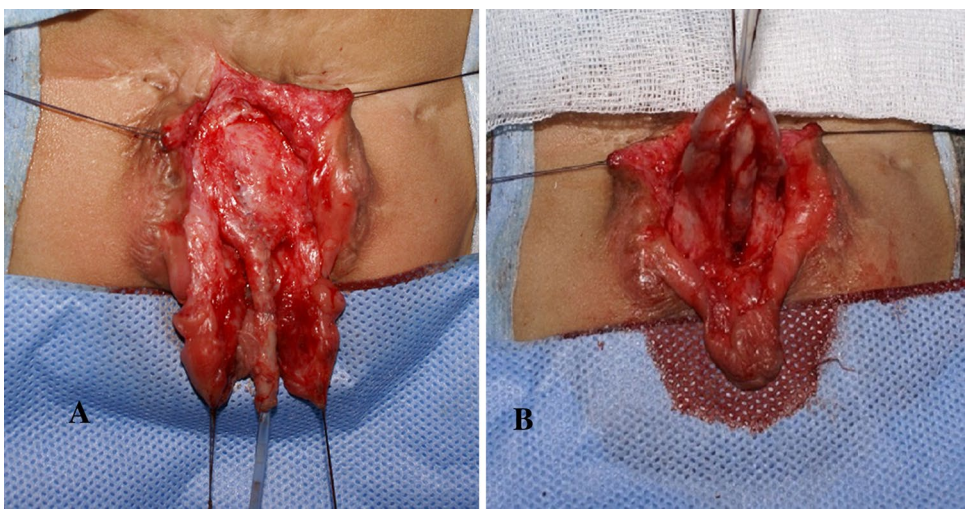

Fig. 1 **a** Complete disassembly of the penis in three parts: the urethral plate and the right and left corporeal–glandular bodies. **b** The corpora cavernosa are closed over the neourethra by interrupted sutures

Results

After completely disassembling the penis in three parts, the shortening of the urethral plate was observed in 30 patients (97% of cases), and this shortening varied between 6 and 16 mm and increased proportionally with the length of the penis. However, the narrowing of the urethral plate was present in all patients, and this narrowing varied between 30 and 50% of the width of the plate. The urethral plaque of the isolated epispadias was more extensible than that of epispadias associated with bladder exstrophy (a fibrosed urethral plate). We also noticed a poor blood supply of the distal part of the urethral plate in 11 patients (35.5%).

Intra-operatively, the curvature of the corpus cavernosum was corrected in all patients. However, we observed reappearance of a curvature of the penis just after ablation of the urinary stent in 4 patients treated for isolated epispadias (57% of cases) (Fig. 2) and in only 2 patients treated for epispadias with bladder exstrophy (8.3%).

The postoperative complications shown in Table 1 revealed a high frequency of fistulas and dehiscence in patients who had previously undergone a closure of bladder exstrophy. These fistulas and dehiscence occurred immediately after surgical gesture (between 4 and 10 days postoperatively), and they were often located at the bulbar or proximal urethra, parts of the urethra uncovered by corpora cavernosa (Fig. 3). However, there were 3 fistulas located at corona, and 2 of them were connected directly to the meatus by a glandular canal which passes over the urethra. Their treatment, especially with dehiscence, was difficult, and required 3 to 8 operations (median 5) which was huge. However, after repairing fistulas and dehiscence, the cosmetic

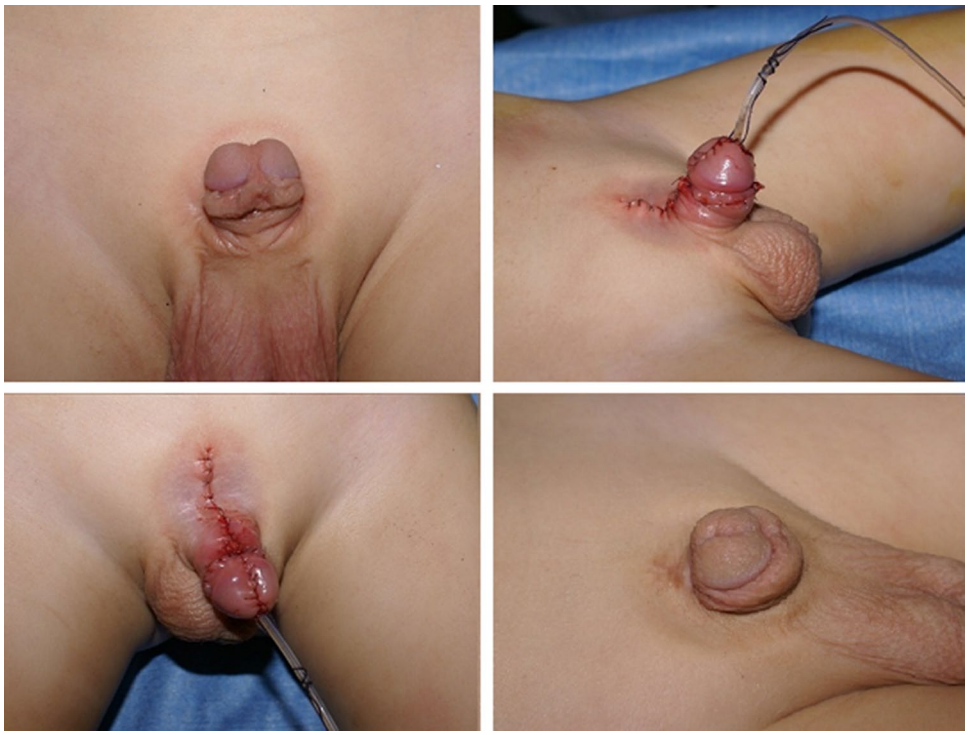

Fig. 2 Reappearance of curvature of the penis after surgical repair

Table 1 Complications encountered with complete penile disassembly in epispadias repair

	No. of patients ($n=31$)	Isolated epispadias ($n=7$)	Epispadias with bladder exstrophy closed ($n=24$)
Fistula	15 (48.4%)	1 (14.3%)	14 (58.3%)
Dehiscence	5 (16.1%)	0	5 (20.8%)
Complete dehiscence	1 (3.2%)	0	1 (4.2%)
Meatal stenosis	1 (3.2%)	1 (14.3%)	0
Proximal stenosis	3 (9.7%)	0	3 (12.5%)
Diverticula	0	0	0
Glans rotation	4 (6.5%)	2 (28.5%)	2 (8.3%)

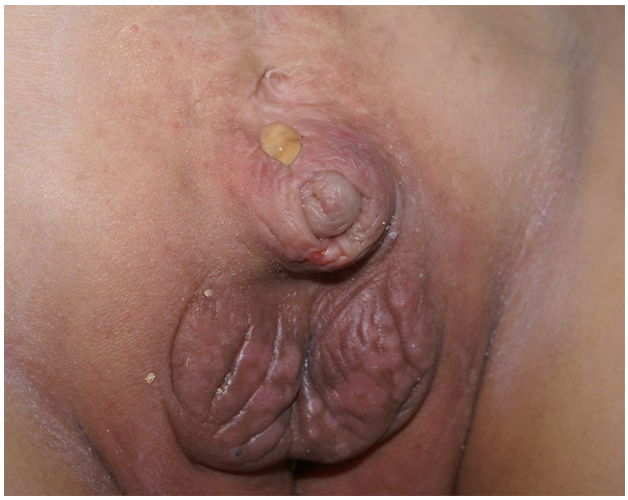

Fig. 3 Complications encountered postoperatively which are dominated by fistulas and dehiscence at the proximal urethra and bladder neck

outcome was considered good by parents and surgeon in the majority of patients with a conical glans, a straight penis, and a good penile skin. In 28 patients, the meatus was often vertically oriented and in anatomical position: located at the tip of the glans in 19 patients and in its ventral orthotopic position in 9 patients.

The urinary continence with dry intervals of at least 1 h/day was observed in 6 patients (19% of cases), in three isolated epispadias and in two bladder exstrophy–epispadias complex, and ≥ 3 h in only 3 patients (9.7% of cases), in two isolated epispadias and in one bladder exstrophy–epispadias complex.

Discussion

The ideal surgical technique for epispadias repair must meet three criteria:

- Restores the normal anatomy of the penis with a urethra in ventral position.
- Gives a good cosmetic result with a straight penis, a conical glans, and meatus at the apex of the glans.
- Provides acceptable urinary continence.

Several techniques have been described for epispadias repair, but only three of them merit to be discussed. The Kelly's procedure, despite Kelly reporting a significant penile lengthening by complete mobilization of soft tissue (complete detachment of insertions of the corpora cavernosa from the pubic bones) and an improvement of the continence [6, 7], has not gained in popularity but remains used in a few centers, and it is considered as dangerous and can expose to catastrophic complications, such as partial or complete penile loss [10]. The preferred techniques in the majority of centers are the Cantwell procedure modified by Ransley [4, 5], and the complete penile disassembly technique described by Mitchell and Bägli [8] which restores the normal anatomy of the penis. And although a study published in 2008 [11] reported that 67% of cases became continent after epispadias repair by Mitchell's procedure versus 0% treated by Cantwell–Ransley technique. And that among 21 patients, 10 (48%) had complications, 8 underwent Cantwell–Ransley's procedure (57%), and 2 Mitchell's technique (29%). However, the Cantwell–Ransley technique that we used in the past remains an excellent procedure for the repair of male epispadias [12] with often good cosmetic results.

The shortening of the urethral plate was present in 97% of cases and the narrowing in all patients. This shortening of the urethral plate was only observed in 1/3 of the cases for Hafez et al. [13], while the narrowing of plate was not reported in the literature. The poor blood supply for the distal part of the urethral plate observed in 11 patients seems related to the manner of its dissection. To avoid the shortening of the urethral plate and to ensure a better blood supply for the plate, Perovic et al. [14] have proposed a variant of the technique which involved leaving the distal part of the urethral plate attached to both hemiglans. However, this procedure, which we used in 2 patients not included in the study, does not permit a complete correction of the curvature of the penis.

The glans is nourished by two pedicles; each pedicle is intended for half of the glans. These pedicles anastomose into glans. Thus, the visualization of the pedicles is an important step in the surgical gesture, and the two hemiglans should never be separated if one of two was injured, because we will have a necrosis of the hemiglans. In isolated epispadias, this pedicle passes on the dorsal side of the corpora cavernosum, between 2 and 3 h. However, anatomical variations can exist and the pedicle can pass lower (on the ventral side of the corpora cavernosum) which can constitute a trap for the surgeon. In epispadias with bladder exstrophy, the pedicle is often more apical.

The cosmetic result of complete penile disassembly was considered good in the majority of patients. However, the rates of fistulas and dehiscence were very high. The majority of the fistulas and dehiscence appeared at the bladder neck and bulbar urethra. They are probably due to the superficial location of the bladder neck and the proximal urethra, not covered by the symphysis pubis. The osteotomy facilitates the reduction of the pubic symphysis diastasis, and therefore bladder and abdominal wall closure. In addition, the deep location of the bladder and the pelvic floor restoration seem to improve the urinary continence [15]. However, the osteotomy must be maintained by an external fixating for 4 to 6 weeks, which can be an issue for the child and his family.

Among the complications reported in the literature, the intentional hypospadias that seems to be an inherent complication of complete penile disassembly was not observed in patients of our study. However, this complication was encountered in 6 patients (31.5%) treated by Caione et al. [16] and in 15 patients (68%) treated by El-Sherbiny et al. [17]. These contradictory results are difficult to explain. In the original technique, Mitchell and Bägli reported a ventral orthotopic position of the meatus in 8 of 10 patients (a normal anatomical position of the meatus according to the authors). We think that the shortening of the urethral plate has given a retraction of the penis, not an intentional hypospadias.

Cases of partial or complete penile loss after complete penile disassembly associated with bladder exstrophy closure were reported, particularly when the osteotomy was not performed. This is due to the compression of the pudendal vessels and/or direct injury of pudendal vessels [18]. Thus, it is dangerous to perform at the same operative time a bladder closure with complete penile disassembly.

It is clear that the impact of this surgical technique on urinary continence, particularly in epispadias with bladder exstrophy without pelvic osteotomy, is not promising, and the good results reported by some authors, 83 to 100% of patients completely dry or with a dry interval > 4 h 16, remain debatable. However, long-term data are required to evaluate the outcomes of the technique on urinary continence and sexual functions.

Conclusions

The complete penile disassembly described by Mitchell and Bägli remains one of the best techniques for epispadias repair. It restores the normal anatomy of the penis. However, the shortening of the urethral plate present in the majority of patients appears to be responsible, especially in isolated epispadias, for the reappearance of dorsal curvature of the penis in a large number of patients. In addition, its functional results on urinary continence, particularly for bladder exstrophy–epispadias complex, remain reserved.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This study conforms to the World Medical Association Declaration of Helsinki (June 1964) and subsequent amendments and the investigations were carried out to a high ethical standard. However, in our country, there is no formal and documented ethical approval from an appropriately constituted research ethics committee, which requires to be obtained for all studies involving human.

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