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Epispadias: recent techniques

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Abstract

Aim: This paper presents the latest surgical approaches for epispadias treatment in the pediatric population, as well as those for adolescent and adult populations after initial failed repair in childhood.

Methods: The retrospective study was conducted between March 2005 and May 2020 and included 18 patients with the mean age of 21 months (range 11-48 months) (Group A), who underwent primary epispadias repair and 15 patients with the mean age of 18 years (range 13-29 years) (Group B), who underwent redo surgery after failed epispadias repair in childhood. In Group A, the surgery was performed as a one-stage procedure using complete penile disassembly technique, while, in Group B, the surgery was done as a two-stage procedure and included complete straightening and lengthening of the penis, followed by urethral reconstruction. Penile straightening and lengthening were achieved by tunica albuginea incision and grafting. In Group A, the urethral plate was mobilized, transposed ventrally, and tubularized and augmented with vascularized preputial skin flap where needed. In Group B, the urethra was reconstructed either using the buccal mucosa graft and genital skin flaps or with tubularization of genital skin flaps. Successful treatment was defined as a functional and esthetically acceptable penis without complications.

Results: The mean follow-up was 88 months (range 15-197 months). Satisfactory results were achieved in 26/33 patients. Urethral fistula occurred in 4/18 patients from Group A and in 3/15 patients in Group B and was surgically repaired after four months. Skin dehiscence occurred in eight patients, five from Group A and three from Group B. Recurrent penile curvature was observed in 2/18 patients from Group A and required surgical correction and in

2/15 patients from Group B and was mild and did not need surgical repair. Eleven patients from Group B who filled out the International Index for Erectile Function reported satisfying erectile function, sexual desire, intercourse, and overall satisfaction.

Conclusion: Primary or redo epispadias repair is challenging even for experienced reconstructive urologists. Only radical surgical approach can lead to complete correction of all deformities and provide successful outcome.

Keywords: Epispadias, primary repair, penile disassembly, urethroplasty, buccal mucosa graft, genital reconstruction, failed epispadias

INTRODUCTION

Primary epispadias, either isolated or associated with bladder exstrophy, represent a rare congenital genital anomaly with the incidence of 1 in 117,000 male live births, with a male-to-female ratio of 5:1 in the general population[1]. It is characterized by a dorsal lack of penile prepuce, ectopic meatus, abnormally positioned urethra, dorsal penile curvature, divergence of corpora cavernosa, pubic diastasis, and urinary incontinence in proximal forms, because of the associated defect of the sphincteric muscle mechanism[2].

The origin of exstrophy-epispadias is multifactorial, with both genetic and environmental factors playing a role[1]. Pregnancy counseling regarding familial recurrence risk should emphasize that exstrophy-epispadias complex most commonly occurs as an isolated sporadic birth defect with the risk of recurrence of less than 1%[3].

The treatment is exclusively surgical and usually radical depending on the epispadias form. Detailed knowledge of penile anatomy is of essential importance for successful results. The goal of epispadias repair is to provide for an adequately functional and cosmetically acceptable penis. Early surgical repair of congenital genital anomalies is considered to have a positive impact on the patient's psychosexual development. Despite the constant development of epispadias repair, high incidence of failure and need for reoperation characterizes epispadias as one of the most difficult genital anomalies and a great challenge for pediatric and adult reconstructive urologists. Typically, patients with severe forms of epispadias undergo more than one surgical repair. Outcomes can be questionable and even worsened after penile growth in puberty if the corporal deformity was not adequately corrected. Penis size, glans, and overall penile appearance become more obvious in adolescents and young adults, and their expectations for functional and esthetically appealing penis impose successful redo epispadias repair[4].

This paper presents the latest surgical approaches for epispadias treatment in the pediatric population, as well as those for the adult population after initial failed repair in childhood.

METHODS

After Institutional Review Board approval was obtained (062021-U/918-2), a retrospective study was conducted using the institutionally approved database and included all patients treated for isolated epispadias in our institution from March 2005 to May 2020. The study included 18 patients aged 11-48 months (mean 21 months) (Group A) who underwent primary epispadias repair and 15 patients aged 13-29 years (mean 18 years) (Group B) who underwent redo surgery due to failed epispadias repair in childhood. Two out of fifteen patients from Group B had exstrophy-epispadias repair in childhood. Included patients from Group B had a mean of four surgeries for epispadias correction. In all patients from Group B, surgery was performed as a two-staged epispadias repair. The first stage included correction of the recurrent dorsal

penile curvature and maximal straightening and lengthening of the penis, while the second stage included penile urethra reconstruction using buccal mucosa graft or hairless penile skin flap in combination with scrotal skin flap, or tubularization of the penile skin flap. Patients were instructed to perform either electrolysis or laser epilation on the marked area of the scrotum for permanent hair removal before second stage of epispadias repair. Prior to the inclusion in the study, all patients and/or their legal guardians gave their written consent to study participation and permission to have their genitalia photographed anonymously.

The patients from Group A were divided into three subgroups according to epispadias severity: penopubic epispadias (Group A1, two patients), midshaft penile epispadias (Group A2, nine patients), and distal penile (glanular) epispadias (Group A3, seven patients).

All patients underwent preoperative evaluation and physical examination. In all patients, the surgery was performed in general anesthesia. In patients in Group A, caudal analgesia was additionally administered while epidural catheter was used in older patients. Intravenous antibiotic therapy was administered preoperatively, according to the patient's weight.

Operative technique

The patient was placed in a supine position. In all patients from Group A, the penile disassembly technique was used with the aim to restore all penile entities in a one-stage procedure [Figure 1A]. The stay suture was placed on each hemiglans carefully to avoid injuring the urethral plate. A circumcision line incision was made ventrally and a periurethral incision was made dorsally, with careful mobilization of the urethral plate. In penopubic epispadias, a suprapubic incision was made with the simultaneous bladder neck reconstruction to achieve continence. The urethral plate was carefully dissected from the corpora cavernosa, together with the Buck's fascia to ensure blood supply and to avoid injury of the urethral plate[5]. Distal attachment of the urethral plate to the glans was preserved[1]. The neurovascular bundles were carefully mobilized together with each hemiglans. Corpora cavernosa were detached completely from the glans and totally freed to their attachments on the pubic bones [Figure 1B]. The dorsal curvature was then repaired using a graft if severe to prevent penile shortage. The corpora cavernosa were derotated and approximated in the midline dorsally [Figure 1C]. The dissected urethral plate was then transposed ventrally and fixed to the corpora cavernosa [Figure 1D]. The ventrally positioned urethral plate was then tubularized over a silicone Foley catheter 6-8 Ch (depending on the patient's age). In cases where the urethral plate is short and anticipated to present a limiting factor for penile lengthening and straightening, it should be transected and transposed ventrally and tubularized and fixed to the corpora cavernosa to prevent retraction[1]. Hemiglanses were reshaped to have a conical appearance and fixed to the corpora cavernosa using a U suture. Neurovascular bundles were joined on the dorsal side of the penis, establishing normal anatomical relations of all penile entities[1] [Figure 1E]. The gap between the upper and lower parts of the urethra could be reconstructed using rotational preputial flap if suitable anatomy is present [Figure 1F]. Urethroplasty was then completed by anastomosis between the tubularized urethra proximally and preputial flap distally over the urethral stent or catheter [Figure 1G]. The penile shaft was reconstructed using available skin [Figure 1H]. A suprapubic catheter was introduced into the bladder for two weeks. Oxybutynin was administered for prevention of bladder spasms. Elastic-adhesive compression dressing was placed around the penis to prevent swelling and subsequent lymphedema. In two patients who had cryptorchidism, orchiopexy was simultaneously performed.

In all patients from Group B, isolated redo epispadias repair was performed as a two-stage surgery [Figure 2A]. The patient was also placed in a supine position. Circumcision incision was made and penile

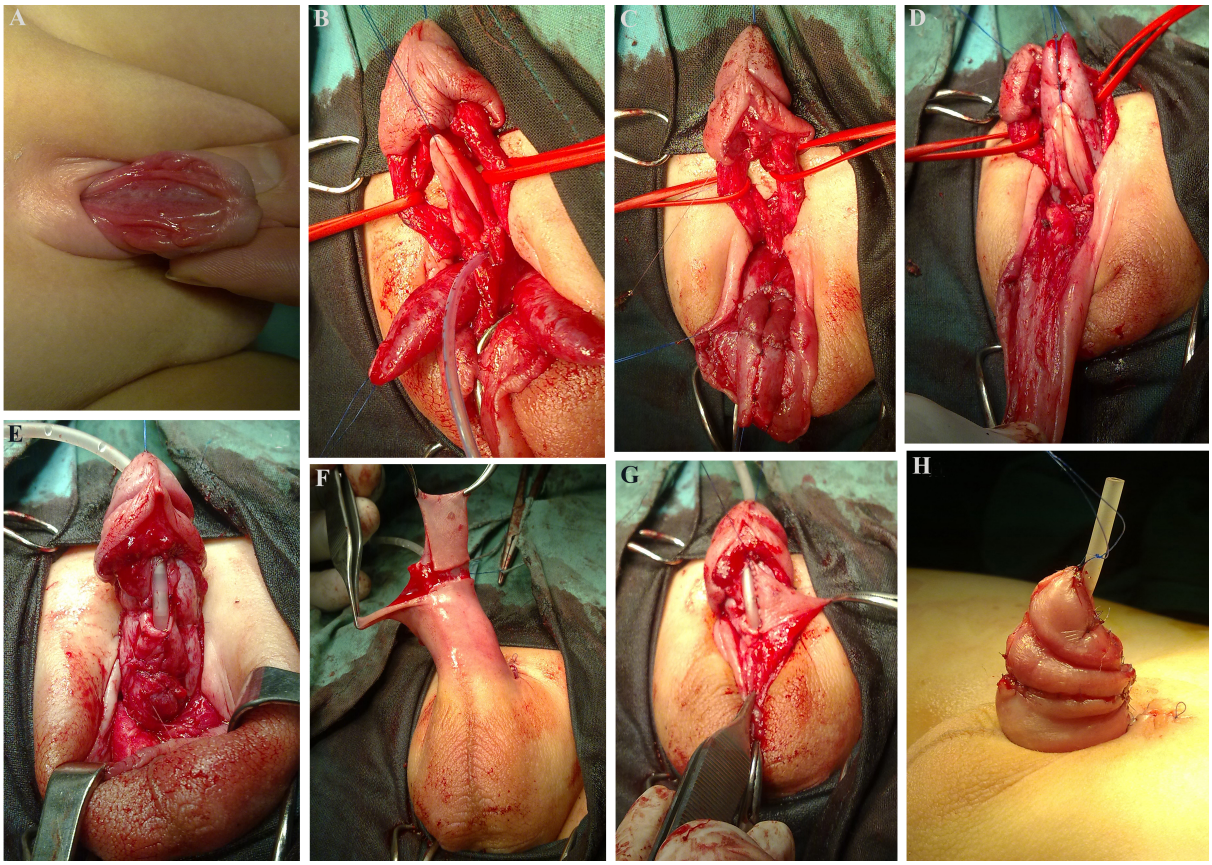

Figure 1. Penopubic epispadias. (A) Preoperative appearance of the patient with penopubic epispadias. (B) Complete penile disassembly. Glans with neurovascular bundles. Both corpora cavernosa completely detached from the glans and mobilized urethral plate. Silicone urinary catheter placed inside the urethra. (C) Correction of dorsal curvature using grafting technique. Both corpora joined and derotated. Glans with two neurovascular bundles positioned dorsally. (D) The urethral plate is transposed ventrally and fixed to the corpora cavernosa. (E) Tubularization of the urethral plate over the silicone catheter. Glans is fixed to the corpora cavernosa. Glansplasty forming conical glans is finished. Gap between tubularized urethral plate and glans is visible and is approximately 2 cm long. (F) Mobilization of the preputial skin flap for urethral reconstruction. (G) Urethroplasty is completed using preputial island skin flap that is anastomosed proximally to the tubularized urethral plate and distally with the glandial part of the urethral plate. Tubularization is performed around the urinary catheter. Suture lines are covered with vascular subcutaneous tissue. (H) Outcome at the end of surgery. The urethral stent is positioned in the neourethra. The penile shaft is reconstructed using available penile skin.

degloving was performed with caution to prevent penile skin devascularization. If urethra was short and presented the limiting factor for maximal straightening of the corpora cavernosa, it was transected at the subcoronal level [Figure 2B]. Artificial or pharmacological erection introduced by prostaglandin E1 (PDE1) was performed and recurrent curvature, present in the majority of redo cases, was noted[4]. Curvature correction using bovine pericardium to cover the incision defects on tunica albuginea led to a complete straightening of both corpora cavernosa and allowed for penile lengthening, preventing shortage of the penis. Complete correction of the curvature was confirmed using artificial or pharmacological (PDE1) erection [Figure 2C]. The short urethra was transposed ventrally creating new a "hypospadiac" meatus at the base of the penis. The penile shaft was reconstructed using available penile and scrotal skin flaps [Figure 2D]. Silicone Foley Ch 12-16 catheter was introduced into the bladder. Elastic-adhesive compression bandage was placed around the penis to prevent swelling and lymphedema. In postoperative recovery, the patient was instructed to use a penile vacuum device for a period of six months after the surgery and before the second-stage repair and to perform permanent hair removal by laser epilation or electrolysis.

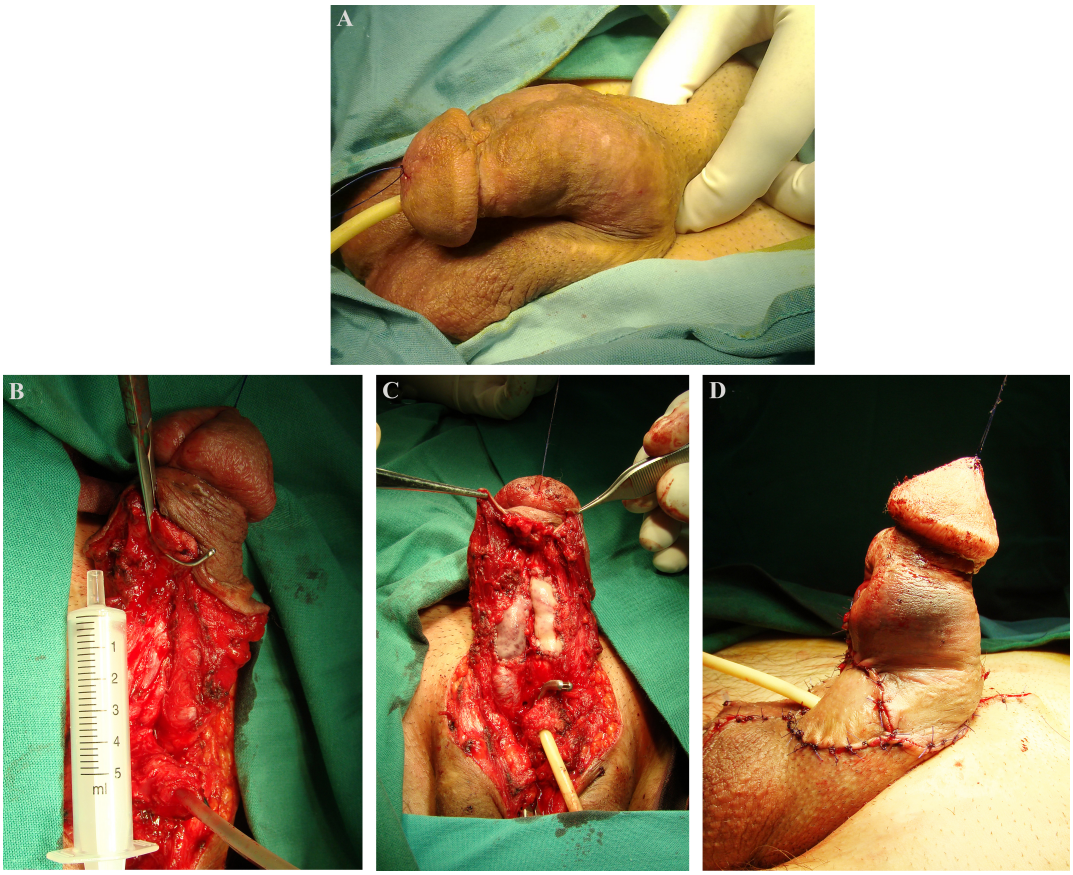

Figure 2. Failed epispadias repair. First stage repair. (A) Failed epispadias repair with ventral curvature. (B) After penile degloving, short urethra was noted and dissected. Distance between two ends of the urethra is 5.5 cm. (C) Grafting of the corpora cavernosa using bovine pericardium to correct the penile curvature. (D) Penile and scrotal skin reconstruction using available penile and scrotal skin flaps. Meatus is positioned ventrally at the base of the penis.

The second stage of epispadias repair was performed six months later and consisted in urethral reconstruction [Figure 3A]. The missing part of the urethra was reconstructed using buccal mucosa grafts quilted to the corpora cavernosa, creating the dorsal urethral wall, and an island skin flap harvested from the scrotal skin over the silicone Foley catheter 12-16 Ch [Figure 3B]. The buccal mucosa graft was harvested from the patient's inner cheek in a previously described fashion, defatted, and fixed to the corpora cavernosa with interrupted 5.0 polidyoxanone suture[6,7]. The flap pedicle was placed over the urethra and suture lines to prevent the formation of a fistula [Figure 3C]. Penile skin reconstruction was performed to avoid suture superposition and to prevent penile curvature using available penile and scrotal skin flaps [Figure 3D]. A suprapubic urinary catheter was introduced into the bladder for a period of three weeks. Oxybutynin was administered postoperatively to all patients, to prevent bladder spasms while the catheter was in place. Elastic-adhesive compression bandage was placed around the penis. The urethra was moistened every 3 h for the first 72 h during the hospital stay using 0.9% saline solution. Broad spectrum antibiotics were administered together with metronidazole during the hospital stay. The patients were instructed on flushing the urethra once daily with a 0.9% saline solution after hospital discharge. Urinary Foley catheter was removed 10 days after the surgery. Sexually active patients were instructed to refrain from sexual intercourse for a period of eight weeks postoperatively.

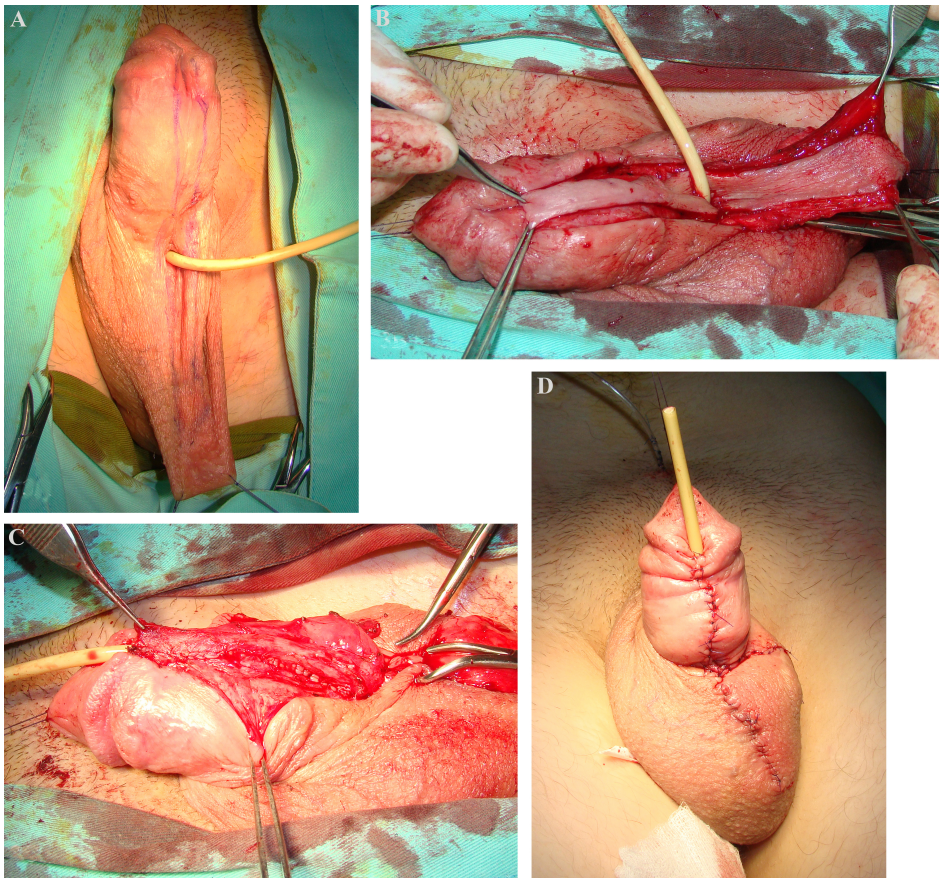

Figure 3. Second stage repair. (A) Preoperative appearance. Lines are marked on the penis ventrally and for scrotal flap mobilization. (B) The buccal mucosa graft is harvested for the urethral reconstruction and positioned dorsally. The longitudinal scrotal skin flap is mobilized with abundant vascular pedicle. (C) Urethroplasty is performed by anastomosis of the longitudinal scrotal skin flap and buccal mucosa graft. All suture lines are covered with vascular tissue. (D) Final appearance. The urethral stent is positioned inside the neourethra. Penile and scrotal skin reconstruction is performed using available genital skin. Penrose drain is placed.

In cases with previously treated bladder exstrophy epispadias complex (two patients), radical surgical approach was applied for two-stage redo epispadias repair [Figure 4A and B]. Circumcision incision was made and penile degloving was performed with subsequent partial or complete penile disassembly, depending on entities needing corrective surgery. Short urethra positioned dorsally was transected and transposed ventrally in the form of penoscrotal urethrostomy [Figure 4C and D]. The penile shaft was reconstructed using available penile skin [Figure 4D]. Elastic-adhesive compression bandage was placed around the penis for swelling and lymphedema prevention. Postoperatively, the patient was instructed to use a penile vacuum device for a period of six months after the surgery and before the second stage of repair and to perform permanent hair removal by laser epilation or electrolysis. The vacuum device, which is approved for medical indications, was used twice a day for 30 min.

The second stage of epispadias repair was performed six months later and consisted in urethral reconstruction [Figure 5A]. A longitudinal penile skin flap was harvested from the ventral side of the penis, around the urethral meatus, and tubularized around the silicone Foley catheter 12-16 Ch [Figure 5B]. Urethral reconstruction was completed by urethral advancement and meatoplasty [Figure 5C]. Penile skin reconstruction was performed using modified Z plasty to prevent superposition of the sutures using available penile skin. Elastic-adhesive compression bandage was placed around the penis as previously

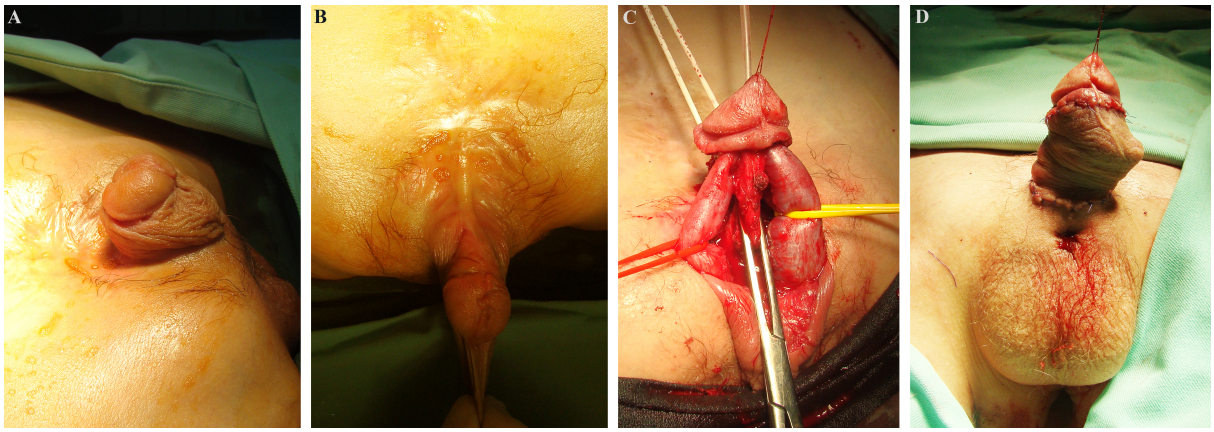

Figure 4. Patient with previously operated exstrophy epispadias complex. First stage repair. (A) Preoperative appearance. Excessive skin positioned ventrally. (B) Short superficial urethra positioned dorsally. (C) Partial penile disassembly. Both corpora cavernosa divided without detachment of the glans. Urethra transposed ventrally. (D) Final aspect. Meatus positioned ventrally at the penoscrotal angle forming hypospadias. Penile skin reconstruction using available penile skin flaps keeping the excessive skin ventrally for the second stage urethroplasty.

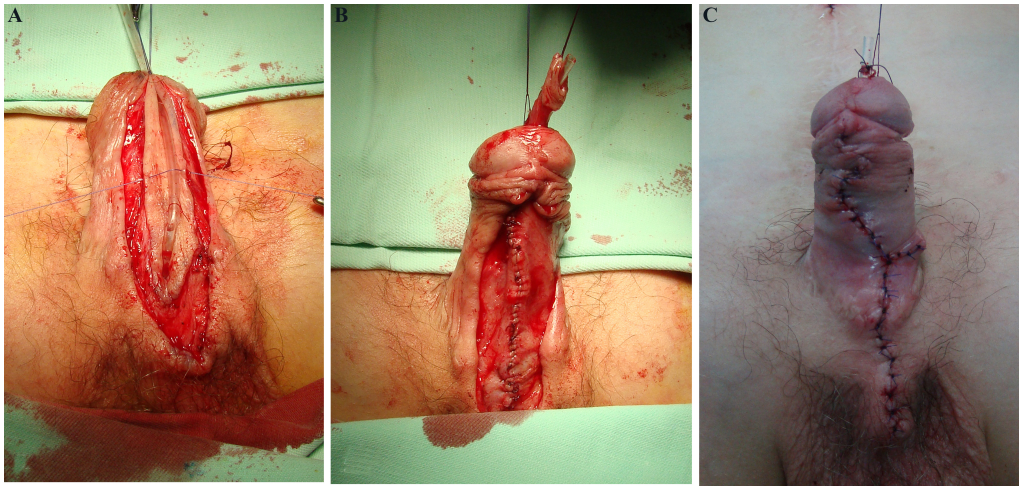

Figure 5. Second stage repair. (A) Dissection of the urethral plate (penile skin) and its tubularization over the silicone Foley catheter. (B) Complete tubularization of the urethra and meatal advancement. (C) Appearance at the end of surgery. Penile shaft reconstructed using available penile skin flaps.

described. Broad spectrum antibiotics were administered during the hospital stay. The patients were instructed on flushing the urethra with a 0.9% saline solution after hospital discharge. Silicone stent was removed from the urethra 10 days after the surgery. Sexually active patients were also instructed to abstain for a period of eight weeks after the second stage of repair. Absence of a urethral fistula and/or stricture and residual curvature with an appealing penile appearance was considered as successful repair. Follow-up visits were at 3, 6, 9, and 12 weeks. then every 3 months during the first postoperative year, and yearly thereafter.

Sexually active patients aged 16 years and above (able to sign informed consent) were interviewed regarding the quality of their sex life and satisfaction using the International Index of Erectile Function (IIEF) questionnaire[8], while, in younger patients, uroflowmetry was performed to confirm adequate voiding function, in addition to recording parents' reports considering presence/absence of the curvature and penile appearance.

RESULTS

Follow-up ranged from 15 to 197 months (mean 88 months). Satisfactory results in terms of cosmesis and function were achieved in 15 patients from Group A and in 11 patients from Group B. Voiding function was adequate except in two patients from Group A with penopubic epispadias who were incontinent. Uroflowmetry in Group A showed mean values of Qmax 12 mL/s (range 8-18 mL/s), while in Group B showed mean values of Qmax 19 mL/s (range 13-25 mL/s). Continence was present in all but two patients with penopubic epispadias, who were above the age for toilet-training. Mean preoperative penile length in erect state in Group B was 9.6 cm (range 7.1-10.2 cm), while postoperative length in erection was increased by a mean of 3.6 cm (range 2.6-6.5 cm). Recurrent penile curvature was seen in two patients from Group A and required surgical repair and in two patients from Group B, but it was mild and patients did not report difficulties in penetrative sexual intercourse. Urethral fistula occurred in four patients from Group A and in three patients from Group B. Surgery to repair fistula was performed after at least four months of complete healing after initial surgery. In one patient from Group B, fistula repair required two surgical repairs. One patient from Group B developed urethral stenosis that required surgical repair. Partial glans dehiscence developed in one patient from the Group A. Partial skin dehiscence developed in five patients, three from Group A and two from Group B [Table 1]. All patients from Group B who filled the IIEF questionnaire (11 patients) reported satisfying erectile function, sexual desire, intercourse, and overall satisfaction. Two out of eleven patients from Group B reported low ejaculatory function on the IIEF questionnaire.

DISCUSSION

Many surgical techniques are described for epispadias repair, with various success rates. The literature is still lacking data and success rates regarding isolated epispadias repair. However, we obtained some data on bladder exstrophy-epispadias repair[9]. A high rate of postoperative complications makes epispadias repair still challenging even for experienced reconstructive urologists, as it presents one of the most severe congenital genital anomalies. Any surgical approach considered for epispadias repair should address the following cornerstones: correction of the dorsal penile curvature, urethral reconstruction (including continence), glansplasty, and penile shaft reconstruction[10,11]. The repair should be performed during the first year of life, based on experts' opinion[9,12].

Despite the large number of surgical techniques for primary epispadias repair, two approaches are mostly used by the majority of specialist urology centers: the modified Cantwell-Ransley approach and the Mitchell-Bagli approach[12-14].

Cantwell's epispadias repair consists of mobilizing urethra positioned dorsally and its tubularization and placement ventrally in a hypospadiac position, while corpora cavernosa are joined over it[15]. Almost one century later, Ransley made the modification of Cantwell's approach by tubularization of the most distal part of the urethral plate in transverse fashion, creating the reversal meatal advancement and glansplasty (IPGAM)[1]. Further repair includes mobilization of the corpora cavernosa and correction of the dorsal curvature by incisions on tunica albuginea at the point of maximum deformity and subsequent suturing of the corpora cavernosa above the urethra completing cavernosocavernosostomy[16]. In their study, Gearhart *et al.*[11] performed Cantwell-Ransley epispadias repair in 75 boys with postoperative fistula in 21%. The same center reported the use of modified Cantwell-Ransley epispadias repair in 129 patients, of whom 97 were exstrophy epispadias cases and 32 isolated epispadias with the incidence of 13% of postoperative fistula in epispadias group[17].

Table 1. Postoperative complications in epispadias repair

No	Type of the complication	Group A (*n*/%)	Group B (*n*/%)
1	Incontinence	2/11.1%	0/0%
2	Urethral fistula	4/22.2%	3/20%
3	Urethral stenosis	0/0%	1/6.7%
4	Glans dehiscence	1/5.6%	0/0%
5	Skin dehiscence	5/27.8%	3/20%
6	Recurrent curvature	2/11.1%	2/13.3%
Total		14/77.8%	9/60%

Mitchell and Bägli[18] further improved the epispadias repair by introducing the penile disassembly approach, which includes dissection of the penis in three penile entities: corpora cavernosa, urethra, and glans with neurovascular bundle[9]. Complete dissection of the corpora cavernosa enables their satisfying medial rotation and ventralization of the tubularized urethral plate and the correction of dorsal curvature[10]. The authors reported orthotopic meatus in seven out of ten patients from their study and three postoperative fistula formation[18]. Because of the short urethral plate, Mitchel-Bagli penile disassembly could lead to resultant hypospadias in 36%-77% of cases, as reported in several other studies[19-21]. In the study by Braga *et al.*[22], published in 2008, they analyzed the treatment of isolated epispadias repair using one of the above-mentioned surgical approaches for epispadias repair. They reported that 67% of their patients treated by Mitchel-Bagli technique became continent, *vs.* 0% treated by modified Cantwell-Ransley approach. Furthermore, 48% of their patients from both groups developed complications during the follow-up period, 57% from the Cantwel-Ransley group and 29% from the Mitchel-Bagli group[22,23].

Our technique is similar to Mitchell-Bagli penile disassembly with the difference being the glans with mobilized neurovascular bundle is completely detached from corpora cavernosa and the urethral plate is totally dissected from the corpora cavernosa except the distal urethral plate attachment[5]. Complete correction of the dorsal curvature using grafting technique or plication (in mild forms and in young children) is essential in maximal lengthening and straightening of the epispadiac penis[4]. It is possible to perform urethroplasty in primary epispadias cases in one stage together with penile lengthening and straightening with the help of different available grafts and local hairless skin flaps, with an acceptable rate of postoperative complications. Redo epispadias repair is always challenging due to the questionable quality, elasticity, and availability of tissues required for the reconstruction. The radical approach with complete penile disassembly is the sole method that permits an approach to all penile deformities and their precise correction. Maximal corpora cavernosa lengthening and straightening is of utmost importance for the patients, especially in postpubertal and adult age. The best results can potentially be achieved by maximal proximal mobilization of the corpora cavernosa and grafting of the dorsal side of the corpora cavernosa. Moreover, pubic diastasis can affect the definitive length and deformity of the epispadiac penis[10].

Complications that arise after epispadias repair are fairly common. They include urethral fistula and stenosis, meatal stenosis, problems with continence, glans or skin dehiscence, residual curvature, partial or complete skin necrosis, and glans or corporal ischemia with partial or complete loss of the affected entity[10,20]. The majority of published studies analyzed early surgical outcomes of epispadias repair, but recently researchers focused on the long-term functional, esthetic, and psychosexual results of patients with severe congenital genital anomalies[13,21,24,25]. Thomas *et al.*[13] reported that 28/30 patients from their study required additional surgery after their primary epispadias repair during the follow-up period, of whom 26 required surgery for their continence and 12 required revision surgery. At the follow-up, 15 patients were continent and voided using the neourethra. Out of 30 patients from the study, 17 patients expressed

concerns regarding the esthetic appearance of their penis, 20 had normal erections, 6 reported recurrent curvature, and 9 reported retrograde ejaculation[13]. Kibar *et al.*[21] also reported concerns related to continence after penopubic epispadias or exstrophy-epispadias complex repair in the long run. They found the rate of continence ranging 22%-65%, as reported by other institutions. The authors also concluded that complete urinary continence can be obtained in 70%-90% of patients after bladder neck reconstruction.

The mean follow-up in our study was 88 months, and overall satisfaction in terms of cosmesis and function was achieved in 78.8% of our patients. Complications occurred in 23 out of 33 patients in our sample, with the majority of complications occurring in Group A. The most common complication was skin dehiscence, which was seen in eight patients from both groups. Urethral fistula occurred in 22.2% of patients in Group A and in 20% in Group B, which is in accordance with literature data[13,20,26]. Recurrence of penile curvature is relatively common even up to 60%, and in our series recurrent penile curvature occurred in 12.1% and required surgical repair in 50%[26]. Severe complications, such as glans or corporal ischemia and partial or complete loss, were not seen in our sample, while the literature reports an incidence of 5%-12%[21]. Regarding the scoring on the IIEF questionnaire, the 11 patients who were old enough to fill in the questionnaire scored 25 or greater out of 30 regarding the quality of erection, sexual desire, and intercourse, which is in accordance with other studies[26]. Ejaculation problems are still present in the majority of patients with epispadias, exstrophy-epispadias, and severe hypospadias according to the literature data and range up to 53%[26]. However, certain studies report very high percentage of normal ejaculation with 93% of patients, while this was present in 81.8% of our patients[26,27].

In conclusion, penile epispadias, either isolated or associated with bladder exstrophy, represent one of the most difficult congenital genital anomalies requiring multistaged treatment, sometimes with questionable success. Surgery at an early age and anatomical restoration of penile entities provides acceptable outcomes in terms of esthetics and functionality. On the other hand, redo epispadias repair after failed surgery in childhood is still a demanding procedure and should be performed only in highly specialized centers. Lack of vascularized and hairless tissue for urethral reconstruction, crippled penis, residual curvature, and hypotrophic corpora cavernosa are additionally challenging for the reconstructive urologist. The radical surgical approach is often needed to achieve functionality and esthetics.

Long-term follow-up of patients with epispadias is necessary to observe the postoperative complications in time and to treat them adequately. Follow-up of sexually mature and active patients treated for epispadias is needed for better understanding of sexual functioning of this group of individuals.

DECLARATIONS

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Authors' contributions

Made substantial contribution to conception and design of the study: Bizic MR, Djordjevic ML
Performed data analysis and interpretation: Stojanovic B, Joksic I
Performed data acquisition and provided technical support: Stojanovic B, Bencic M, Joksic I
Performed supervision and had responsibility for the organization and course of the project and the manuscript preparation: Bizic MR, Djordjevic ML
Performed writing of the manuscript: Bizic MR, Stojanovic B, Bencic M
Performed critical review of the manuscript: Djordjevic ML

Availability of data and materials
Not applicable.

Financial support and sponsorship
None.

Conflicts of interest
All authors declared that there are no conflicts of interest.

Ethical approval and consent to participate
The study was approved by Institutional Review Board (062021-U/918-2) and an informed consent to participate is obtained from the patients prior the surgery.

Consent for publication
A written informed consent for publication is obtained from patients.

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