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Original Article

Prefabricated partial distal urethral in 2-staged repair of proximal hypospadias with severe chordee

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Abstract: Purpose: To describe a new technique for staged hypospadias repair in which the urethral plate is divided and tubularized transverse island flap prefabricated partial distal urethral at the time of the first stage. Materials and methods: Sixteen patients with proximal hypospadias associated with severe chordee were operated on using a new staged technique. At the time of the first stage, the urethral plate was divided and chordee was corrected. Then tubularized transverse island flap was used to prefabricate partial distal urethra. The defective urethra was repaired using the Thiersch-Duplay principle at the second stage. Results: All participants have completed both stages of the operation. The mean follow-up duration was 18.4 months (range from 6 to 72 months). In the first-stage surgery, the modified tabularized transverse preputial island flap was performed on 6 patients, whereas the modified preputial double-faced island flap was performed on the other 10 patients. All of the prefabricated partial distal neourethras had no evidence of stenosis or scarring. The result of the second-stage procedure was a complete penis with integrated urethral. All patients were satisfied with cosmetic and functional results. Neither stricture nor diverticula was observed. A good urinary stream during the urination was attained in 12 (75.0%) patients. Four cases (25.0%) developed urethrocutaneous fistula after the second stage repair. Conclusions: In our preliminary series, this procedure improved functional and cosmetic results. It may be applicable to most cases of proximal hypospadias. Even when complications occur, they are less severe compared to those of the traditional staged approach.

Keywords: Hypospadias, staged repair, penis, urethra surgical flaps

Introduction

Hypospadias is a congenital defect of the penis resulting a proximal urethral meatus, ventral curvature, and ventral deficiency of the foreskin. Numerous surgical techniques were classified as 1, 2 or multiple stage procedures [1]. Although the majority of children born with hypospadias can be corrected with a single surgery, there exists a subgroup that may require a staged procedures. These apply to children having proximal hypospadias with severe chordee. According to the most practical classification of hypospadias, penoscrotal, scrotal, and perineal types make up the 20% that are classified as proximal hypospadias [2, 3]. There are many surgical procedures which can deal with the proximal hypospadias in one-stage operations. However, for complex cases with severe chordee, the urethral plate must be transected to resolve curvature. Furthermore, for the long urethral defects, one-stage repair has high complication rates, so a staged approach for these complex cases was advocated [4]. Here, we describe a new technique for staged hypospadias repair. We carried out a modified tubularized transverse preputial island flap (TPIF) or a modification preputial double-faced island flap (PDIF) repair as 1-stage procedure, which reconstructed partial distal urethral in the 1-stage. The second stage was undertaken when the previously mobilized Byar's flaps were tubularized to create a neourethra to bridge the residual urethral defect.

Methods

From October 2008 to January 2014, 16 patients with an age range from 19 months to 7 years (means 4.5±3 years) underwent staged proximal hypospadias repair. All of the patients had proximal hypospadias with severe chordee.

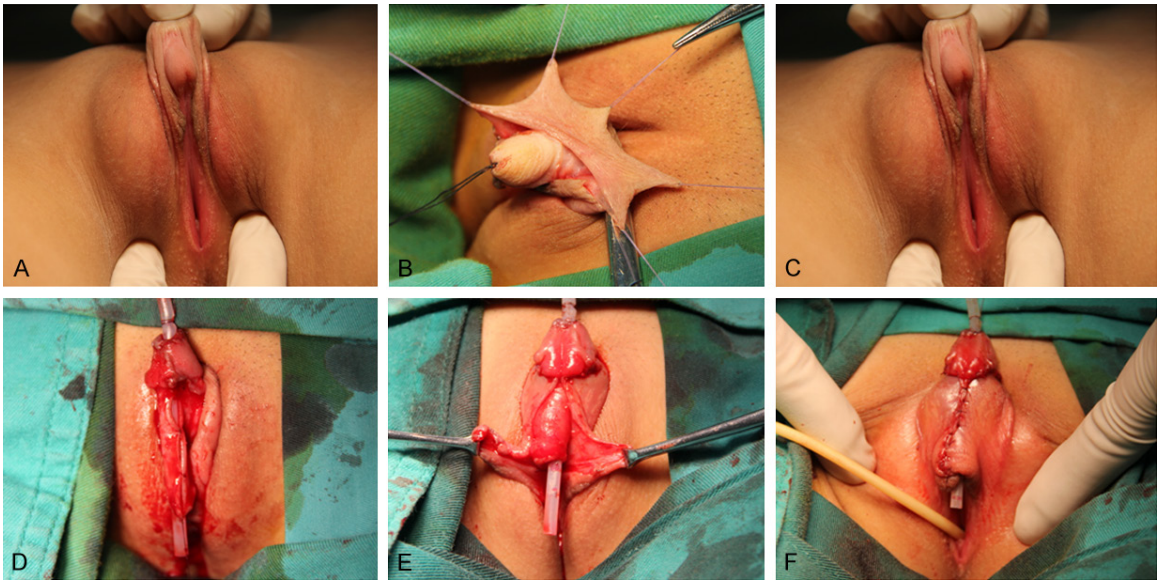

Figure 1. Modified TPIF prefabricated partial distal urethral. A. Preoperative appearance. B. Transverse preputial island flap. C. The neourethral tube was formed, the pedicle was mobilized and then rotated around to the ventrum. D. The glans tunnel was employed. E. Byar's flaps were rotated ventrally resurface the penis. F. Prefabricated partial distal urethral were completed.

Meatal position following correction of chordee was penoscrotal in 2 patients (12.5%), scrotal in 7 patients (43.8%) and perineal in 7 patients (43.8%). Six patients had undescended testes (3 unilateral, 3 bilateral). All of the perineal had undergone a determination of Karyotype and SRY gene.

Operative technique

First stage procedure: All patients were placed in a supine position under general anesthesia. A glans holding suture was placed and a circumscribing skin incision was made below the corona and proximal to the meatus and the shaft skin was degloved. The urethral plate was transected and chordee was corrected by excising the inelastic ventral shaft tissue. An artificial erection was used to detect ventral curvature, when necessary. When the penis was demonstrated to be straight, the inner preputial island flap was mobilized away from the dorsal preputial and penile skin to make a rectangle of skin. The pedicle was mobilized down to the base of the penis and rotated to the ventral aspect of the penis. The skin tube was created with an interrupted suture of 6-0 Vicryl sewn over a No 8-16 Fr multi-perforated silicone stent. Then the proximal tube-end was sutured to the native urethral plate, which had proximal migrated at the penoscrotal junction or at the perineum. A glans tunnel was made underneath the glans cap out to the tip of the penis, then the glans tunnel was employed, the neourethra was sewn to the glans and the stent was sewn to the glans. The dorsal skin was divided in the midline and Byar'a flaps were rotated ventrally to resurface the penis. This modified TPIF reconstruction partial distal urethral (**Figure 1**). If the patient's prepuce was adequate, modification PDIF repair as 1-stage procedure was used to reconstruct partial distal urethral (**Figure 2**). The double-faced island flap technique had been described in detail previously [5, 6]. Briefly, the inner surface of the prepuce was incised to form a transverse rectangular flap, and then it was tubed around a suitable stent without separating from the outer layer of the skin. The outer layer of the prepuce was also incised (**Figure 2C**), and a vascularized double-sided preputial pedicle flap based on subcutaneous tissue was formed (**Figure 2D**). The flap was transferred to the ventral side without causing any torsion of the penis (**Figure 2E**). The proximal end of the tubed prepuce was anastomosed to the urethral plate. The distal end of the tubed prepuce was pulled through the tunneled glans and its tip was anchored, and the outer layer of the prepuce was used to cover the ventral surface skin

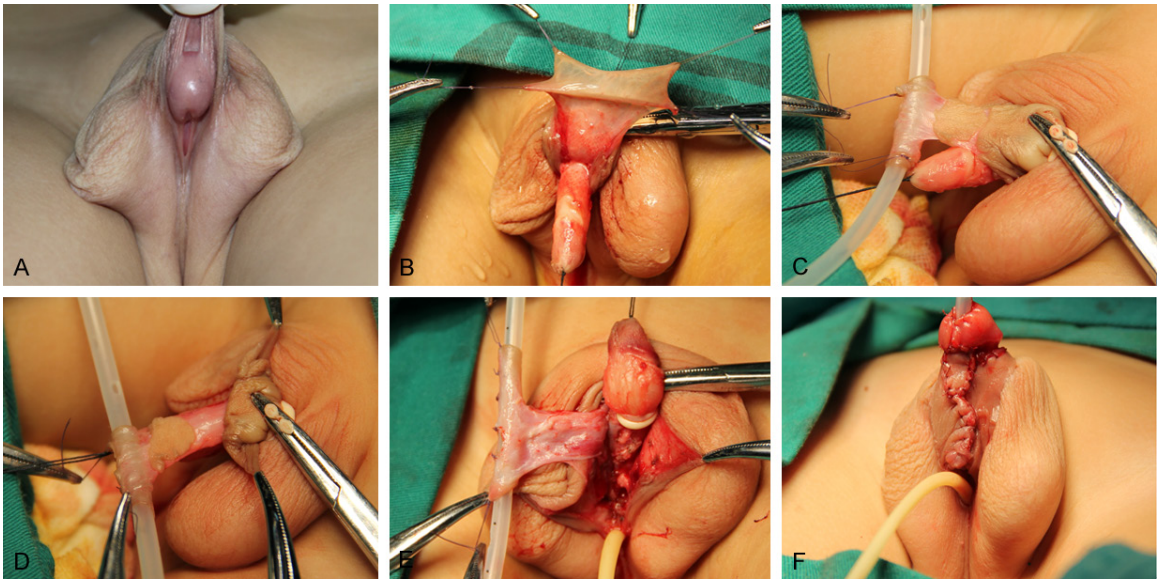

Figure 2. Modified PDIF prefabricated partial distal urethral. A. Preoperative appearance. B. The inner surface of the prepuce was incised to form a transverse rectangular flap. C. The outer preputial skin attached to the inner tabularized flap. D. The pedicle was mobilized down to the base of the penis. E. The double-faced island flap rotated around to the ventrum. F. Prefabricated partial distal urethral were completed.

defect (**Figure 2F**). The reconstruction of the partial distal neourethra was completed. Cryptorchidism was simultaneously corrected as an ancillary procedure in 6 cases. The native hypospadiac meatus were inserted a catheter for 2-3 days. The silicone stent was rinsed by injection of gentamicin 4 ml twice a day and maintained for 11-12 days until it was removed. Prophylactic antibiotics and analgesies were prescribed for 3 days.

Second stage procedure: Stage 2 was completed following an interval of 6 to 8 months when the prefabricated neourethra was soft and pliable. The defective urethra was repaired using the Thiersch-Duplay principle [7, 8]. A suprapubic catheter was placed for urinary diversion. Parallel lines were marked on the ventrum of the defective urethra between the two meatus to be anastomosed. The width of this strip measured approximately 15-24 mm and deep incisions were made along these lines to the superficial fascia. This strip of skin was approximated and sutured using a continuous stitch around the multi-perforated silicone stent. A second layer of adventitial tissue was raised from the surrounding penile area and sutured as a "waterproof" layer over the first suture line, making sure that the stitches were away from the sutures of the first layer [9]. The ventral skin closure was performed using an interrupted 5-0 absorbable Vicry suture (**Figure 3**). Bifid scrotum was simultaneously corrected as an ancillary procedure in 14 cases. The silicone stent was rinsed by injection of gentamicin 4 ml, twice a day for 4 days, and the patients were encouraged to urinate gently two to three times per day by clipping the suprapubic catheter. The silicone stent was removed on the eleventh to twelfth postoperative day. If the patients passed urine satisfactorily, then the suprapubic catheter was pulled out.

Results

The two-stage hypospadias repair technique was performed on 16 patients. All patients had completed both stages of the operation. The mean follow-up period was 18.4±12 months (range from 6 to 72 months) after the last surgical repair. All patients were available for follow-up examinations. In the first-stage surgery, modified TPIF was performed on 6 patients, whereas modified PDIF was performed on the remaining 10 patients. The end result of the first-stage procedure was a straight penis with prefabricated partial distal urethral and the normal-shaped glans having the neomeatus at its tip. Neither meatal stenosis nor meatal recession was observed. All of the prefabricat-

Figure 3. The defective urethra repaired using the Thiersch-Duplay principle. A. Parallel lines were marked on the ventrum of the defective urethra. B. Deep incisions were made along these lines. C. Postoperative appearance.

ed partial distal neourethras had no evidence of stenosis or scarring. Neither skin necrosis nor wound infections were seen in any of these cases. All patients were satisfied with cosmetic and functional results. The end result of the second-stage procedure was a complete penis with integrated urethral. Cosmetic and functional results were satisfactory in all patients. Neither stricture nor diverticula was observed. A good urinary stream during the urination was attained in 12 (75.0%) patients. Four patients (25.0%) developed urethrocutaneous fistula after the second stage repair in the penoscrotal. The size was a pinpoint in one case and 2 to 3 mm in diameter in the other 3 cases. The 4 patients were required to receive another operation of fistula repair 6 to 8 months later.

Discussion

Currently, repair of proximal hypospadias is still one of the most challenging surgical procedures facing the hypospadiologist. Even in the hands of the most experienced surgeons, single-stage procedures are often associated with various complications and reoperations. Previously reported series of single-stage repairs for proximal defects have revealed complication rates of 20-50% [10-12], Dewan et al reported a reoperation rate of 44% [4]. Therefore, in a subset of patient with perineoscrotal hypospadias and associated severe chordee, a single stage repair may not yield acceptable final results. If complicated complications occurs, such as skin necrosis, infection, strictures, the patient subsequently should receive multi-stage complex operation. Aiming at decreasing the incidence of postoperative complications, two-stage procedures may still advisable in some complex cases. Recently, there has been a resurgence of the two-stage correction of these severe primary cases [13-15].

The proximal hypospadias with severe chordee require transaction of the urethral plate. The ordinary first-stage consists of excision of the chordee and the resurfacing of the ventrum of the penis by the transposed preputial and penile skin. During the complete excision of the fibrous chordee, the hypospadiac orifice will be retracted proximally. The gap produced in the ventral aspect of the penis needs to be filled during the first stage usually with a free graft, it can be of genital or extragenital origin [14]. Byar's flaps can be transposed ventrally either to substitute entirely the plate or to fill the gap after urethral plate sectioning [16, 17]. At the second stage, tubularization of the transposed skin is performed using the standard Thiersch-Duplay technique.

In the traditional staged repair, the second stage is much more difficult than the first stage, because tubularization of the transposed skin is often most difficult technically at the coronal level where neovascularity and pliability of the surrounding tissues are less than that observed more proximally on the penile shaft [16]. That's because the multiple suture lines are present at the coronal level from transposition of Byar's flaps and mucosal collar. Meanwhile, in many cases, it is difficult to get well vascularized tissue out to the tip of the penis for additional coverage, and sometimes there is some tension closure when we suture the strip to complete the neourethral at the cornonal level at the second stage repair. Therefore, it is not surprising that the most common complication that occurs at the coronal level is fistulas and metal recession. The incidence of partial glans dehiscence was ranging from 5% to 25% [14, 18].

In order to overcome these drawbacks of the traditional staged repair, the new modified staged operation procedure, in which TPIF prefabricated partial distal urethral is used in the first stage. This procedure creates relative simplicity in the second stage. TPIF procedure is a classic procedure and hypospadiasist are quite familiar with it. In the new first-stage repair procedure, all the patients required transaction of the urethral plate, and chordee correction was adequately achieved followed by modified TPIF or a modification of PDIF repair. The proximal end of the prefabricated partial distal urethral was sutured to the native urethral plate, which has proximal migrate at the penoscrotal junction or at the perineum. The intraglanular tunnel technique was used to position the meatus on the penile tip. The healing of the diatal neourethral was achieved in a "dry" state, which lead to a superior healing capacity. The data of these 16 cases showed that there were no complications such as stricture formation, infection, metal recession, breakdown and fistula in the first-stage repair. The cosmetic results were satisfactory to the patients with this modified technique. Thus, the new first-stage operation consists of prefabricated partial distal urethral. Cheng et al reported proximal division of the urethral plate and application of the Snodgrass procedure for incision and tubularization in situ of the intact urethral plate for formation of part of the neourethra [16]. Our results suggested that, in most cases of severe hypospadias, there might be too little or no plate between the hypospadiac meatus and glans, and preservation of the plate might be impossible. Thus, our modification may be completely applicable to most cases of proximal hypospadias.

The second-stage urethroplasty, was performed 6 to 8 months later using the Thiersch-Duplay principle. Compared with the traditional second stage repair, it is relatively simple, because the length of reconstruction urethral is very short. Even when complications, such as fistula occur, they are more likely to occur in the penoscrotal where they are technically easier to repair given the vascularity and availability of adjacent skin. In our series, no urethral stricture, diverticula or recurrent chordee were observed. However, four cases (25.0%) developed urethrocutaneous fistula after the second stage repair in the penoscrotal. The size was a pinpoint in one case and 2 to 3 mm in diameter in the other 3 cases. To decrease the incidence of fistula, we recommend that a second layer of adventitial tissue be raised from the surrounding penoscrotal area and sutured as a "waterproof" layer over the first suture line, ensuring that the stitches were away from the sutures of the first layer [9].

Conclusions

The majority of hypospadias can be surgically corrected with a 1-stage technique. However, there exists a subgroup of patients with proximal hypospadias and severe chordee who will best benefit from a staged procedure consisting of tubularized transverse island flap prefabricated partial distal urethral followed by a Thiersch-Duplay urethroplasty. As such, one complicated operation is divided into two relatively simple operations. This procedure has resulted in improved functional and cosmetic results in our preliminary series, and therefore may be applicable to most cases of proximal hypospadias. Even complications may occur, they are less severe compared to those of the traditional stage approach.

Disclosure of conflict of interest

None.

Abbreviations

TPIF, tubularized transverse preputial island flap; PDIF, preputial double-faced island flap.

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