Tunica Vaginalis Flap as a second layer for Tubularized incised plate urethroplasty (Snodgrass method) in reoperation for hypospadias

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Purpose:
Reoperation for failed hypospadias has been considered to be seriously bothersome because abundant penile skin doesn’t tend to remain for urethroplasty or for penile shaft skin coverage. In this study, the tubularization of incised urethral plate wrapped by tunica vaginalis flap as the second layer to increase the success rate of operation and decrease the incidence of urethrocutaneous fistula.

Materials and Methods:
Between March 2008 and November 2013, 23 boys, (3.5 -18) years old, who were treated using a Tubularized Incised Plate Urethroplasty (Snodgrass method) and vascularized tunica vaginalis flap as a second layer, for previously failed hypospadias repair. The hypospadias defects included 12 (52%) distal (coronal or subcoronal), 6 (26%) distal penile and 5 (22%) mid shaft defects (three of them have residual chordee). 17 patients had one operation and 6 had two operation previously, all patients did not have foreskin because of the previous surgery. There was no apparent scarring of the plate.

Wound infections, meatal stenosis, and urethrocutaneous fistula were considered as treatment complications. Success rates of surgery were recorded. Failure was defined as need for re-operation.

Results:
The operation was successful in 14 out of 17 (82.3%) patients who had undergone one operation before, and 4 out of 6 (66.6%) of patients with 2 operation previously as well have sufficient outcome. Complication was observed in 5 patients. Of studied patients, 2 developed wound infection, 2 developed urethra-cutaneous fistulas, and one developed meatal stenosis. The patients with meatal stenosis and wound infection were managed conservatively.

Conclusion:
Snodgrass technique in combination with tunica vaginalis flap as a second layer is a reasonable procedure for hypospadias repair especially in reoperation when there is no excess skin; also it has good cosmetic appearance and acceptable complication rates. Currently, fistula formation remains the most common complication of this technique, which often needs surgical repair.

Introduction:
Hypospadias refers to incomplete urethral development due to incomplete fusion of urethral folds that results in a meatus located anywhere from the proximal glans to the perineum. The word (hypospadias) is Greek; hypo = under, and spadias to tear off. The condition occurs in approximately 1 in 150 to 1 in 300 males, making hypospadias the second most common birth defect in boys after cryptorchidism. Recent surveys suggest that the incidence of hypospadias is increasing in industrialized countries, possibly due to environmental estrogen or antiandrogens.1

The external genitalia are initially indifferent and, in the absence of androgen, inherently develop the female phenotype. The critical time frame for phallic development is from 8 to 12 weeks gestation, when the genital tubercle elongate and the urethral plate on its ventral surface tabularizes from proximally to the tip of the glans. During this phase, the penis is curved ventrally because of the corpora cavernosa, as well as shaft skin and prepuce, develop faster on the dorsal than the ventral aspect, after 12 week gestation, androgen stimulation increases the size of the phallus.
Hypospadias result from an arrest in these normal processes. The incompletely tabularized urethra opens on the undersurface, the penis may curved downward, and the foreskin typically is deficient ventrally (fig.1). In a related variant, the urethral meatus may be located properly on the glans, but the ventral foreskin is lacking. Less often complete prepuce conceals the urethral defect that is detected only during circumcision.[3]

Figure 1. Varieties of hypospadias. A. In most cases, the urethral opening is on or near the glans, and the tissue that should have completed tubularization extends distally as the “urethral plate.” B. With proximal hypospadias, the urethral meatus is at the penoscrotal junction, with the urethral plate extending to the glans tips. Most cases of proximal hypospadias also have ventral curvature, commonly referred to as “chordee.” C. Hypospadias variant with a completely developed foreskin concealing the defect. D. When the foreskin is retracted, the meatus is noted at the corona.

Pathogenesis:

Any error in masculinization theoretically could result in hypospadias and no specific defect has been found to explain the condition. The karyotype usually is normal. Subtle abnormalities in the hypothalamic-pituitary-testis hormonal axis have been reported, although subsequent pubertal development appears unaffected.[3] Similarly, minor defects in testosterone formation, 5-alpha reductase activity and androgen receptor function have been detected. Altered molecular process normally resulting from androgen stimulation also may play a role. Finally genetic factors have been identified in approximately 20% of cases. The likelihood that a couple will have a boy who has hypospadias increases if the father, another sibling, or other relatives have the condition. [4]

Diagnoses and evaluation:

Most often, hypospadias is suspected at birth because of the abnormal appearance of the foreskin. Physical examination reveals the displaced urethral meatus and also should confirm the presence of two normally descended testicles. In more severe cases involving a proximal meatus, the scrotum may have a deep cleft and sometimes extends along the sides of the penis to engulf it partially. In the past, such cases often were evaluated further with radiography to detect renal anomalies. However, recognition that the arrest in penile development that creates hypospadias occurs after kidney formation has ended that practice. In addition, renal anomalies rarely occur in patients who have hypospadias.[5]

Although hypospadias represents incomplete masculinization, typical cases are not considered evidence of intersexuality. However, most pediatric urologists recommend that a karyotype be obtained when cryptorchidism also is present. Under these circumstances, intersexuality is found in up to 50% of cases, especially when the urethral meatus is proximal and a testicle is not palpated. The most common abnormality is mixed gonadal dysgenesis with a 46XY, 45XO mosaic pattern. If neither testicle is felt, virilization of a female who has congenital adrenal hyperplasia must be excluded, even if the phallus is well formed. [6]

Grading scales have been proposed to classify the severity of penile malformation. Primary care physicians commonly divide patients into three grades according to the position of the urethral meatus: First-degree, on the glans; second-degree, on the penile shaft; and third-degree, penoscrotal to perineal. The major shortcoming of this system is that it does not take into account either the extent of ventral penile curvature (so-called “chordee”) or the occasional finding of a distal meatus with a...
dysplastic urethra that actually represents a form of proximal hypospadias (Fig. 2). Although both curvature and a poorly formed urethra often can be suspected preoperatively, the impact of either on surgical decision-making cannot be determined reliably until correction is undertaken. This emphasizes the need for even apparently minor hypospadias to be repaired by experienced pediatric urologists.

Figure 2. Dysplastic urethra. Although the meatus ends on the proximal glans, the distal urethra in this boy was very thin and closely adherent to the overlying skin. Under such circumstances, it may be necessary to reconstruct the entire penile urethra.

Management:

Today, most boys who have hypospadias and related variants undergo surgical correction. It has been emphasized not to circumcise these boys, especially because some repairs incorporate preputial skin into the urethroplasty. Although most distal hypospadias currently are corrected by using techniques that do not require foreskin, it still is advised not to attempt newborn circumcision for any boy found to have a foreskin anomaly. In the event that an apparently normal child who has a complete prepuce is not recognized to have hypospadias until after circumcision, there is little cause for concern because urethroplasty still can be performed. The family should be reassured, however, that a “botched circumcision” did not cause the urethral anomaly. In some cases, examination may suggest a small urethral meatus, but no urinary obstruction, and meatotomy is not needed as an interim step before hypospadias repair. In fact, no special care of the penis is needed.

The need for surgery is obvious in boys who have severe hypospadias with a curved penis and proximal meatus. However, even a more distal urethral opening may produce a deflected or splayed urinary stream. Furthermore, the abnormal foreskin calls attention to the condition and may lead to ridicule in school locker rooms. Given these concerns, the ability to accomplish most surgical repairs in a single operation, and the excellent functional and cosmetic results of surgery, pediatric urologists now recommend that most boys who have hypospadias undergo surgery.

Tubularized incised plate method was first described by Snodgrass in 1994 and has rapidly become a procedure for various types of hypospadias. The principal advantage of this technique is the excellent cosmetic appearance with the minimum scarring in the urethra. In any reconstructive surgeries like hypospadias repair, vascularity of the repaired site is a major concern. Hence, to obtain better outcome of hypospadias repair, some vascularized flaps like dartos fascia and tunica vaginalis flap were introduced. These vascularized flaps are placed on the neourethra as the second layer. It seems that use of a vascularized tunica vaginalis flap as a second layer combined with Snodgrass procedure results in better outcome.

Complication of hypospadias surgery:

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<th>Early Complications&lt;sup&gt;10&lt;/sup&gt;</th>
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Complications may occur after any reconstructive surgery. The most common problem after hypospadias repair is urethrocutaneous fistula. Usually these are small and can be closed at a secondary operation 6 months later. Stenosis of the new urethral meatus or stricture of the urethroplasty should be suspected if there is difficulty voiding or a very small and forceful stream. Occasionally, the repair dehisces and must be redone after the tissues heal. Another complication is formation of a urethral diverticulum, which is seen as ballooning of the urethra during voiding.\(^\text{(1)}\)

The incidence of complications varies according to the severity of hypospadias and the technique employed for repair. Generally, fewer than 8% of patients undergoing distal hypospadias surgery experience problems; complications may be more frequent when the original meatus was located at the penoscrotal junction or more proximally. Between 5% and 20% of boys who have these conditions experience problems leading to another procedure. However, even children who require additional surgery because of complications generally achieve good functional and cosmetic outcomes.\(^\text{(12)}\)

It is worth emphasizing that increasing attention has been given to improving cosmetic results of hypospadias surgery during the past 20 years. Prior to that time, some questioned the need to bring the urethral meatus to the tip of the glans; the primary concern was to create a functional urethra that allowed the boy to void while standing. Pediatric urologists now realize that the urinary stream is difficult to direct if the meatus is not positioned properly, and patients are more likely to be dissatisfied with the outcome if the glans does not appear normal. Therefore, the desired outcome of today’s procedure is a functional penis that appears only to have been circumcised, when the foreskin is preserved and repaired, never to have undergone surgical repair (Fig. 3).\(^\text{(13)}\)

Fig. 3 Post-operative appearance. A. with circumcision, note the normal appearing meatus at the tip of the glans.
B. with foreskin reconstruction, creating a penis that looks as though no surgery was performed.

**Aim of the Study**

The aim of the study is to evaluate the results of tunica vaginalis vascularized flap as a second layer with tubularized incised plate (TIP) urethroplasty (Snodgrass method) in reoperation for patient with distal or midpenile hypospadias. The study discusses patient selection, complications, and the final outcome.

**Patients and Methods**

Between March 2008 and November 2013, 23 boys, (3.5 - 18) years old, who were treated using a Tubularized Incised Plate Urethroplasty (Snodgrass method) and vascularized tunica vaginalis flap as a second layer, for previously failed hypospadias repair in Al-Hussain teaching hospital.

The hypospadias defects included 12 (52%) distal (coronal or subcoronal), 6 (26%) distal penile and 5 (22%) mid shaft defects (three of them have residual chordee). 17 patients had one operation and 6 had two operation previously, all patients did not have foreskin because of the previous surgery. There was no apparent scarring of the plate.
All the patients underwent Tubularized Incised Plate supported by tunica vaginalis flap. Five patients received pre-operative androgen therapy, which was administered as testosterone enanthate injection (2 mg/kg) for 2 to 5 weeks before the operation. We followed up the patients every 3 months for the first year, every 6 months thereafter, and whenever a patient experienced a problem. We called the patients if they did not show up for the follow-up. A need for repeat surgical intervention during the follow-up was considered as a failure. Wound infections, development of meatal stenosis, scrotal disorders, and urethrocutaneous fistula were regarded as surgical complications.

**Surgical Technique:**
Under general anesthesia, after placing staysutures, according to the traditional Snodgrass technique, one midline deep incision was carried out in the urethral plate from hypospadic meatus to the glans penis. Then, by another 2 parallel incisions, tubularized urethroplasty was completed over a silicon urethral catheter (8-12 F according to the penile size and patient’s age). Thereafter, the testis was delivered via a separate scrotal incision and a vascularized tunica vaginalis flap was harvested and transferred to the site of surgery through a subcutaneous tunnel. Care was taken to make a wide tunnel to avoid compression of flap pedicle. Scrotal dissection was done gently with paying attention to complete hemostasis. Ventral side of the urethra was covered by the serosal layer of tunica vaginalis flap. The penile skin was then sutured with 5-0 or 6-0 Vicryl sutures.

Following repair, the child may have a urethral stent that drains urine into the diapers for several days to allow healing of the urethroplasty before resumption of normal voiding. During this time, antibiotics are prescribed to reduce the likelihood of urinary tract infection. Recommendations regarding pain management, dressings, and bathing vary among patients. Families can be reassured that most patients who undergo surgery during the preferred timeframe do not experience substantial postoperative discomfort. Urethral catheter was removed 5 to 7 days after the surgery (Figure).

**DISCUSSION:**
Surgery for hypospadias is continuously evolving, implying that no single technique is considered perfect. The use of interposition tunica vaginalis vascularised flaps is well documented in the literature. Several different surgical methods have been proposed to achieve normal appearing penis with low complications rates in the treatment of hypospadias. Some of these techniques use the penile skin while other methods use extrapenile tissues, including the buccal mucosa, the skin graft, and the tunica vaginalis as a flap or graft. Snodgrass procedure or Incised PlateUrethroplasty is a method with high success rate; however, urethrocutaneous fistula is a common complication following this technique. To decrease the rate of this complication, a Tunica Vaginalis Flap in Urethroplasty vascularized tissue is applied as a second layer between the neourethra and the skin coverage. Dorsal flap is a tissue that has been used for the neourethra coverage to improve the outcome; however, this technique sometimes results in penile torsion or chordee. An alternative technique is the use of tissues such as dartos fascia of ventral side of the penis. Furness and Hutcherson reported a success rate of 98% for this method and of 109 patients, only 2 developed fistulas. A study in Turkey demonstrated better cosmetic results using mucosal collars. In that study, fistula and meatal stenosis rates were 8.3% and 14%, respectively. It should be noted that fascia is not always available to be used as a second layer. In our study, a vascularized tunica vaginalis flap (arrow) is harvested through a scrotal incision. The tunica vaginalis flap (arrow) covers the neourethra. Tunica vaginalis is another tissue that can be used as a second layer in hypospadias repair, especially in re-operation as far there is no excess skin which made preparation of dorsal based dartos flap difficult.

Advantages of this flap are its availability and excellent vascularity. Furthermore, because this tissue is far from the penis, it is not affected by the penis disorders. Besides, acceptable outcomes have been achieved from the use of tunica vaginalis flap for repair of urethrocutaneous fistula. In another study, the success rate with tunica vaginalis flap was 100% without a significant complication.
In a study by Snow and colleagues, most of the post tunica vaginalis flap complications were related to scrotal hematoma and abscess, while the rate of 5% was reported for urethrocaneous fistula. Therefore, Snow and associates recommended tunica vaginalis flap as a second layer for primary hypospadias repair. In our study, the rate of fistula was higher compared to their study. This could be due to the use of microscope by Snow and colleagues. By performing complete hemostasis, anatomical dissection, and well dressing of the scrotal region, we did not encounter scrotal complications. In an Indian study, Snodgrass method along with dartos fascia was used in 20 patients and tunica vaginalis flap in 29 patients as a second layer for hypospadias repair. After urethral catheter removal, 20% and 10% urinary leakage was observed in dartos fascia and tunica vaginalis groups, respectively. The rate of urinary leakage was higher than fistula rate in our study. Interestingly, in the above-mentioned study, placement of a urethral catheter (urethral recatheterization) for another 7 to 10 days resulted in urinary leakage improvement as well as prevention of permanent fistula formation. In contrast, those subjects in whom a dartos fascia has been used as the second layer, urethral re-catheterization could not prevent permanent fistula formation. Since we did not use urethral re-catheterization, we could not comment on this subject.
CONCLUSION

Overall, tunica vaginalis flap is a good option that should always be kept in mind in redo complicated cases of hypospadias. When the local tissues seem to be scarred, it offers a second-layer cover that is properly vascularized, virgin and with mostly any length that might be needed. However, further refinement of this technique could lower the complication rate. Careful dissection of the scrotum and attention to hemostasis can reduce scrotal complications as well. Currently, fistula formation remains the common complication of this technique, which often necessitates re-operation.

References: