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Grafted tubularised incised plate urethroplasty: an excellent option in primary hypospadias with poor urethral plate

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ABSTRACT

Background: Hypospadias represents the most frequent penile anomaly. The most challenging part of hypospadias surgery is urethral reconstruction. We here-in assess the cosmetic and functional outcome with primary single stage dorsal inlay urethroplasty using preputial skin grafts in tubularised incised-plate. We extended this indication to be the standard technique for primary hypospadias repair with poor urethral plate, flat glans and minimal ventral curvature.

Methods: Children with a narrow urethral plate, shallow glans and minimal ventral curvature formed the study group. Children having severe chordee needing transection of the urethral plate, having undergone circumcision and failed hypospadias repair was excluded. This prospective study included the surgical experience of 87 cases of primary hypospadias operated upon between 2010 and 2016.

Results: A straight penis was achieved in 97.7% of the patients with a 3.4% incidence of urethrocutaneous fistula. Acceptable cosmetic results were achieved in 96.5% of cases. Slit like appearance of neo urethral meatus was achieved in 96.5%, position was on the tip in 81 patients and in 6 it was mid glans. Glans dehiscence was seen in 3 patients. Meatal stenosis in 1, stricture, diverticulum and penile torsion was not seen in this series. Single and straight urinary stream was seen in 91.95%, splaying of urine in 3 patients and a thin stream in 4 patients.

Conclusions: Primary dorsal inlay inner preputial graft urethroplasty successfully fulfils all traditional hypospadias repair criteria. It offers a viable option in the management of primary hypospadias with a narrow urethral plate.

Keywords: Hypospadias, Inlay graft, Primary repair, Urethra, Urethroplasty

INTRODUCTION

Hypospadias is a common genitourinary anomaly affecting 3.5-4.5 per 10 000 live births, either treated or untreated, can have functional, cosmetic and psychosexual consequences extending into adulthood. The goals of hypospadias surgery include the establishment of a straight penis with a urethral meatus at the glans tip, the establishment of a well-vascularized neourethra of adequate caliber with a solid, straight urinary stream and the achievement of normal sexual function when the patient reaches maturity. In primary hypospadias surgery, controversy exists while making

decisions. Options exist depended on whether the urethral plate is available for urethroplasty after associated ventral curvature is straightened. If an adequate urethral plate exists, then either tubularised incised plate (TIP) repair or an onlay preputial flap could be used. When the urethral plate needs to be transected a one-stage urethroplasty could be accomplished by tubularised preputial flaps or the Koyanagi flap or a two-stage repair done. TIP urethroplasty has gained widespread acceptance for repairing distal hypospadias. The technique is simple, versatile and produces a good cosmetic result; however, several technical issues, including the problem of meatal or neourethral complications and the need for regular

urethral dilatation, have been pointed out.^{3,4} It may be anticipated that this problem would be potentially more significant in patients with a flat and narrow urethral plate than in patients with a deeply grooved and wide urethral plate.

TIP repair was introduced in 1994, and is considered the procedure of choice in management of distal hypospadias by most surgeons.⁵ The technique relies on an incision of the urethral plate to permit a tension-free tubularization of the neourethra. The mechanism of healing of the incised-plate is debatable. Snodgrass postulated that healing occurs by re-epithelialization, with no evidence of neourethral stenosis or stricture formation, whereas many others consider that it heals by epithelial creeping, which theoretically increases the incidence of complications because of healing by primary intention if allowed to contract.^{3,6,7} This can be prevented by separating the two sides of the gapped urethral wound; therefore, regular daily dilatation of the neourethra was advised to prevent meatal stenosis, fistula formation and urethral narrowing.4

At times in cases of hypospadias, the urethral plate is very narrow, consequently, the urethral plate needs to be augmented or substituted for further tubularization. Kolon and Gonzales described a technique of 1-stage urethroplasty using an inner preputial based dorsal inlay graft and reported in follow-up to have no patient with a stricture, fistula or diverticulum at the inlay graft site.⁸

In the present study, we evaluated the surgical results of this procedure and extended the indications in primary hypospadias repair with poor urethral plate and minimal ventral curvature. Outcomes of hypospadias repair have been assessed by reoperation rate secondary to fistula, stenosis, diverticulum, residual penile curvature and overall cosmesis of phallus.

METHODS

Children with a narrow urethral plate and skin lined hypospadias formed the study group. A thorough physical examination was done. The penis was examined for length, curvature, urethral plate and size. Children needing transection of the urethral plate, having undergone circumcision and hypospadias repair previously was excluded.

We performed dorsal inlay graft urethroplasty in 87 patients with poor urethral plate, shallow groove and no severe curvature between 2010 and 2016. Mean patient age was 3.6 years, range (17 months to 8.7 years). Hypospadiac meatus was distal in 52, 21 in mid penis and 14 in a proximal location. Ventral curvature was less than 30 degrees in all of the patients. Dorsal prepitiual hood was well developed in 85% (74/87), moderately developed in 10.3% (9/87) and poorly in 2 patients. Glans size varied from 9 mm to 18 mm. Glans groove was flat in 90% (78/87 patient). All patients had urethral plate less

than 6 mm. All patients were prospectively reviewed to evaluate the surgical results, particularly concerning urethrocutaneous fistula, meatal stenosis, the urinary stream adequacy, neourethral caliber and cosmetic appearance.

Operative steps

The surgical technique was based on the principles described by Kolon and Gonzales.⁸ A circumferential incision was made below the corona and proximal to the hypospadiac urethral meatus. The penis was degloved and curvature was corrected by excising inelastic ventral shaft tissue and when needed by dorsal plication. An artificial erection was utilized to detect ventral curvature, when necessary. The urethral plate was retained intact. The urethral plate was separated from the glans wings by parallel longitudinal incisions. The glans wings were mobilized laterally for later closure over the neourethra. The urethral plate was incised longitudinally in the manner described by Snodgrass.⁵ A free graft was then measured and harvested from the inner prepuce. The graft was defatted and sutured onto the incised urethral plate. The neourethra was rolled into a tube over a Fr catheter.⁶ Another layer of closure was also accomplished.⁶ A vascularize tunica vaginalis flap was developed and used as a second layer cover. The glans and corona were approximated and the ventral shaft was covered with mobilized outer preputial skin flaps.

Post-operatively, the catheter was removed after 10-12 days. The children were observed for urinary stream. During the follow up, the penis was reviewed for complications such as wound infection and wound dehiscence.

Follow-up

The patients were followed-up every 2 months for the first 6 months, then every 6 months for the next year and annually thereafter. Success was defined as having a functional urethra without fistula, stricture, or residual curvature and having a cosmetically pleasing glandular meatus and phallus.

RESULTS

The mean follow-up time was 38 months (range: 1 year 5.4 years). A straight penis was achieved in 97.7% of the patients. Acceptable cosmetic results were achieved in 96.5% of cases. Slit like appearance of neo urethral meatus was achieved in 96.5%, position was on the tip in 81 patients and in 6 it was mid glans. Glans dehiscence was seen in 3 patients. Inlay graft length required varied from 1.2cm to 4.8cm. Dorsal placation was needed in 36 patients. 84 patients achieved straight penis and voided without difficulty in the postoperative period. Urethrocutaneous fistulas developed in 3, meatal stenosis in 1. The fistula was repaired subsequently after 6 months. Meatoplasty was performed in 1 patient with

meatal stenosis. In 91.9% (80/87) the patients voided in single and straight urinary stream, splaying of urine was seen in 3, 2 children after 3 months started voiding in a single stream. In 4 patients, the urinary stream was thin, however, dilatation alone was performed once every week initially in 4 patients then fortnightly and once monthly for three months for the management of patient with thin urinary stream. After urethral dilation, the patients voided well. Stricture, diverticulum and penile torsion were not seen in this series.



Figure 1: Poor urethral plate.



Figure 2: Incised urethral plate.



Figure 3: Dorsal preputial graft placed.



Figure 4: Post-operative.

DISCUSSION

Perhaps no surgical concern in history has inspired such widespread and varied opinion with regard to management as has hypospadias.⁹

Hypospadias is a frequent genitourinary anomaly affecting nearly 1/300 male newborns. More than 100 different types of procedures have been described for the repair of this anomaly. Irrespective of the technique used. The goals of repair remain unchanged. A straight penis,

with a urethral meatus in the normal position on the glans, a neourethra of adequate homogeneous caliber, with a solid, straight urinary stream and adequate skin coverage of the phallus.¹⁰

During the past decades, the most common technique of hypospadias repair involved the use of a vascularize transverse preputial island flap as a tubularised neourethra or as a ventral onlay over an intact urethral plate. 11,12

Snodgrass described the TIP technique for hypospadias repair as a means to widen and improve the mobilization of the urethral plate.³ However, this operation has higher requirements of the urethral plate, including a wide plate and good quality of the urethra.

Current knowledge recommends preservation of the urethral plate whenever possible after chordee correction.¹³ Hypospadias repair is performed by rolling the urethral plate into a tube. Whenever adequate urethral plate is not available to roll into a tube, then incision of the plate or a preputial island onlay flap is utilized to augment the plate. A urethral plate incision enables a urethral tubularization, but due to narrow urethral plate, shallow urethral groove, scar tissue may form in the incision of the urethral plate without epithelium. 14 A more extended urethral length implies more risk of scar tissue formation, which can increase flow resistance and prompt to proximal fistula and impedance in urine flow. 15 Kolon and Gonzales described the use of inner preputial free graft to augment the urethral plate by suturing it into the incised urethral plate.8 They grafted the incised urethral plate bed with the aim of encouraging healing by epithelisation, and reported that grafting prevents the development of meatal stenosis, neourethral stricture, urethro cutaneous fistula and urethral diverticulum, in patient with narrow urethral plate.

We review our single-surgeon experience with grafted TIP repair of primary hypospadias in 87 children. Our results show that single-stage hypospadias repair with grafted TIP has good success with acceptable complication rates. ^{16,17} Our overall complication rate of 8% favorably compares with other series of primary hypospadias repairs with onlay urethroplasty techniques. ¹⁸⁻²⁰

In this series, the author believes that this technique successfully fulfilled all the traditional hypospadias repair criteria. Dorsal inlay graft repair preserved the urethral plate and increased the surface area of healthy epithelium. Moreover, this technique does not leave the neourethra with a long-denuded surface awaiting reepithelialization. 8

Our study too has demonstrated that dorsal inlay inner preputial graft urethroplasty is a safe and viable option for the treatment of primary hypospadias with a narrow urethral plate. Inner preputial free graft helps in augmenting the urethral plate so as to make it possible to tubularise the plate. Complications such as meatal stenosis are not seen with this procedure as the incision was not extended distally into the glans. 18-20

The most common complications after TIP urethroplasty are urethrocutaneous fistula, meatal stenosis and dehiscence. Distributed outcomes from patients who had undergone TIP urethroplasty for primary hypospadias repair has been outlined, and the mean overall complication rate was 10.8% (range, 0–33.3%); mean rate of urethrocutaneous fistula was 5.7% (range, 0-21.2%), mean rate of meatal stenosis was 4.7% (range, 0-19.0%) and mean rate of dehiscence was 1.3% (range, 0-4.2%).²¹⁻²³

Our results show that single-stage hypospadias repair with grafted TIP has good success with acceptable complication rates. Our overall complication rate of 8% favorably compares with other series of hypospadias repairs. Useful outcome implies a decent caliber neourethra that transmits urine without overabundance resistance. In children with distal and mid penile hypospadias with a decent urethral plate, the TIP repair gives incredible corrective and practical outcomes and is the first decision of repair in such cases. In any case, hypospadias with ineffectively formed urethral plate and more proximal hypospadias may not be appropriate for TIP repair. Holland and Smith found high incidence of urethro cutaneous fistula in patients with a shallow glans, and with a narrow plate (6 mm).²⁴ Grafting allows immediate coverage with epithelium and minimises the fibrous reaction in the incised urethral plate bed.^{25,26} Leslie et al evaluated the histological and functional characteristics of the preputial inlay graft in an experimental rabbit model and reported that the preputial graft kept its original histological characteristics, with good graft take and integration, thus hypothesizing its application in human.^{27,28} Similarly, Gundeti et al, reported that G-TIP urethroplasty reduces complication rates, with narrow urethral plate.²⁸ Shimotakahara et al described the prospective comparative analysis between TIP and G-TIP urethroplasty and reported a low complication rate in patients undergoing G-TIP urethroplasty and hence sturdily recommended it as the procedure of choice in primary hypospadias.²⁹ Subsequently, Mouravas et al reported that G-TIP resulted in lower fistula and urethral stricture rates in a comparative analysis of TIP and G-TIP and thus proposing it as the procedure of choice in patients undergoing primary hypospadias surgery with poor urethral plate. 18

Urethral stricture is the most intricate complications. Several reports have recognized abnormal flow curves with obstructive pattern after TIP repair even in the absence of an actual stricture.³⁰ Braga et al reported a plateau uroflow curve in 66.7% of patients with proximal hypospadias repaired using the TIP technique.¹⁴ They proposed that stiff urethra with low compliance resulted

in obstructive flow pattern. In our series, we had no case of neourethral stenosis after grafted TIP repair. This is because of the ability with grafted TIP repairs to consistently create a good caliber neourethra irrespective of the width or depth of the urethral plate with immediate epithelium coverage.

CONCLUSION

Study performed dorsal inlay graft urethroplasty for hypospadias patients with shallow glans, no severe curvature and poor urethral plate less than 6mm. Our results indicate that dorsal inlay graft urethroplasty is an effective method for primary hypospadias repair and leads to a good cosmetic outcome with minimal risk of complications. The versatility of this procedure makes it a good option to consider in cases of hypospadias with poorly developed urethral plates where single-stage onlay urethroplasty is indicated. Study consider this procedure to be an effective method for hypospadias repair, particularly in cases with no deep groove and no severe curvature that leads to good cosmetic outcome without meatal stenosis or neourethral narrowing. A study with more patients and with long-term follow up including functional evaluation with uroflowmetry is needed to confirm our results.

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