Double breasting spongioplasty in tubularized/tubularized incise plate urethroplasty: A new technique

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ABSTRACT

Introduction: The main disadvantage of currently described techniques of spongioplasty is superimposition of 3 suture lines (neourethra, spongioplasty, and skin closure) which is likely to increase the chances of a fistula. We describe and evaluate the results of a double breasting spongioplasty in urethroplasty.

Methods: A prospective study of 60 primary hypospadias was undertaken by double breasting spongioplasty from August 2012 to March 2014. Mobilization of the urethral plate and the spongiosum is done by creating a plane just proximal to the meatus. Double breasting spongioplasty is done after tubularization of urethral plate. First layer of spongiosum is sutured toward lateral side of the neourethra covering the suture line. A second double breasting layer is sutured over the first layer with its suture line toward the opposite side covering the suture line of the first layer; thus avoiding overlapping of suture lines of all the three layers.

Results: Age of the patients varied from 10 months to 16 years with a mean and median of 3.73 and 3.50 years, respectively. Hypospadias was distal, mid, and proximal in 38, 10, and 12 cases, respectively. Chordee was noticed in 35 cases and torque in 28 cases. Overall complication rate was 5% and fistula rate was 1.66%.

Conclusions: Double breasting spongioplasty avoids superimposition of suture line and adds two layers of spongiosum over neourethra, thus decreases the chances of urethral fistula and gives cylindrical shape to neourethra.

INTRODUCTION

Tubularized incise plate urethroplasty (TIPU), Mathieu flip-flap, Thiersch–Duplay, dorsal dartos-based inner preputial flap/tube repair, and modified Duckett’s tube urethroplasty are commonly used for hypospadias repair.1 TIPU is the most commonly performed surgery for hypospadias, and the common complications are urethrocystaneous fistula, meatal stenosis, stricture uretha, and residual chordee.2 Many modifications in surgical technique have been tried to reduce postoperative complications of hypospadias repair.3-8 Fistula is the most common complication in hypospadias repair. Various healthy tissues (transverse island dorsal subcutaneous flap, de-epithelialized skin flaps, lateral dartos flap, double dartos flaps, double-breasted de-epithelialized penile skin flap, tunica vaginalis, and corpus spongiosum) have been used to cover neourethra for reducing fistula rate in TIPU. Recently, spongioplasty is more frequently used as a healthy interposing tissue layer.9,10 Disadvantages of the techniques of spongioplasty described in the literature are a superimposition of suture line of neourethra, spongioplasty, and skin closure; conical shape of the urethra and comprising the blood supply of spongiosum by both medial and lateral mobilization of spongiosum. Superimposition of suture line is likely to increase the chances of fistula. The principle of avoiding the superimposition of suture line is being used in vesicovaginal fistula repair. We applied the same principle to reduce the fistula rate in tubularized/Thiersch–Duplay urethroplasty. The objective of this study was to evaluate the results of this new technique of double breasting spongioplasty in tubularized/TIPU.

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METHODS

A prospective study of 60 primary hypospadias managed by TIPU with double breast spongioplasty was undertaken between August 2012 and March 2014 after clearance from the Ethical Committee of our institution. All patients were operated by a single surgeon in similar conditions with the same instruments. Written informed consent was taken from parents of all the patients. Clinical examination was done to assess meatal location, chordee, size of the urethral plate, penile torsion, and size of the penis, glans, and prepuce. The quality of the spongiosum and width of the urethral plate were graded intraoperatively as per published literature into poorly, moderately and well developed.[11] Similarly, the width of urethral plate is assessed and categorized into wide, when it can be tubularized easily without incision (on the largest acceptable size catheter in normal proximal urethra). If urethral plate requires a superficial incision for tubularization; then, it is considered to be an average one, and when it requires a deep incision then urethral plate is considered as narrow.[12] Severity of hypospadias was decided by meatal location at the level of bifurcation of spongiosum after penile degloving.

The patients with well or moderately developed spongiosum and those who adhered to the defined follow-up protocol were included in the study. Patients who were found to have poorly developed spongiosum, if it was not possible to cover the neourethra with spongiosum intraoperatively and the re-operative cases were excluded from the study.

Surgical technique

An incision is given encircling the meatus, then to the corona, preserving the urethral plate, and then extended circumferentially around the corona; and encircling meatus to corona with extension into prepubial hood where prepuciaplasty is contemplated. A penile erection test[13] is done to evaluate the chordee after penile degloving. A plane of dissection is created just proximal to the meatus between Buck fascia and tunica albuginea and the urethral plate along with the corpus spongiosum is mobilized from corpora. Care is taken while dissecting spongiosum and urethral plate from corpora, not to damage the spongiosum and cavernous so that the blood supply to spongiosum and urethral plate is maintained [Figure 1a–c]. The proximal urethra is mobilized up to the bulbar region in case of persistence of chordee/torsion and the adequacy chordee/torsion correction is confirmed by penile erection test. Subsequently, the corpus spongiosum is dissected into the glans, glanular wings are raised, [Figure 1d and e] and glanular chordee correction is again checked by Gittes test. Thus, urethral plate is mobilized distally up to future meatus. The urethral plate is tubularized with or without a dorsal incision using 7-0 PDS [Figure 1d]. Then, the double breast spongioplasty is done. The first layer of spongiosum is sutured toward lateral side of the suture line of neourethra [Figure 1e–g]. A second layer of spongiosum is sutured over the first layer with its suture line toward the opposite side (double breasting) in such a way that the second layer completely buries the suture line of the first layer with no overlapping of suture lines among all the three layers [Figure 1h–j]. These steps are shown in Figure 2 as diagrammatic representation, and intraoperative photograph depiction of the same is shown in Figure 3. Ventral dartos is closed over neourethra, and then skin sutures are applied. A 6–10 Fr urethral catheter, depending on patient age, is left in situ. Pressure dressing is applied with cotton gauze and double elastic adhesive tape in all cases.

Cephalosporins with analgesic and anti-inflammatory drugs are given for 7–10 days till the catheter is in situ. Patients are evaluated at follow-up visits after 1, 3, and 6, 12 months and then yearly. Results are evaluated in terms of patients', parents', and surgeon's satisfaction, in view of meatus size, stream of urine, cosmesis, and complications. In follow-up visits at 1, 3, 6, and 12 months meatus is calibrated by 6, 8, or 10 Fr size infant feeding tube, if meatus is found to be narrow as per age of the child at any of the visits, it is considered as a case of meatal stenosis. These patients are put on monthly meatal calibration up to 6 months, and if meatus continues to remain narrow beyond 6 months, then it is taken as nonresponder to meatal dilatation.

RESULTS

Age of the patients varied from 10 months to 16 years with a mean and median of 3.73 years and 3.50 years, respectively. Hypospadias was distal, mid, and proximal in 38, 10, and 12 cases, respectively. A number of patients in the age group 0–5, 5–10, and 10–16 years were 34, 14, and 12, respectively. Chordee was noticed in 35 cases (17 in distal, 6 in mid penile, and 12 in proximal) and the torque was seen in 28 cases (19 in distal, 3 in mid penile, and 6 in proximal). Chordee correction was achieved by penile degloving in 6 cases, mobilization of the urethral plate with corpus spongiosum was needed in 24 cases, and further proximal urethral mobilization was necessary in 5 proximal hypospadias cases to correct the ventral curvature of penis. Correction of torque was possible by penile degloving and mobilization of urethral plate with spongiosum in 19 cases and 9 required proximal urethral mobilization. Twenty-six patients had a wide urethral plate, which could be tubularized without incising the urethral plate, whereas 34 patients had average wide urethral plate that required incision of urethral plate for tubularization. Neourethra after spongiosplasty with double breasting was cylindrical, and suture line was lateral in all cases [Figure 1i]. A total of 3 patients had complications (1 seroma, 1 fistula, and 1 meatal stenosis). Seroma (a serous subcutaneous collection along the stitch line) developed in early postoperative days and got relieved by simple compression dressing. Meatal stenosis was managed by simple meatal calibration. Fistula developed in
Figure 1: Operative photograph showing steps of double breasting of corpus spongiosum. (a) Distal penile hypospadias. (b) Mobilization of spongiosum from corpus cavernosum on the right side. (c) Mobilization of spongiosum from corpus cavernosum on the left side. (d) Mobilization of spongiosum into glans and tubularization of urethral plate. (e-g) Suturing the left spongiosal pillar lateral to suture line tubularized urethral plate. (h-j) Suturing the right spongiosal pillar over the sutured lateral spongiosal pillar covering the suture line.

Figure 2: Diagrammatic representation of double breasting of corpus spongiosum (a) Incised urethral plate after mobilization. (b) Tubularized urethral plate. (c) Spongioplasty started with left side keeping suture line laterally (d) Left side spongioplasty completed (e and f) double breasting of Right side spongiosum over sutured left side spongiosum.
one patient (14 years old) with proximal hypospadias with moderately developed spongiosum. Correlation of various variables with a number of complications is shown in Table 1. None of the patients had stricture of the urethra, residual chordee, and other complications. Overall incidence of complications was 5% only and fistula rate was 1.66%. Fistula required second surgery and did not have second recurrence. The hospital stay ranged from 8 to 10 days.

**DISCUSSION**

Snodgrass popularized TIPU for hypospadias, which gained widespread acceptance due to its versatility, low complication rate, and reliable creation of vertically oriented meatus, with excellent cosmetic outcome. TIPU is considered as the technique of choice for the primary distal and midshaft hypospadias cases and with increasing trend of its use for the proximal ones. TIP can be done in selected cases of re-operative cases with unscared urethral plate. The common complications reported after TIPU repair include fistulae, urethral stricture, meatal stenosis, and persistent chordee. Urethrocutaneous fistula is the most common complication, and the causes of fistulae are local infection, ischemia, and distal obstruction due to meatal stenosis. Spongioplasty is being used as a healthy tissue interposing cover of neourethra to reduce the complication rate. Dodat et al. mobilized the spongiosum after incising it both medially as well as laterally and then sutured in the midline. The disadvantages of the technique are incising medially and mobilizing the spongiosum on both sides may compromise blood supply; superimposition of suture line of urethroplasty, spongioplasty, and skin closure; spongiosum is neither sutured to neourethra nor to corpora on lateral side leaves urethra uncovered; and partial coverage of urethra at the bifurcation of spongiosal pillar may increase the chances of fistula.

Yerkes et al. did spongioplasty after mobilization of the spongiosum lateral to medial along with urethral plate and suturing the edges to midline converting the diverting Y spongiosum to I. Bhat et al. have done spongioplasty with the difference from Yerkes et al., that they did not incise the spongiosum transversely at corona, rather mobilized spongiosum into glans and spongioplasty was done up to distal most part of neourethra which has an added advantage of covering the neourethra with healthy spongiosum to

| Variables    | Number of cases | Complications |
|--------------|-----------------|---------------|
| Hypospadias  |                 |               |
| Proximal     | 12              | 1             |
| Mid-penile   | 10              | 0             |
| Distal       | 38              | 2             |
| Age group (years) |       |               |
| 0-5          | 34              | 1             |
| 5-10         | 14              | 1             |
| 10-15        | 12              | 1             |
| Curvature    | 35              | 2             |
| Torque       | 28              | 3             |

**Table 1: Correlation of variables and complications**

**Figure 3: Operative photograph showing double breasting of corpus spongiosum (a) mobilized urethral plate with spongiosum (b and c). Tubularization of urethral plate (d and e) suturing the left spongiosal Pillar over tubularized urethral plate (e) Right spongiosal pillar covering over the sutured left spongiosal pillar and (g and h) the double breasting of Right spongiosal pillar over Left and completion of spongioplasty**
prevent fistula at corona. However, the disadvantages of these techniques are superimposition of suture line of urethroplasty, spongioplasty, and skin closure, and conical shape of neourethra after spongioplasty. Spongiosum of hypospadiac patients are divergent in nature, and bulk of the spongiosum lies laterally and posteriorly to the urethral plate, so it requires its complete mobilization and medialization during its repair to completely cover the neourethra with bulk of the spongiosum.

In the present technique of double breasting spongioplasty, we mobilized the spongiosum completely on both sides and sutured the spongiosum lateral to suture line of tubularized urethral plate of one side, and then sutured other side spongiosum again laterally to cover the suture line of the first layer of spongiosum as double breasting. Mobilization of spongiosum is an important step for tension-free double breasting. It may be little difficult in infants but if plane of dissection is created at the level of Buck’s fascia proximal to the meatus and dissected distally, then the mobilization of spongiosum becomes easy.\[20\] The advantages of the technique are mobilization of spongiosum lateral to medial, and distal mobilization of the spongiosum up to mid glans keep the blood supply of the urethral plate intact and also cover the neourethra even at corona. Double breasting of spongiosum has the advantage of covering the neourethra by two layers of healthy spongiosum, avoids the superimposition of suture line of urethroplasty and skin closure, covers the urethra with spongiosum both at corona and bifurcation of spongiosum and shape of neourethra is cylindrical, which is near to a normal urethra achieving the goals of hypothesis. All these factors help in the prevention of fistula even at more common sites such as corona and divergent spongiosum. Hence, it is logical that incidence of fistula, stricture urethra, and wound dehiscence will be low in the technique with two additional layers of spongiosum over neourethra without any overlap in suture line with creation of cylindrical neourethra.

In literature, the reported incidence of complications in TIPU range from 6% to 30%.\[21-24\] In the present study, overall incidence of complications was 5% which is lower than the reported. The fistula rate in TIPU with spongioplasty ranges from 4% to 40%.\[9,10,20-28\] and fistula rate in present series with double breasting spongioplasty is 1.66% which is significantly lower than the reported in the literature. The fistula rates reported with conventional spongioplasty by the same operating surgeon in similar circumstances (7.96–14.28%) are much higher than double breasting spongioplasty in the present series (1.66%) which suggest that double breasting spongioplasty reduces the fistula rate significantly [Table 2]. The type of hypospadias, development of spongiosum and urethral plate, and the degree of curvature are important variables in the development of fistula in hypospadias repair. More proximal hypospadias, severe curvature, poor development of spongiosum, and urethral plate increase the chances of fistula.\[20,25\] In our previous studies of conventional spongioplasty with the similar inclusion criteria to the present series, we had 9% and 14.28% fistula in severe hypospadias in spite of dorsal dartos/ventral flap is added as an additional tissue layer. We excluded the poorly developed spongiosum cases in present series (fistula rate 1.66%) but were included in the earlier study of conventional spongioplasty where fistula rate was 7.96% but on exclusion of the poorly developed spongiosum cases in that study to make study cases comparable with present series (having moderately and well-developed spongiosum); then, the fistula rate was 6%, still higher than the present series. Hence, in patients with poorly developed spongiosum addition of an interposing layer such as dartos or tunica should be used.\[20\]

Although the hypospadias surgery is a day care surgery in recent times but hospitalization is likely to be longer (5–7 days) in developing countries because of lack of the basic/specialist surgical services at home towns/villages of the patients, who come from far off/remote places to the tertiary center.\[12\] Patients were discharged from the hospital in 8–10 days after removal of per urethral catheter in the series.

Strength of our study is that it is a prospective one, and all patients were operated by a single surgeon. This is the first study using a new technique of double breasting spongioplasty based on sound surgical principles of surgery. Limitations of the study are small sample size with comparatively short period of follow-up and longer hospitalization; did not have control group to compare the results but compared with our earlier results. We evaluated the meatal stenosis by meatal calibration which is cumbersome and painful for a child and

| Spongioplasty          | References | Year | Number of patients | Number patients having fistulae | Fistula rate (%) |
|------------------------|------------|------|--------------------|-------------------------------|------------------|
| Conventional           | Kocvara et al.\[24\] | 2005 | 37                 | 15                            | 40               |
| Conventional           | Bhat\[25\] | 2007 | 34                 | 3                             | 9                |
| Conventional           | Gamal et al.\[26\] | 2009 | 50                 | 2                             | 4                |
| Conventional           | Eassa et al.\[27\] | 2011 | 39                 | 5                             | 13               |
| Conventional           | Hayashi et al.\[28\] | 2013 | 37                 | 3                             | 8                |
| Conventional           | Bhat et al. \[29\] | 2014 | 113                | 6                             | 7.96             |
| Conventional           | Bhat et al. \[30\] | 2015 | 14                 | 2                             | 14.28            |
| Double Breasting       | Bhat et al. present series | 2016 | 60                 | 1                             | 1.66             |
again remains a limitation of the study. Uroflowmetry is a noninvasive and preferable method to evaluate the meatal stenosis.

CONCLUSIONS

Double breasting spongioplasty is a novel technique in Tubularized/TIPU with significantly lower overall complication rate. The technique covers the neourethra with two layers of spongiosum avoiding the superimposition of suture line and maintaining blood supply of spongiosum which helps in reducing the complications such as the fistula and creates near normal shape of urethra. Incidence of fistula was significantly low clinically. It is our initial experience with very good results, but it needs further studies at different centers for its validation.

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