

# Reconstructing forked corpus spongiosum to correct glans droop in distal/midshaft hypospadias repair

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## Abstract

**Purpose:** We reviewed our experience and efficacy of reconstruction of a forked corpus spongiosum (FCS) to correct glans droop in distal/midshaft hypospadias repair.

**Methods:** Eighty-five consecutive patients who underwent distal/midshaft hypospadias repair by the same surgeon in our center from October 2015 to June 2018 were retrospectively analyzed. All cases were accompanied by different degrees of glans droop, which we corrected by cutting off and reconstructing the FCS along the plate. We recorded the degrees of glans droop, development of the FCS, and postoperative complications including residual chordee, fistula, diverticulum, glans dehiscence, meatus stenosis, and urethral stricture.

**Results:** The follow-up period ranged from 5 to 37 months (mean, 19.7 months). Two patients (2.3%) developed a coronal fistula and underwent a second repair. Two patients (2.3%) developed a mild urethral diverticulum and underwent continued observation. One patient (1.2%) developed a meatus stenosis that resolved after 1 month of meatus expansion combined with external mometasone furoate. No patients developed postoperative residual chordee or urethral stricture.

**Conclusions:** The degree of glans droop is closely associated with the development of an FCS. Reconstructing the FCS to correct the glans droop can yield satisfactory outcomes and should be popularized in distal/midshaft hypospadias repair.

## Keywords

Distal/midshaft hypospadias, forked corpus spongiosum, FCS, glans droop, chordee, reconstruction

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## Introduction

Correcting penile chordee is the first step in all hypospadias repairs. The key is to completely straighten the penis and avoid residual chordee, which is very difficult to resolve in re-operations during long-term follow-up. In patients with distal/midshaft hypospadias, the chordee often exists at the distal end of the penis, and drooping of the glans is particularly obvious. The urethral plate is transected to correct the penile curvature. However, the tissue damage associated with this procedure is severe, the continuity of the urethral plate is lost, and the postoperative complications are serious. Penile dorsal tunica albuginea plication preserves the urethral plate and the damage is mild, but this technique leads to shortening of the penis. Neither of the above-mentioned methods for correcting the glans droop in patients with distal/midshaft hypospadias is ideal. Previous clinical studies have indicated that glans droop is associated with dysplasia of the corpus spongiosum. A fibrotic forked corpus spongiosum (FCS) can cause traction on the penis head. Thus, we reviewed our experience in reconstructing the FCS to correct glans droop in distal/midshaft hypospadias repair and analyzed the efficacy of this technique.

## Materials and methods

### *Patients and study design*

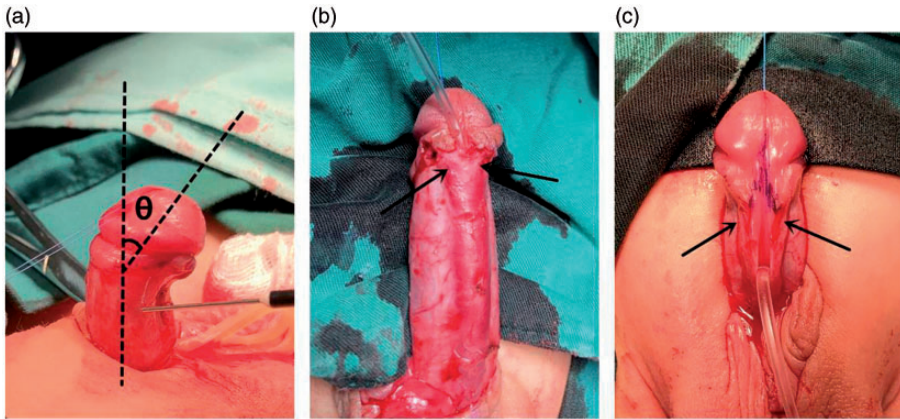
We retrospectively analyzed consecutive patients who underwent surgical repair of distal/midshaft hypospadias by the same surgeon in our center from October 2015 to June 2018. All patients underwent the penile erection test after degloving during the operation, and the results suggested that every penis body was basically straightened but that all were accompanied by varying degrees of glans droop. The angle

between the long axis of the penis body and the long axis of the penis head was used as the angle of droop and was divided into three groups:  $<15^\circ$ ,  $15^\circ$  to  $30^\circ$ , and  $30^\circ$  to  $45^\circ$ . The development of the FCS (well-developed or fibrotic) was recorded in each group (Figure 1). We preserved the urethral plate during surgery and chose the surgical method according to the width of the urethral plate between the FCS. If the width of the urethral plate was  $\geq 6$  mm, tubularized incised plate (TIP) urethroplasty was performed, and if the width of the urethral plate was  $<6$  mm, the onlay flap technique was performed. The FCS was reconstructed in each case.

All eligible patients were included in the study. All patients were followed up for postoperative complications, including residual chordee, fistula, diverticulum, glans dehiscence, meatus stenosis, and urethral stricture. The chi-square test was used for intergroup comparisons. A P-value of  $<0.05$  was considered significant.

### *Method of reconstructing the FCS*

The FCS reconstruction method is shown in Figures 2 to 4. Before dissecting the glans wings, the FCS was cut off along both sides of the middle urethral plate and then dissected along the penile tunica albuginea closely from the near to far side of the penis until the top of the penis head was reached. The corpus spongiosum on both sides was reserved for the two wings of the glans. The two wings of the glans were carefully expanded to at least to the 3- and 9-o'clock positions of the penis. In some patients with a small glans, dissection was performed to the 2- and 10-o'clock positions to close the two wings of the glans with no tension when performing glansplasty. Additionally, the original FCS on both sides was combined at the coronal sulcus, covering the surface of the new urethra.



**Figure 1.** (a) The angle of glans droop was measured as the angle between the long axis of the penis body and the long axis of the penis head. The development of a forked corpus spongiosum was defined as (b) well-developed or (c) fibrotic.



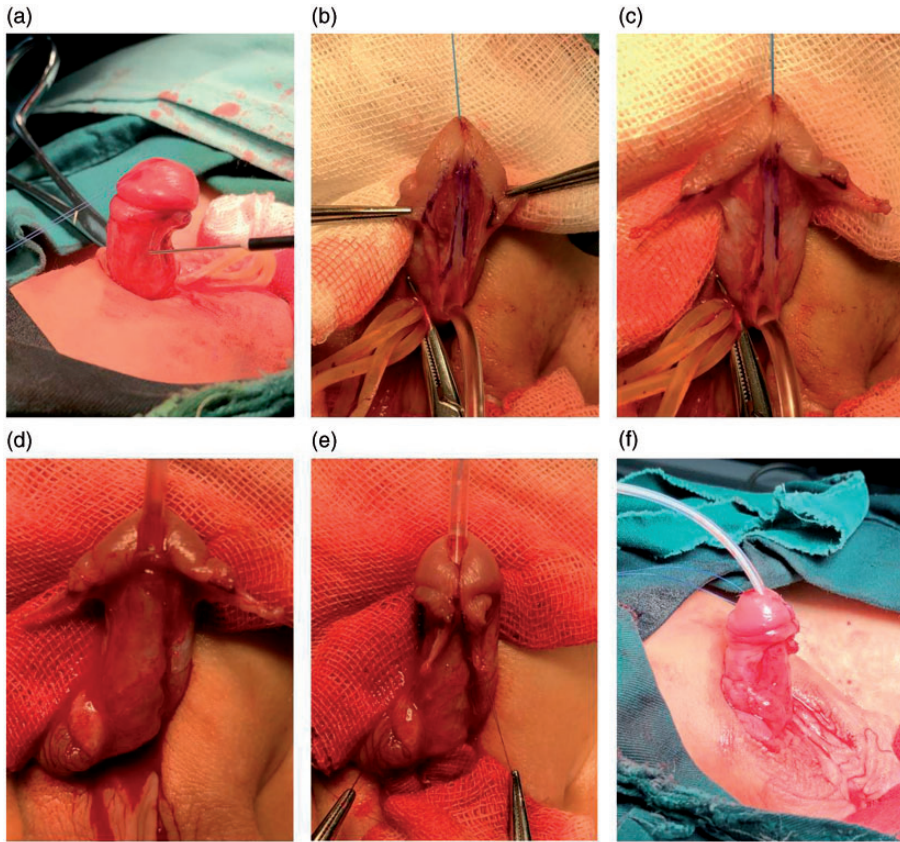
**Figure 2.** Preoperative appearance.

## Results

### *Intraoperative situation (Table 1)*

Eighty-five patients were included in this study. Their average age at the time of the operation was 33.0 months (range, 6–159 months). TIP urethroplasty was performed in 24 patients, and the onlay flap technique was performed in 61 patients. The glans drooping angle was  $<15^\circ$  in 22 patients, among whom the FCS was well-developed

in 18 patients and fibrotic in 4. In 38 patients, the glans drooping angle was  $15^\circ$  to  $30^\circ$ , including 15 patients with a well-developed FCS and 23 patients with fibrosis. The remaining 25 patients showed glans drooping angles of  $30^\circ$  to  $45^\circ$ , among whom 2 showed well-developed FCS and 23 showed fibrosis. The P-value was  $<0.05$  between the first two groups, and the same was true between the latter two groups.



**Figure 3.** Method of reconstructing the forked corpus spongiosum (FCS) in the onlay procedure. (a) Glans droop before correction. (b) Dissection of the FCS along both sides of the middle urethral plate. (c) Cutting off of the FCS expansion of the two wings of the glans. (d) Urethroplasty by an onlay flap. (e) Combining the original FCS at the coronal sulcus during glansplasty. (f) Appropriate straightening of the penis after reconstructing the FCS.

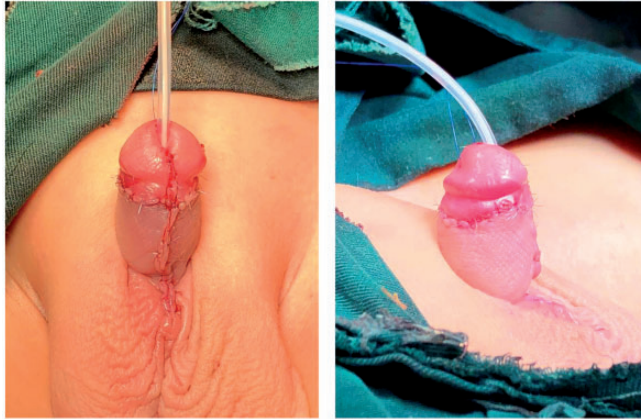
### Postoperative complications (Table 2)

The average follow-up time was 19.7 months (range, 5–37 months). In all patients, the penis was straightened well after the operation. No patients had residual chordee, glans dehiscence, or clinical symptoms of urethral stricture. The total postoperative complication rate was 5.9% (5/85), with two cases (2.3%) of coronal fistula repaired after 6 months. Two patients (2.3%) with a mild urethral diverticulum underwent long-term observation without further surgery. One patient (1.2%)

showed meatus stenosis that was resolved after 1 month of meatus expansion combined with topical mometasone furoate.

### Discussion

In general, distal/midshaft hypospadias repair preserves the urethral plate, and TIP urethroplasty, the most popular technique, was first described in 1994 by Snodgrass,<sup>1</sup> Springer et al.,<sup>2</sup> and Steven et al.<sup>3</sup> However, Bush et al.<sup>4</sup> also reported that the glans size was an independent risk



**Figure 4.** Postoperative appearance.

**Table 1.** Development of the FCS in 85 patients with hypospadias with varying degrees of glans droop.

	<15° (n = 22)*	15°–30° (n = 38)* <sup>Δ</sup>	30°–45° (n = 25) <sup>Δ</sup>
FCS well-developed	18 (81.8%)	15 (39.5%)	2 (8.0%)
FCS fibrotic	4 (18.2%)	23 (60.5%)	23 (92.0%)

FCS, forked corpus spongiosum.

\*Comparison between the first two groups:  $P = 0.003$

<sup>Δ</sup>Comparison between the latter two groups:  $P = 0.008$

**Table 2.** Postoperative complications in 85 patients with hypospadias with varying degrees of glans droop.

	<15° (n = 22)	15°–30° (n = 38)	30°–45° (n = 25)	Incidence rate* (%)
Residual chordee	/	/	/	/
Fistula	1 (TIP)	1 (onlay)	/	2.3
Diverticulum	/	/	2 (onlay)	2.3
Glans dehiscence	/	/	/	/
Meatus stenosis	1 (TIP)	/	/	1.2
Urethral stricture	/	/	/	/

TIP, tubularized incised plate.

\*The total postoperative complication rate was 5.9%.

factor for urethroplasty complications after hypospadias repair by TIP urethroplasty. They reported that the prognosis was good when the widest point of the glans was  $\geq 14$  mm, and in these cases, it seemed that there was no need to consider the

quality of the urethral plate. However, the penile dimensions vary among different ethnicities, and the penis size is generally slightly smaller in Chinese patients than in Western patients.<sup>5–8</sup> Accordingly, we may need to consider the quality of the urethral

plate and use different surgical methods to improve the success rate of surgery and reduce postoperative complications. Some surgeons prefer to use the onlay technique, particularly in patients with a small glans and shallow urethral plate, which make tubularization difficult.<sup>9,10</sup> Therefore, based on our experience, the onlay technique was performed when the urethral plate was <6 mm; otherwise, TIP urethroplasty was performed.

Correcting penile chordee is crucial in the repair of hypospadias. It is necessary to fully straighten the penis. Otherwise, the treatment of residual chordee will be more difficult because of postoperative material loss, scar hyperplasia, and other complications, and the difficulty of reoperation will increase, thus reducing the success rate. Moreover, the number of hospitalizations will increase, the treatment cycle will be prolonged, and patients will incur an additional financial burden and psychological stress. Mild penile chordee correction is relatively simple; repair is usually performed by loosening the ventral side of the penis, including degloving and removing the abnormal fibrous tissue from the surface of Buck's fascia. However, severe penile chordee correction is relatively complicated. Acimi and Acimi<sup>11</sup> noted that by completely loosening the ventral side of the penis, most chordees with a curve of <45° can be straightened, but more severe chordee must involve transection of the urethral plate to straighten the penis. For penile chordees that remain after transecting the urethral plate, Schlomer<sup>12</sup> recommended dorsal tunica albuginea plication for penile chordees of <45° and ventral lengthening for those of >45°.

The clinical condition addressed in this study applies only to distal/midshaft hypospadias. That is, distal/midshaft hypospadias is often characterized not by overall curving of the penis but by drooping of the glans. Based on our past experience,

we can indeed correct penile chordee by transecting the urethral plate or by penile dorsal tunica albuginea plication. However, the effect of either method on correcting glans droop is not ideal. Transecting the urethral plate damages the tissue and loses the continuity of the urethral plate; thus, the clinician is forced to perform a more complicated surgical method or staged surgery, which increases the risk of complications to some extent. If dorsal tunica albuginea plication is performed close to the head of the penis, separation of the nerve vascular bundle is difficult and the glans is liable to remain partially drooped and may even relapse. Although a single plication does not shorten the penis, multiple plications will.<sup>13,14</sup>

Tugtepe et al.<sup>15</sup> reported that many patients with distal hypospadias and their families are not aware of penile chordee, and only 9.6% of these patients know that they have penile chordee preoperatively. We have encountered patients with distal/midshaft hypospadias who were unsatisfied with postoperative residual chordee, which in fact was glans droop. These patients, who stated that their urine did not stream far from the penis, indicated the need to lift their penis when urinating. Such patients are generally eager to reoperate the penis; in most cases, however, the penis must be repaired in stages, which is a large burden on the patients.

We reviewed a large number of studies and found no information about correcting glans droop in patients with hypospadias. Perhaps most pediatric urologists choose to traverse the urethral plate according to the conventional management of penile chordee. Additionally, some doctors might not pay attention to the condition of glans droop, which is not considered a complication even if it occurs postoperatively. However, as researchers become more aware of the condition of hypospadias, patients' postoperative quality of life will

improve. A considerable number of patients will pay attention to the problem of drooping of the penile head postoperatively.

Snodgrass et al.<sup>16</sup> published a report in 2000 challenging the historical notion that the urethral plate is the sole cause or a major cause of penile curvature. Using optical microscopy and conventional staining techniques, the researchers performed biopsies of 17 urethral plates of boys with hypospadias, which demonstrated well-vascularized connective tissue composed of smooth muscle and collagen.<sup>16</sup> The researchers found no histological evidence of fibrous cords historically considered responsible for chordee. Consistent with this view, Eron et al.<sup>17</sup> stated that extensive blood vessels, glands, and smooth muscle were present under the urethral plate in the hypospadias specimens that they examined. These relatively well-organized tissues corresponded to an abnormally formed corpus spongiosum.<sup>17</sup>

This view was also confirmed by our clinical research. When distal/midshaft hypospadias surgery was performed, we found that the urethral plate had good elasticity and a certain ductility but that the bilateral corpus spongiosum pulled the penis head, causing drooping. Moreover, the degree of the FCS development varied: in some cases, the FCS was well-developed with light fibrosis, and in other cases, it was poorly developed with severe fibrosis. Nevertheless, we still preserved the urethral plate in all 85 patients. Whether using the TIP or onlay procedure, we dissected the penis according to the method of reconstructing the FCS. Additionally, the original urethral plate had good ductility, and glans droop could be completely corrected without residual chordee. According to our data, the difference in the development of the FCS between the groups was statistically significant, which indicated that the degree of glans droop was likely related to the development of the FCS. This finding

also suggests that we must carefully dissect and cut off the FCS during the operation.

According to our follow-up results, our technique did not increase the incidence of postoperative complications. In contrast, we found fewer common complications. In the literature, the total incidence of postoperative complications of the TIP or onlay procedure in hypospadias repair is approximately 9.4% to 13.7%,<sup>18,19</sup> but only 5 of 85 patients in the present study showed an incidence of 5.9%. Among these patients, the incidence of urethral fistula was only 2.3% (2/85), which is lower than the incidence reported in most studies.<sup>18,20</sup> This finding may be related to the reconstruction of the FCS during glansplasty, which lowers the suture tension and helps the tissue to heal. Of course, our follow-up time was not sufficiently long. Some urethral fistulas occur later and require longer follow-up for determination of the outcome.<sup>21</sup> However, glans dehiscence is easy to identify during the early follow-up period.<sup>18</sup> Our recent case follow-up time was 5 months. No patients developed glans dehiscence after surgery because of the lower tension achieved by reconstructing the FCS.

Because the urethral plate is preserved, the incidence of urethral stricture in the TIP or onlay procedure is very low.<sup>18,22</sup> Our technique simply converted transection of the urethral plate to preservation during hypospadias repair, which resulted in no urethral stricture. The one case of meatus stenosis healed after conservative treatment, and no further surgery was needed. A limitation of our study is that we lacked standardized measures for voiding function after repair. Although no clinically symptomatic urethral strictures were observed, we did not collect data on parameters such as the urine flow rate to analyze whether reconstruction of the FCS affected urine flow. We plan to perform this analysis in future studies.

## Conclusions

Pediatric urologists must intraoperatively address the problem of glans droop in patients with distal/midshaft hypospadias. The degree of glans droop is likely related to the development of the FCS. However, we can satisfactorily straighten the penis by cutting and reconstructing the FCS. Moreover, this technique does not increase the risk of postoperative complications; thus, we recommend that the technique be popularized for distal/midshaft hypospadias repair.

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## Declaration of conflicting interest

The authors declare that there is no conflict of interest.


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## Ethical approval

This study was approved by the Institutional Review Board of the Children's Hospital, Fudan University, with a waiver of requirement for informed consent due to the nature of this retrospective study.

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