

# Penoscrotal transposition: Long-term outcome in 29 patients

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## Summary

**Objective:** Penoscrotal transposition (PST) is a rare anomaly of the external genitalia

characterized by malposition of the penis in relation to the scrotum. This transposition may be partial or complete and may be associated with hypospadias, chordee, and other anomalies. We have reviewed our experience with the surgical repair of PST utilizing a modified Glenn-Anderson technique.

**Materials and Methods:** Twenty-nine patients with a median age of 5.6 years (8 months-15 years) underwent surgical repair of PST at our institution between 2004-2022. Of those, 20 (69%) had complete PST, while 9 (31%) had partial PST. All children were divided into three groups. In the first group of 8 (28%) children, repair of PST was an integral part of one-stage male genitoplasty; in the second group of 18 (62%) children, repair of PST was an isolated last stage of the staged hypospadias repair, and the remaining 3 (10%) children underwent PST repair without the presence of hypospadias. All patients underwent modification of the Glenn-Anderson technique involving utilization of bilateral rotational advancement scrotal flap, complete de-tethering of the testis from the internal part of the scrotum when indicated, and relocation of the scrotal compartment in a normal dependent position. The follow-up ranged from 6 months to 18 years.

**Results:** In the first group, five children (62%) underwent Onlay Prepuccial Island Pedicle Flap (OIF) hypospadias repair, and three (38%) underwent Long Tubularized Incised Plate Repair (TIP). In the second group, 8 (44%) underwent OIF hypospadias repair, 2 (12%) had Long TIP repair, and the remaining 8 (44%) underwent staged hypospadias repair. Post-operative Clavien Dindo grade III complications presented in three patients in group I and only one patient in group II. In the third group, no postoperative complications were observed.

**Conclusions:** Our data show that penoscrotal transposition correction utilizing the Glenn-Anderson technique is a reliable and durable surgery in the pediatric population. These children require careful monitoring till adolescence to ensure that no re-operation is needed.

**KEY WORDS:** Glenn-Anderson technique; Hypospadias; Penoscrotal transposition; Transverse island flap onlay; Tubularized incised plate repair.

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## INTRODUCTION

Penoscrotal transposition (PST) is a rare anomaly of the external genitalia, characterized by malposition of the

penis in relation to the scrotum (1). It is categorized as complete or incomplete variants based on the location of the penis. In incomplete PST, the more common variant, the penis, lies in the middle of the scrotum, while in complete PST, the penis emerges from the perineum and is covered by the scrotum entirely (2). PST is rarely isolated and frequently occurs with a broad spectrum of malformations, including a strong association with severe hypospadias and chordee (3). Surgery is the gold standard of PST management, with various surgical techniques utilized for PST correction, including reorienting the scrotum inferiorly with limited rotational flaps, inguinal-based groin flaps, or transposing the penis superiorly (4).

This study aimed to evaluate our experience and long-term results with PST correction using a modified Glenn-Anderson technique.

## MATERIALS AND METHODS

### Study population

Following institutional board approval (Shaare Zedek Medical Center Helsinki Committee approval number 0303-22-SZMC), we have conducted a retrospective cohort study by collecting data on all patients with PST who underwent surgical repair in our department between 2004 to 2022. A single pediatric urologist (BC) performed all surgeries.

Patients were categorized into three groups: in the first group, PST repair was an integral part of one-stage male genitoplasty; in the second group, PST repair was a separate last stage of the staged hypospadias repair; and the third group consisted of patients without hypospadias.

Only patients with recent follow-ups entered the study, including patients who attended an office visit or provided a recent photographic image of the operative site and answered questions regarding satisfaction with the surgery, lower urinary function, and curvature status. Additional information included age at the time of surgery, preoperative chordee and hypospadias severity, other genital anomalies and congenital malformations, type of operation, and postoperative complications.

### The surgical technique

Briefly, all patients were considered for surgery after the age of six months. Hormonal supplementation was given

to those with a small phallus, with the utilization of topical testosterone cream twice daily before surgery for one month to accomplish penile lengthening with the avoidance complication of hypothalamus pituitary-testicular axis, as we recently reported (5).

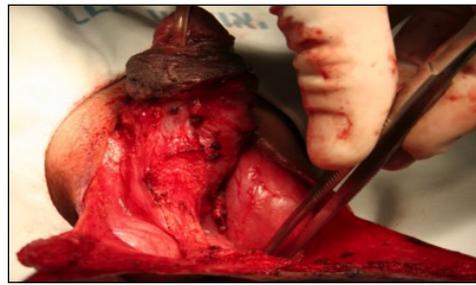
In patients where PST repair was performed as a separate procedure, the first step was to draw lines of an incision around the root of the penis to elevate the transposed scrotum as rotational advancement flaps leaving the dorsal penile skin connected to the skin of mons pubis (Figure 1). Compared to the other surgical techniques, the incision does not meet in the midline as in Glenn-Anderson. Still, it leaves a skin bridge of about 5-10 mm, separating the two incisions and connecting the penile skin to the skin of the mons pubis (Figure 2). The second step included a complete de-tethering of the testis from the internal part of the scrotum when indicated, and the relocation of the scrotal compartment to a typical dependent position (Figure 3). The two scrotal wings were then rotated inferomedially behind the penis (Figure 4). In patients who underwent penoscrotal transposition repair as an integral part of a hypospadias repair, we followed the steps above: full penile degloving and penile curvature correction. In these cases, a tunica vaginalis flap was harvested from the testis and spread over the neourethra when indicated as part of the hypospadias repair. Figure 5 presents the final result at the end of surgery. All patients had one routine follow-up visit six months and one year after surgery. Subsequently, those without complications were advised to return to the clinic at age 12 to 13 years and at age 18 years upon the completion of adolescence or before recruitment into the army unless there were urological problems or dissatisfaction with the surgical or functional outcome. Figure 6 shows long-term follow-up after Penoscrotal transposition repair.

**Figure 1.**

*Drawing surgical landmark on external genitalia before surgery, lines of an incision around the root of the penis to elevate the transposed scrotum.*



**Figure 2.**  
*Designing the scrotal rotational flaps.*



**Figure 3.**  
*Complete dissection of scrotal flaps.*



**Figure 4.**  
*Scrotal flap rotated inferomedially.*



**Figure 5.**  
*Appearance of the scrotum at the end of surgery.*

**Figure 6.**

*An 18-year-old patient who underwent multiple surgeries with a long-term follow-up for 14 years post-operative.*



### Statistical analysis

Qualitative variables are presented as frequencies and percentages, while quantitative variables are presented as means  $\pm$  Standard Deviation (SD). All data were analyzed using the *Statistical Package for Social Sciences* (SPSS) by IBM software version 26.0.

**RESULTS**

A total of 29 patients who underwent PST repair using the Glenn-Anderson technique were included. Of those, 20 (69%) had complete SPT, while 9 (31%) had incomplete SPT variants. Demographic and patient characteristics by group are presented in Table 1.

In group I (n = 8), five patients (62%) underwent OIF hypospadias, and 3 (38%) had Long TIP urethroplasty. Two Clavien Dindo grade II complications were observed in this group; both cases developed wound infections which were treated by intravenous antibiotics. Three patients (38%) required re-operation for PST due to unsatisfactory cosmetic results at an average of two years after the first operation.

In group II (n = 18), eight patients (44%) underwent OIF repair, two (12%) had Long TIP urethroplasty, and the remaining eight (44%) underwent staged hypospadias repair. Two patients with Clavien Dindo grade II complications were observed in this group; both have had wound infections treated by intravenous antibiotics. Six patients presented with late complications secondary to urethral repair, including a buried penis in two patients (50%), urethrocuteaneous fistula in three (33%), and meatal stenosis in two patients (17%). Only one patient (5.5%) required secondary PST repair due to unsatisfactory cosmetic results two years following the original procedure.

In group III (n = 3), no postoperative complications were observed, and no additional procedures were required (Table 2).

According to severity of malformation, one (5%) patient with complete penoscrotal transposition had Clavien Dindo grade III following staged hypospadias repair; three (33%) patients with partial penoscrotal transposition had Clavien Dindo grade III following OIF hypospadias repair.

During a median follow-up of 13 years, satisfactory anatomical, cosmetic, and functional results were obtained in all patients, excluding a single post-pubertal patient from group II awaiting a re-do PST repair.

**DISCUSSION**

PST describes an improper anatomical relationship between the penis and the scrotum, in which the scrotum is viewed as being improperly positioned in reference to the penis. The surgical correction of PST is a very complex one. Although one of the most popular surgical techniques for PST repair is the Glenn and Anderson technique, data goes back to the seventies, and the medical literature on its usage and long-term results is scarce (6). In addition, the recent evolution in hypospadias surgical techniques has greatly influenced the approach to penoscrotal hypospadias repair and, as a result, PST surgery. At the beginning of our learning curve, most patients (group I) underwent long TIP hypospadias repair combined with penile curvature repair and simultaneous reconstruction of PST. A third of the patients in this group required re-intervention due to unsatisfactory cosmetic results. In the second and third groups, patients underwent PST repair as a separate step of hypospadias repair or as an isolated condition, resulting in a better outcome than patients from the first group. We have attributed this to the fact that the repair of PST was carried out as a stand-alone procedure, and nowadays, therefore, we do recommend proceeding with PST reconstruction as a separate last stage of male genitoplasty following curvature repair and urethroplasty. As we have aforementioned, it is essential to perform a meticulous dissection of the rotational advancement flaps of the scrotum, leaving the dorsal penile skin connected to the skin of the mons pubis.

In some cases, complete detachment of the testis on both sides is essential to reach full mobility of the scrotal flaps and to bring them into regular dependent positions below the penile shaft. By using this technique as a separate step of male genitoplasty, we preserve the blood supply to the urethra and do not jeopardize the blood supply of the penile shaft skin. Being penile edema, one of the most common complications of PST repair (7), we recommend reserving a bridge of the dorsal penile skin during a single and staged repair procedure. We believe this maneuver avoids the development of penile edema, speeds overall recovery, and enhances early hospital discharge.

We have previously published data on the re-intervention rates in post-pubertal patients after pre-pubertal hypospadias repair (8). Approximately 5% of all patients with satisfactory outcomes of hypospadias surgery during childhood required re-intervention after they reached puberty. One of the major drawbacks of all studies on PST repair is a lack of long-term data. In this study, 21 patients (72%) have reached puberty, and 16 (55%) com-

**Table 1.**  
*Patients characteristics.*

	Group I (n = 8)	Group II (n = 18)	Group III (n = 3)
Median age at 1 <sup>st</sup> surgery (months)	18 ± 10	79 ± 48	78 ± 51
Preoperative testosterone, %(n)	12.5% (1)	44.4% (8)	0%
Additional anomalies, %(n):	62.5% (5)	44.4% (8)	66.6% (2)
Undescended testis (Rt./Lt./Bilateral)	3/0/2	2/0/6	1/0/1
Inguinal hernia	11.1% (2)	25% (2)	100% (3)
Chordee	87.5% (7)	66.6% (12)	0%
Micropenis	0%	5.5% (1)	0%
Heart anomalies	0%	5.5% (1)	0%
Kidney anomalies	0%	0%	0%
Chromosomal anomalies, %(n)	12.5% (1)	11.1% (2)	0%

**Table 2.**  
*Operation type and post-operative complication (Clavien-Dindo classification).*

	Group I (n = 8)	Group II (n = 18)	Group III (n = 3)
1. Onlay Prepuccial island pedicle flap %(n)	62% (5)	44% (8)	0%
2. Long TIP hypospadias %(n)	38% (3)	12% (2)	0%
3. Staged hypospadias %(n)	0%	44% (8)	0%
Complication %(n)	62.5% (5)	16.6% (3)	0%
Grade I	0%	0%	
Grade II	25% (2)	11% (2)	
Grade III	37.5% (3)	5.5% (1)	

pleted their puberty period with sufficient post-pubertal follow-up. Of those, one patient from group II is waiting for re-intervention due to poor functional results. We believe that our modification of the Glenn Anderson technique, allowing an extensive dissection of the scrotal folds without jeopardizing blood supply and preserving skin integrity, as well as the separation of PST surgery from hypospadias and curvature repair, provides the best solution for PST patients with durable long-term results. This surgical approach is entirely different from another popular technique for PST repair, proposed by *Mark and his colleagues*, stating that the penis and not the scrotum were mispositioned (9).

In their technique, after penile straightening, the penis is transferred into a button-hole designed in the skin of the mons-pubis. We have had minimal experience with this technique at the beginning of our learning curve and have witnessed tethering of the scrotum to the ventral penile surface in one case and buried penis in the second case. Therefore, we have omitted this technique from our surgical armamentarium. Since our experience with this technique is very limited, we have not found it appropriate to compare both methods, but only to mention it for the sake of discussion.

Our study is not without limitations, which need to be mentioned. This a retrospective observation that suffers all the flaws of this kind of study. We have reported our outcome only on a single surgical technique and mentioned our dissatisfaction with other techniques in the discussion section. However, we do report one of the longest follow-ups on PST repair in the literature with durable post-pubertal data. We could not provide any data on the sexual function of our patients following PST repair. Still, we do believe that will not be different from our previously published data regarding the sexual and voiding status of the patients who underwent hypospadias repair (10). We did not use any validated questionnaire or objective criteria for cosmetic appearance after surgical correction. However, 55% of our patients are capable of expressing their own satisfaction with the appearance of external genitalia, and the success of the operation was defined based on the patients and not the surgeons' or parents' satisfaction with the surgical outcome. Of course, missing data on the sexual and voiding status of these patients will be a subject of our future studies.

## CONCLUSIONS

PST is a rare genital anomaly with a broad spectrum of presentation, often associated with other anomalies, mainly undescended testis and hypospadias. Surgically correcting these anomalies required a complex learning curve with different practice methods.

Our data show that penoscrotal transposition correction utilizing the modified Glenn-Anderson technique is a reliable and durable surgery in the pediatric population. These children require careful monitoring even in adolescence to ensure that no re-operation is needed. The sexual function and voiding status in these patients should be an objective of future studies.

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