

# OUTCOMES OF SINGLE-STAGE THIERSCH-DUPLAY TECHNIQUE WITH DARTOS FLAP REPAIR FOR MID AND DISTAL HYPOSPADIAS: A SEVEN-YEAR EXPERIENCE IN HOSPITAL PAKAR UNIVERSITI SAINS MALAYSIA (HPUSM)

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## ABSTRACT:

**Background:** Outcome data on single-stage Thiersch–Duplay hypospadias repair with dartos flap reinforcement from Malaysian centres are limited. **Objective:** To evaluate surgical, functional, and cosmetic outcomes of single-stage Thiersch–Duplay repair for mid and distal hypospadias at Hospital Pakar Universiti Sains Malaysia (HPUSM). **Methods:** This retrospective observational study reviewed hypospadias surgeries performed from January 2019 to December 2025. Among 65 cases, 21 underwent Thiersch–Duplay repair; 2 were excluded due to incomplete data, leaving 19 for analysis. Demographics, operative details, complications, and HOSE outcomes (parental telephone interview) were evaluated. **Results:** Mean age at surgery was  $6.74 \pm 4.90$  years. Distal hypospadias comprised 13 (68.4%) and midshaft 6 (31.6%); chordee was present in 10 (52.6%). Complications occurred in 5 (26.3%) patients: fistula 2 (10.5%), wound dehiscence 2 (10.5%), and hematoma 1 (5.3%). Revision surgery was required in 3 (15.8%). Mean HOSE score was  $14.58 \pm 1.50$ , with 15 (78.9%) achieving  $\text{HOSE} \geq 14$ . **Conclusion:** Single-stage Thiersch–Duplay repair with dartos flap reinforcement achieved favourable HOSE outcomes with acceptable complication rates at HPUSM.

**Key words:** Hypospadias; Thiersch–Duplay; dartos flap; HOSE score; Malaysia.

## INTRODUCTION

Hypospadias is among the most common congenital anomalies of the male genitalia, with a reported incidence of approximately 1 in 200–300

live male births. [1] It is characterised by an ectopic ventral urethral meatus and is frequently associated with ventral penile curvature (chordee) and incomplete preputial development. Distal and midshaft hypospadias constitute most cases and

are commonly managed surgically to restore functional voiding, penile straightness, and a satisfactory cosmetic appearance. [2]

The primary objectives of hypospadias repair are to achieve a straight penis, a terminally positioned and functionally competent meatus, a normal urinary stream, and a cosmetically acceptable penile appearance. Numerous reconstructive techniques have been developed, reflecting the complexity of achieving durable reconstruction while minimising postoperative morbidity. Contemporary surgical principles emphasise the preservation of the urethral plate, meticulous tissue handling, adequate vascular support, and tension-free tissue approximation. [3]

The Thiersch–Duplay technique remains one of the foundational urethral plate–based methods in hypospadias reconstruction. [4] This procedure involves tubularising the native urethral plate over a catheter to create a neourethra, and it continues to be utilised in carefully selected patients with favourable urethral plate characteristics. Modern urethral plate–preserving approaches are conceptually derived from these principles.

An important refinement in contemporary hypospadias surgery is the use of a vascularised intermediate coverage layer, most frequently a dartos flap placed between the neourethra and the skin closure. [5] This layer separates overlapping suture lines, improves tissue perfusion, and reduces neourethral breakdown, thereby decreasing the risk of postoperative urethrocutaneous fistula formation. Nevertheless, postoperative complications such as fistula formation, wound dehiscence, glans breakdown, meatal stenosis, and hematoma alongside the subsequent need for revision surgery remain clinically significant challenges. [6]

Correction of penile curvature (chordee) is primarily achieved through penile degloving and the careful release of ventral tethering tissues. This approach straightens the penis by freeing fibrous bands without extensive dissection, thereby

preserving surrounding vascular structures and maintaining urethral plate integrity. This technique is generally preferred for less severe curvature and serves as the initial step in chordee correction. [7]

Variations in reported outcomes are often attributed to differences in meatal location, the severity of chordee, glans configuration, urethral plate quality, surgeon experience, operative technique, and the duration of follow-up. To standardise outcome reporting, Holland et al. introduced the Hypospadias Objective Scoring Evaluation (HOSE), a validated scoring system that assesses meatal location, urinary stream, erection straightness, the presence of a fistula, and cosmetic appearance. [8,9]

At Hospital Pakar Universiti Sains Malaysia (HPUSM), hypospadias repairs are performed across the Urology, Paediatric Surgery, and Plastic and Reconstructive Surgery Units, depending on patient characteristics and institutional referral patterns. In contrast, the present study specifically evaluates a cohort of patients who underwent single-stage Thiersch–Duplay repair with dartos flap reinforcement performed exclusively by the Urology Unit. Published Malaysian and Southeast Asian data evaluating uniform, single-stage hypospadias repair techniques using standardised outcome assessments remain limited. [10]

Therefore, this study aimed to retrospectively evaluate postoperative complications, revision rates, and functional and cosmetic outcomes—using the HOSE scoring system—among patients who underwent single-stage Thiersch–Duplay hypospadias repair by the Urology Unit at HPUSM between January 2019 and December 2025.

## METHODOLOGY

This retrospective observational study was conducted at the Urology Unit of Hospital Pakar Universiti Sains Malaysia (HPUSM)—a tertiary academic referral centre in Kelantan, Malaysia—

covering the period between January 2019 and December 2025. The study aimed to evaluate postoperative outcomes, complication rates, and functional and cosmetic results following single-stage Thiersch–Duplay hypospadias repair reinforced with a dartos flap.

During the study period, a total of 65 hypospadias surgeries were performed at our institution, comprising 44 single-stage and 21 staged procedures. Within the single-stage cohort, 21 patients underwent a Thiersch–Duplay repair with dartos flap reinforcement. Two patients were excluded due to incomplete documentation, resulting in a final analytical cohort of 19 patients.

Eligible participants included male patients aged under 18 years who underwent primary single-stage repair for distal or midshaft hypospadias using the Thiersch–Duplay technique with dartos flap reinforcement. Patients with incomplete operative or follow-up data, including those with an inability to complete the post-operative scoring assessment, were excluded. Cases managed using alternative techniques (e.g., TIP, MAGPI, Byars, LABO, or Koyanagi), as well as staged or redo repairs, were omitted from this analysis.

All procedures were performed uniformly using the Thiersch–Duplay technique with preputial dartos flap reinforcement. Following penile degloving and the correction of ventral curvature where necessary, the lateral wings of the urethral plate were mobilised and tubularised over an appropriately sized urethral catheter to construct the neourethra. A vascularised flap was then harvested from the preputial dartos tissue while strictly preserving its vascular pedicle. This flap was transposed ventrally via a buttonhole manoeuvre and secured over the neourethral suture line to serve as an intermediate waterproofing layer prior to glansplasty and skin closure. The interposition of the dartos flap provided physical separation between the neourethral and skin suture lines, thereby enhancing tissue coverage and minimising the risk of urethrocutaneous fistula formation.

Data extracted from operative notes, inpatient records, and follow-up clinical documentation included demographic variables, hypospadias characteristics, operative details, follow-up duration, and postoperative complications. Complications were classified as early (<30 days) or late ( $\geq 30$  days); these included urethrocutaneous fistula, wound dehiscence, hematoma, meatal stenosis, and the subsequent requirement for revision surgery.

Functional and cosmetic outcomes were quantified using the Hypospadias Objective Scoring Evaluation (HOSE) system, which assesses meatal location, urinary stream, erection straightness, the presence of a fistula, and overall cosmetic appearance (maximum score of 16). Scores  $\geq 14$  were defined as excellent. HOSE assessments were completed via structured telephone interviews conducted with parents or legal guardians after obtaining verbal informed consent.

Data analysis was performed using IBM SPSS Statistics version 26.0. Continuous variables were summarised as means  $\pm$  standard deviations or medians, where appropriate, whereas categorical variables were expressed as frequencies and percentages. Subgroup comparisons between distal and midshaft hypospadias configurations were executed using the Mann–Whitney U test and Fisher’s exact test. Statistical significance was established at  $p < 0.05$ .

The study was conducted in strict accordance with the principles of the Declaration of Helsinki and was formally approved by the Human Research Ethics Committee of Universiti Sains Malaysia (JEPeM). Patient confidentiality was rigorously protected through the use of anonymised study identifiers and secure, password-protected digital data storage.

## RESULT

Of the 65 hypospadias surgeries reviewed at Hospital Pakar Universiti Sains Malaysia (HPUSM) between January 2019 and December 2025, 44 were single-stage repairs and 21 were staged procedures. Within the single-stage cohort, 21 cases involved the Thiersch–Duplay procedure. After accounting for the two exclusions detailed in the Methodology section, the final analysis focused on the remaining 19 patients.

The analytical cohort consisted entirely of Malay patients, who presented predominantly with distal hypospadias and concomitant chordee (Table 1). The mean operative duration was approximately 109 minutes, with an average postoperative hospital stay of 9.3 days and a mean follow-up duration exceeding 16 months (Table 1). No intraoperative complications were documented.

Postoperative complications occurred at a relatively low rate and were predominantly classified as early events. Urethrocutaneous fistula and wound dehiscence emerged as the most common adverse outcomes, whereas no cases of meatal stenosis were observed. A small subset of patients required subsequent revision surgery after an appropriate healing interval to optimise functional and cosmetic results (Table 3).

Functional and cosmetic outcomes were highly favourable, with the vast majority of patients achieving excellent overall Hypospadias Objective Scoring Evaluation (HOSE) scores (Table 2). Specifically, most patients achieved a glanular meatus, a straight urinary stream, and a straight erection. Furthermore, a high rate of fistula-free status was documented at the time of HOSE assessment, and the overall cosmetic appearance was predominantly rated as good or excellent (Table 2).

Subgroup analysis comparing outcomes between distal and midshaft hypospadias demonstrated no statistically significant differences. Favourable outcomes—including mean HOSE scores, success

rates, fistula occurrence, and revision requirements—were comparable between both groups, indicating consistent surgical efficacy regardless of the initial meatal location (Table 4).

## DISCUSSION

Hypospadias reconstruction remains technically challenging because successful repair requires the restoration of urethral continuity, orthotopic meatal positioning, penile straightness, and a satisfactory cosmetic appearance, while simultaneously preserving tissue vascularity and minimising wound tension. Despite substantial advances in surgical techniques, urethrocutaneous fistula, wound dehiscence, and glans breakdown remain the principal causes of postoperative morbidity following hypospadias repair. [11]

In this retrospective single-centre series, Thiersch–Duplay hypospadias repair with dartos flap reinforcement achieved satisfactory functional and cosmetic outcomes in selected patients presenting with distal and midshaft hypospadias. The Thiersch–Duplay principle of urethral plate tubularisation remains fundamental in modern hypospadias surgery, as preservation of the native urethral plate maintains epithelial continuity, vascular integrity, and tissue compliance. [12] Contemporary urethral plate-preserving procedures are conceptually derived from these reconstructive principles. Patient selection within this cohort was restricted to anatomically favourable distal and midshaft defects with preserved urethral plate characteristics, consistent with current recommendations advocating individualised surgical planning based on meatal position, glans configuration, urethral plate quality, and the severity of ventral curvature.

The incorporation of vascularised dartos flap coverage represents an important adjunctive modification intended to reduce neourethral breakdown by separating overlapping suture lines and augmenting local tissue vascularity. [13] Nevertheless, the protective effect of dartos reinforcement is not absolute. In the present series,

urethrocutaneous fistula remained the most common complication despite routine flap utilisation, underscoring the multifactorial pathophysiology underlying wound failure following hypospadias reconstruction. Fistula formation is likely associated with compromised tissue vascularity, distal suture-line tension, local infection, haematoma formation, catheter-related trauma, and intrinsic tissue quality. [14] Excessive tension at the distal neourethra may impair microvascular perfusion and predispose the tissue to focal ischaemia, particularly in the glanular region. Similarly, excessive dartos mobilisation or over-rotation of the flap may compromise its perfusion, thereby reducing its protective efficacy. These findings reinforce the clinical importance of meticulous surgical technique, atraumatic tissue handling, and the preservation of vascular integrity throughout the reconstruction process.

The wound and glans dehiscence rates observed in this cohort align with the recognised biomechanical vulnerability of the distal repair. Distal glanular closure is subjected to significant mechanical stress because of limited local tissue volume, postoperative oedema, a narrow glans configuration, and catheter-related pressure effects. Inadequate glans mobilisation and excessive closure tension may impair tissue perfusion and ultimately predispose the patient to wound separation. [15] These observations support the importance of extensive glans wing mobilisation, tension-free glanuloplasty, appropriate neourethral calibration, and the minimisation of bulky interposed tissue beneath the distal closure.

Although postoperative haematoma and infection were uncommon in this study, both remain biologically important because they can contribute to secondary neourethral breakdown. [16] Notably, no cases of meatal stenosis were identified in this cohort. Meatal stenosis is generally considered to result from factors such as excessive distal tubularisation, impaired epithelialisation, local ischaemia, or cicatricial healing during neomeatal maturation. [17] While

the absence of stenosis in our cohort may reflect careful distal urethral calibration and the preservation of distal vascularity, it is crucial to recognise that the mean follow-up duration of 16.5 months may be insufficient to detect late-presenting strictures or stenosis. Therefore, the 0% meatal stenosis rate reported here should be interpreted with caution, as long-term follow-up may reveal delayed complications that were not captured during the current study window.

One of the principal strengths of this study is the incorporation of the Hypospadias Objective Scoring Evaluation (HOSE), a validated instrument assessing both functional and cosmetic outcomes following hypospadias repair. [18] The high proportion of patients achieving HOSE scores  $\geq 14$  suggests that Thiersch–Duplay repair with dartos reinforcement can achieve satisfactory reconstructive outcomes in appropriately selected patients. Comparable studies similarly demonstrate that successful hypospadias reconstruction should be evaluated using combined functional and aesthetic endpoints rather than relying on complication rates alone.

This study also contributes important, technique-specific outcome data within the Malaysian setting, where previously published reports frequently combine heterogeneous reconstructive approaches and lack standardised outcome assessment methodologies. Restricting our analysis to a single reconstructive technique and incorporating a validated HOSE assessment improves data interpretability and may facilitate future inter-institutional benchmarking.

Several limitations merit consideration. The retrospective design introduces a susceptibility to selection bias and incomplete operative documentation; consequently, important anatomical and technical variables were not uniformly available for analysis. Furthermore, telephone-based HOSE assessment may underestimate subtle functional abnormalities and introduces potential recall bias. Additionally, the cohort size was limited, and the follow-up duration

may be insufficient to evaluate delayed complications, such as recurrent curvature during puberty, urethral stricture formation, and long-term psychosexual outcomes. Given these parameters, these short-term outcomes primarily reflect preliminary institutional experiences rather than definitive long-term outcomes.

## CONCLUSION

In conclusion, single-stage Thiersch–Duplay repair with dartos flap reinforcement for distal and midshaft hypospadias at HPUSM demonstrated favourable functional and cosmetic outcomes. The majority of patients achieved excellent HOSE scores with manageable postoperative complications, supporting the continued use of this technique in appropriately selected patients. However, given the limited sample size and relatively brief mean follow-up duration of 16.5 months, these preliminary findings should be interpreted with caution. Further prospective studies with larger patient cohorts and extended follow-up remain necessary to firmly establish the long-term safety, durability, and efficacy of this technique over time.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the conduct of this study or the preparation of this manuscript.

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**TABLE LEGENDS:**

Table 1. Case flow and baseline characteristics of the analysed cohort (Thiersch–Duplay)

**A) Case flow / surgical approach (overall hypospadias workload, N = 65)**

Category	n
Total hypospadias surgeries	65
Single-stage repairs	44
Thiersch–Duplay (performed)	21
Excluded due to incomplete data	2
Thiersch–Duplay included in analysis	19
Other single-stage techniques (TIP, MAGPI, Byars, LABO, Koyanagi)	23
Staged repairs	21
First-stage repair	10
Second-stage repair / Redo hypospadias repair	11

**B) Baseline characteristics of analysed Thiersch–Duplay cohort (n = 19)**

Variable	Value
Hypospadias type, n (%)	
Distal	13 (68.4%)
Midshaft	6 (31.6%)
Ethnicity, n (%)	
Malay	19 (100.0%)
Age at surgery (years)	
Mean $\pm$ SD	6.74 $\pm$ 4.90
Median	6.0
Chordee, n (%)	
Present	10 (52.6%)
Absent	9 (47.4%)
Associated anomalies, n (%)	
Present	1 (5.3%)
Absent	18 (94.7%)
Operative / perioperative variables	
Duration of surgery (minutes), mean $\pm$ SD	109 $\pm$ 36
Catheter size used (Fr), mean $\pm$ SD	9.5 $\pm$ 2.7
Duration of catheter (days), mean $\pm$ SD	9.0 $\pm$ 4.0
Length of hospital stay (days), mean $\pm$ SD	9.3 $\pm$ 2.4
Duration of follow-up (months), mean $\pm$ SD	16.5 $\pm$ 15.4

**Note:** Two Thiersch–Duplay cases were excluded due to incomplete data; therefore, the analysed cohort comprised 19 patients.

Table 2. Intraoperative and postoperative outcomes (n = 19)

<b>Intraoperative and Postoperative Outcomes</b>	<b>n (%)</b>
Intraoperative complications	0 (0.0%)
Postoperative complications	
Early (<30 days)	4 (21.1%)
Late (>30 days)	1 (5.3%)
Type of postoperative complication	
Urethrocutaneous fistula	2 (10.5%)
Wound dehiscence	2 (10.5%)
Hematoma	1 (5.3%)
Meatal stenosis	0 (0.0%)
Revision surgery required	3 (15.8%)

Table 3. HOSE outcomes summary (n = 19)

<b>HOSE Outcomes</b>	<b>n (%) / Mean ± SD</b>
Meatal location	
Glanular	16 (84.2%)
Subcoronal / distal shaft	3 (15.8%)
Urinary stream	
Single, straight stream	16 (84.2%)
Spraying	3 (15.8%)
Erection straightness	
Straight	17 (89.5%)
Mild curvature	2 (10.5%)
Fistula presence	
Absent	17 (89.5%)
Present	2 (10.5%)
Cosmetic appearance	
Excellent	6 (31.6%)
Good	11 (57.9%)
Fair / lower	2 (10.5%)
Total HOSE outcome score	
Mean ± SD	14.58 ± 1.50
≥14 (Excellent)	15 (78.9%)
<14 (Suboptimal)	4 (21.1%)

Table 4. Subgroup analysis of outcomes by hypospadias type

<b>Outcome measure</b>	<b>Distal (n = 13)</b>	<b>Midshaft (n = 6)</b>	<b>P-value</b>
Total HOSE score (mean)	14.38	15.00	0.888 <sup>a</sup>
HOSE $\geq$ 14	9/13 (69.2%)	6/6 (100.0%)	0.255 <sup>b</sup>
Fistula rate	2/13 (15.4%)	0/6 (0.0%)	1.000 <sup>b</sup>
Revision surgery rate	3/13 (23.1%)	0/6 (0.0%)	0.517 <sup>b</sup>
Any complication rate	4/13 (30.8%)	1/6 (16.7%)	1.000 <sup>b</sup>

<sup>a</sup> Mann–Whitney U test; <sup>b</sup> Fisher’s exact test