ENDOVASCULAR MANAGEMENT OF TRAUMATIC LUMBAR ARTERY HEMORRHAGE FOLLOWING VERTEBRAL BURST FRACTURE IN NONAGENARIAN

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ABSTRACT:
This report describes a case of lumbar artery haemorrhage secondary to vertebral fracture in an elderly patient treated with emergent endovascular embolization. A 91-year-old woman presented after a fall with hypotension and back pain. Initial Focused Assessment with Sonography for Trauma (FAST) was negative. Contrast-enhanced computed tomography revealed multilevel vertebral fractures, active extravasation from the right L3 lumbar artery, and a large retroperitoneal hematoma. Emergency angiography confirmed active bleeding. Super-selective embolization using a Gelfoam-coil sandwich technique achieved complete haemostasis. The patient's hemodynamic status stabilized, and she recovered without further complications. This case highlights the importance of contrast-enhanced CT and the effectiveness of transcatheter arterial embolization in geriatric trauma.

Key words: Lumbar artery injury, retroperitoneal haemorrhage, geriatric trauma, vertebral fracture, transcatheter arterial embolization

INTRODUCTION

Vertebral fractures, particularly in elderly individuals following low-energy trauma such as domestic falls, are frequently encountered in emergency departments. While most vertebral fractures, including compression and burst fractures, are managed conservatively, they may occasionally be associated with vascular injuries that can lead to life-threatening consequences. Although rib fractures often dominate clinical attention in fall-related trauma, concomitant vertebral fractures may result in injury to adjacent vascular structures. Among these, lumbar artery injury is a rare but serious complication that may lead to retroperitoneal haemorrhage and hypovolemic shock if not promptly recognized and managed [1,2].

Focused Assessment with Sonography for Trauma (FAST) is a rapid bedside tool commonly used to detect hemoperitoneum, pleural and pericardial effusions, and, in experienced hands, major solid organ injuries involving the liver, spleen, or kidneys. However, its diagnostic utility is limited

for evaluating retroperitoneal structures, diaphragmatic injuries, and bony trauma [3]. In hemodynamically stable patients, contrast-enhanced computed tomography (CT) remains the imaging modality of choice because of its high diagnostic accuracy and ability to identify active arterial bleeding and associated injury patterns. When vascular injury is suspected, catheter angiography serves both diagnostic and therapeutic purposes. Super-selective transcatheter embolization allows precise localization and effective control of bleeding while minimizing the need for surgical exploration [4].

We report a case of lumbar artery haemorrhage secondary to vertebral fracture in a nonagenarian patient, highlighting the diagnostic limitations of FAST and the crucial role of contrast-enhanced CT and emergent endovascular embolization in achieving rapid haemostasis.

CASE REPORT

A 91-year-old woman presented to the emergency department following a fall at home with complaints of right-sided chest and lower back pain. On arrival, she appeared lethargic and was hypotensive, with bruising and tenderness over the right chest wall. No spinal tenderness or neurological deficit was identified. Laboratory analysis revealed lactic acidosis and a reduced haemoglobin level of 7.7 g/dL. FAST examination performed in the trauma bay did not demonstrate intra-abdominal free fluid.

Resuscitation was initiated, and bedside radiography demonstrated multiple right sided rib fractures and pleural effusion. Despite ongoing resuscitative measures, the patient's condition deteriorated with signs of hypovolemic shock. Urgent multiphase contrast-enhanced CT demonstrated multilevel vertebral compression fractures with an L2 vertebral body burst fracture associated with active arterial contrast extravasation from the right L3 lumbar artery and a large right-sided retroperitoneal hematoma (Figure 1).

The patient was transferred emergently to the angiography suite. Digital subtraction angiography (DSA) of the abdominal aorta confirmed active contrast extravasation from the right L3 lumbar artery (Figure 2). Given the rich anastomotic network of the lumbar arteries, selective DSA using a 4Fr Cobra catheter was performed on the right lumbar arteries one level above (L2) and one level below (L4) the target vessel, as well as the contralateral left L3 lumbar artery, both before and after embolization; no additional bleeding sources or collateral contribution to the haemorrhage were identified at any of these levels. Super-selective catheterization of the right L3 lumbar artery was then performed using a 2.7 French microcatheter (Progreat, Terumo, Japan) advanced coaxially through a 4Fr catheter system. Prior to embolization, selective DSA of the right L3 lumbar artery confirmed no radiculomedullary branch consistent with the artery of Adamkiewicz arising from the vessel. The Gelfoam–coil sandwich technique was executed in a stepwise manner: initially, a 2 mm × 5 cm pushable coil was deployed distally beyond the bleeding point to achieve distal mechanical occlusion; subsequently, small pledgets of gelatin sponge (Gelfoam) were instilled to fill the intervening segment and promote thrombosis; finally, two further pushable coil was deployed proximal to the bleeding point to complete the sandwich construct and prevent retrograde reconstitution. Post-embolization angiography demonstrated complete occlusion of the injured vessel with no residual contrast extravasation (Figure 2). Following the procedure, the patient's hemodynamic parameters stabilized, and serial haemoglobin monitoring demonstrated no further decline. The patient's clinical condition improved progressively, and she was discharged home after ten days of hospitalization.

This case highlights the importance of contrast-enhanced CT in identifying occult retroperitoneal bleeding in trauma patients with negative FAST findings and demonstrates the effectiveness of super-selective transcatheter embolization in achieving rapid haemostasis in elderly patients with lumbar artery injury.

DISCUSSION

The lumbar arteries typically arise in four pairs from the abdominal aorta and course laterally around the vertebral bodies from L1 to L4. At the level of the intervertebral foramen, each artery divides into dorsal and spinal branches supplying the spinal cord, paraspinal muscles, and surrounding structures [5].

Lumbar artery haemorrhage is a rare but recognized complication that may occur following trauma or various clinical interventions such as renal biopsies or spinal surgery. When associated with vertebral fractures, lumbar artery injury may result in significant retroperitoneal haemorrhage and hypovolemic shock. Because of the deep retroperitoneal location of these vessels, early diagnosis can be challenging, particularly when clinical findings are subtle.

Previous reports have described lumbar artery rupture associated with vertebral fractures. Di Meglio et al. described a case of bilateral lumbar artery rupture following vertebral injury that was successfully managed with endovascular embolization [2]. Similarly, Lee et al. reported a patient who developed hypovolemic shock secondary to lumbar artery injury associated with a transverse process fracture, with successful recovery following angiographic embolization [1]. These reports highlight the importance of considering vascular injury in patients presenting with vertebral fractures and unexplained hemodynamic instability.

Transcatheter embolization is a valuable option in the management of traumatic arterial haemorrhage, particularly when the injured vessel is either non-critical for tissue viability or poses significant challenges to surgical access. Lumbar artery injuries typically satisfy both of these criteria. Owing to their deep retroperitoneal location and proximity to vital structures, surgical exposure is technically demanding and associated with increased operative risk. Furthermore, exploration of a retroperitoneal hematoma may disrupt the intrinsic tamponade effect of surrounding tissues and worsen haemorrhage. In contrast, image-guided embolization allows precise localization and occlusion of the bleeding vessel with reduced morbidity and rapid hemodynamic stabilization [6].

The choice between selective and non-selective embolization depends on factors such as vessel anatomy, accessibility, and the urgency of haemorrhage control. Selective embolization enables targeted occlusion of the bleeding vessel while preserving adjacent vascular territories [7]. In the present case, super-selective cannulation of the right L3 lumbar artery allowed distal embolization, reducing the risk of non-target embolization and potential neurological complications.

A critical consideration during embolization of lumbar or segmental arteries is the potential presence of radiculomedullary branches supplying the spinal cord, particularly the artery of Adamkiewicz. This vessel represents the dominant arterial supply to the anterior thoracolumbar spinal cord and most commonly arises from posterior intercostal or lumbar arteries between the T8 and L1 vertebral levels, typically on the left side [8]. It subsequently joins the anterior spinal artery and demonstrates a characteristic hairpin configuration on angiographic imaging [9]. Despite its typical origin between T8 and L1, anatomical variation of the artery of Adamkiewicz necessitates careful angiographic evaluation before embolization, as inadvertent embolization may result in spinal cord ischemia and devastating neurological complications [10]. Digital subtraction angiography of the lumbar segmental arteries was therefore performed before embolization, and no radiculomedullary branch consistent with the artery of Adamkiewicz was identified arising from the L3 lumbar artery, allowing safe super-selective embolization. The choice of embolic agents depends on factors such as vessel size, accessibility, and the need for durable occlusion. Commonly used embolic materials include gelatin sponge, polyvinyl alcohol particles, and metallic coils [3]. In this case, a Gelfoam–coil sandwich technique was employed. This technique involves

a sequential, layered deployment of embolic material: first, a metallic coil is deployed distally beyond the bleeding point to achieve distal mechanical occlusion; second, Gelfoam pledgets are instilled into the intervening segment to promote thrombosis and fill the vascular space; and third, proximal coil is deployed proximally to prevent retrograde reconstitution and complete the sandwich construct. This combined approach provides durable haemostasis by occluding the vessel both proximal and distal to the injury, while the interposed Gelfoam augments thrombosis and reduces the risk of rebleeding compared with either agent alone [4].

CONCLUSION

Lumbar artery injury is a rare but potentially life-threatening complication of vertebral fractures. In trauma patients presenting with unexplained hemodynamic instability and negative FAST findings, retroperitoneal haemorrhage should be considered. Contrast-enhanced CT plays a critical role in identifying vascular injury, while endovascular embolization provides a rapid and minimally invasive method for achieving haemostasis. Careful angiographic evaluation to exclude spinal cord-supplying branches is essential to minimize the risk of neurological complications during embolization.

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FIGURE LEGENDS:

Figure 1: Contrast enhanced CT showed arterial contrast extravasation (blush) (yellow arrow) (A) and pooling of contrast in the delayed phase (yellow arrow) (B) likely from the right L3 lumbar artery coursing adjacent to the L2 vertebral body (yellow arrow head) (C) with right retroperitoneal hematoma (white arrow) (A,B,). Generalized osteopenic bones, with multilevel compression fractures and L2 burst fracture(D).

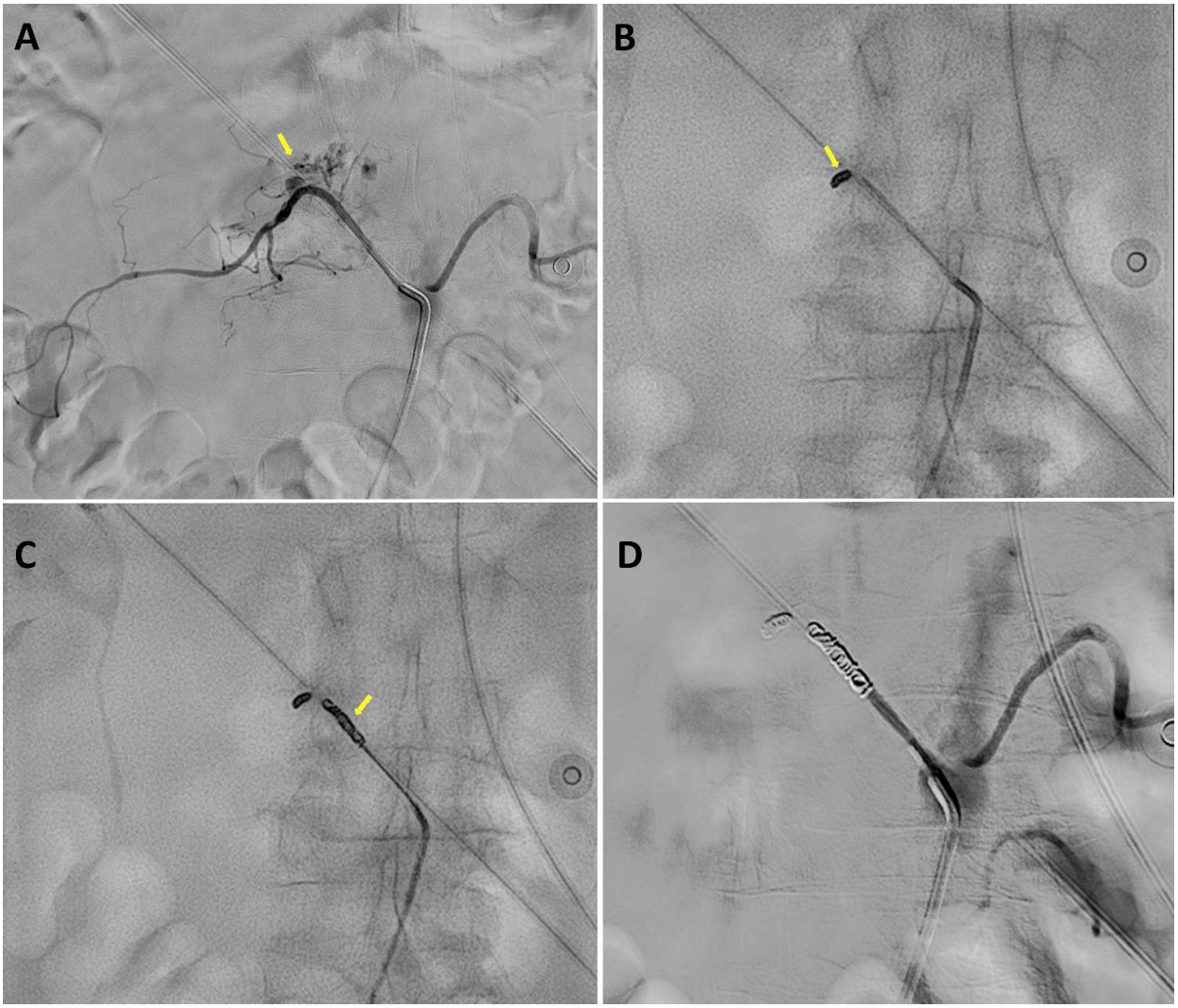

Figure 2: Digital subtraction angiography (DSA) of the right L3 lumbar artery demonstrating active contrast extravasation (yellow arrow)(A). Microcatheter positioned within the right L3 lumbar artery with placement of the proximal pushable coil(yellow arrow)(B). Deployment of two proximal pushable coils following Gelfoam instillation (yellow arrow) (C). Post-embolization DSA confirming satisfactory occlusion of the right L3 lumbar artery with no residual contrast extravasation following the completed coil–Gelfoam–coil sandwich construct (D).

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 ± 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 ± 1.50, with 15 (78.9%) achieving HOSE ≥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 (≥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 ≥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 ± 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 ≥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 ± SD	6.74 ± 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 ± SD	109 ± 36
Catheter size used (Fr), mean ± SD	9.5 ± 2.7
Duration of catheter (days), mean ± SD	9.0 ± 4.0
Length of hospital stay (days), mean ± SD	9.3 ± 2.4
Duration of follow-up (months), mean ± SD	16.5 ± 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)

Intraoperative and Postoperative Outcomes	**n (%)**
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)

HOSE Outcomes	**n (%) / Mean ± SD**
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

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

[a] Mann–Whitney U test; [b] Fisher's exact test

THE FORGOTTEN SENTINEL: A COMPREHENSIVE SERIES OF RARE SPONTANEOUS STENT FRAGMENTATIONS IN NEGLECTED URETERIC STENTS

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ABSTRACT:
Spontaneous stent fragmentation with encrustation is a rare complication of neglected ureteric stent offering a unique endourological challenge often requiring complex, staged or concurrent procedure for complete clearance. This study aims to evaluate the clinical presentation, surgical management strategies and outcomes of patients presenting with uncommon neglected and fragmented ureteral stents.

INTRODUCTION

Ureteric stents play a crucial role in urology services worldwide with use ranging from emergency ureteric calculi or tumor obstruction decompression, stricture bypass, prophylaxis for gynecology or colorectal operations, pre operative ureteric calibration for retrograde intrarenal surgeries.[1] Though it is a modern-day wonder, long term indwelling beyond 3 months risks secondary stone formation, chronic infection ,and obstructive uropathy.[2] A very rare complication of neglected stent are stent fragmentations which reported ranging from 0.3% to 0.5%[3-11]. We present 4 cases of spontaneous ureteral stent fragmentation from the year 2022-2025 and review of literature to understand better on their presentation, risk factors, management strategy and outcome to better understand a rare complication.

Case 1

A 40-year-old foreign national presented to the clinic initially with left loin to groin pain and fever for 2 days to emergency. X-ray noted that the patient had a coiled encrusted stent stone in his kidney and a column of encrusted stent with stone in the left ureter. Further history noted that the patient had endoscopic stone retrieval in his home

country 6 years ago and was not informed on the stent placement post operation. He missed his further follow up when he came to Malaysia for work purposes. The patient underwent emergency left retrograde pyelogram and stenting to decompress his left kidney for left obstructive uropathy and required antibiotics for 2 weeks. Patient had a 2- step operation to remove the stent fragments. He had initial left ureteroscopy with 7Fr semirigid ureteroscope in lithotomy position followed by prone percutaneous nephrolithotomy. Operation was challenging as the ureter was tight and mucosa was edematous. Post operatively the patient developed septic shock which required noradrenaline support and intensive care unit close monitoring for 1 week. The patient had ureteral catheter intubated in the left ureter post operation to prevent further complication and this was subsequently removed prior to discharge.

Case 2

A 50-year-old patient with a history of right proximal ureteric and renal stone for 5 years missed out on her follow up and defaulted subsequently. She presented back with passing out blood and foreign body in urine to emergency. Xray imaging noted her right stent fragmented into 3 pieces with missing distal coil likely passed out in her urine. The patient was admitted to ward following which she underwent endoscopic removal of stone and the stent fragments with flexible ureteroscope 9Fr. Operating and removing the renal coil was challenging due to the encrusted coil which was released with holmium laser energy.

Case 3

A 68-year-old man with an underlying gout and history of rectal malignancy 6 years ago in remission presented with right flank pain and dysuria to the emergency department. Xray noted heavily encrusted 3-part stent fragments in the right kidney right ureter and bladder. Further history from the patient noted that he had right ureteric stenting for right obstructive uropathy secondary to rectal malignancy compression and this stent was not removed after treatment for the rectal tumor 5 years ago. CT urogram noted right kidney was grossly enlarged with thinned out cortex and subsequent functional scan noted a nonfunctioning right kidney. The patient underwent 2 stage operation where he had percutaneous vesicolithotripsy and distal stent fragment removal followed by open right nephrectomy for nonfunctional kidney and removal of rest of the stent fragments. Stone analysis later showed predominantly uric acid content of the stone.

Case 4

A 40-year-old female patient presented with dysuria. Initial imaging noted a 4-part fragment of the right ureteric stent with heavy encrustation of the proximal 2nd coil and distal coil forming a bladder stone. This patient was followed up in another center previously for endometriosis with right obstructive uropathy for which she had a right ureteric stent inserted 4 years ago. She missed out on her subsequent appointments for the stent change. Her functional scan shows a right functioning kidney at 30% with moderate obstructive uropathy on CTU plain. This patient was co-managed with the gynaecology team where an initial right nephrostomy tube was inserted. She underwent vesicolithotripsy followed by an attempt to remove right ureteric and renal stone which was difficult due to stricture at the vesicoureteric junction. The patient subsequently underwent right antegrade percutaneous removal of renal and proximal ureteric stent fragments. Another combined operation was done with the gynecology team where on table ureterolysis and open removal of ureteric stent and ureteric reimplantation of distal ureter was done.

DISCUSSION

3 out of 4 patients in this series (75%) had complication with neglected polyurethane stent which has 76.3% risk of encrustation and 0.3% risk of fragmentation with indwelling time more

than 12 weeks[12].We report one of few silicone ureteric fragmentation in literature as silicone consistently demonstrates a lower incidence of mineral deposition and structural degradation compared to polyurethane.[13][14] Majority of the patients in this study presented with significant renal function deterioration with one patient ending up with non-functioning kidney. This is attributed to persistent ureteral obstruction due to fragment encrustation luminal narrowing which ultimately limits urinary drainage and elevates retrograde pressure.[15] Interestingly, the patients in this series experience stent neglect during the period of coronavirus pandemic which occurred from the year 2020-2023.Worldwide "healthcare shock" attributed to delayed healthcare access, limited elective operative time and prolonged indwelling stent duration beyond recommended indwelling time.[16] This is preventable by the use of extraction strings, robust low technology tracking such as phone message alert on stent expiry and physical stent passport.[17] Operation was challenging with a multistep approach and multidisciplinary team involvement. Post operative sepsis is an expected complication due to micro biofilm formation, endotoxin release during intervention procedure and pyelovenous inflow with ureteric irrigation pressure exceeding 30mmHg.[18] can be reduced with preoperative decompression with percutaneous nephrostomy urine culture directed antibiotics pre operatively, and staged endourological procedures. [19]

CONCLUSION

Stent fragmentation encrustation is a rare complication of neglected ureteric stent which carry significant morbidity to patients pertinent to renal function deterioration and urosepsis risk. Management requires planned staged intervention to reduce operative complications and prevention is possible with low technology tracking and reminding systems.

CONFLICTS OF INTEREST

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FIGURE LEGENDS:

Figure 1: showing x-ray of case 1 with encrusted proximal coil and mid stent fragmentation encrustation. To note here is the missing distal coil on the imaging.

Figure 2: Image 2 depicting the x-ray of case 2 with 3 stent fragments with proximal renal stone and minimal encrustation to the proximal coil.

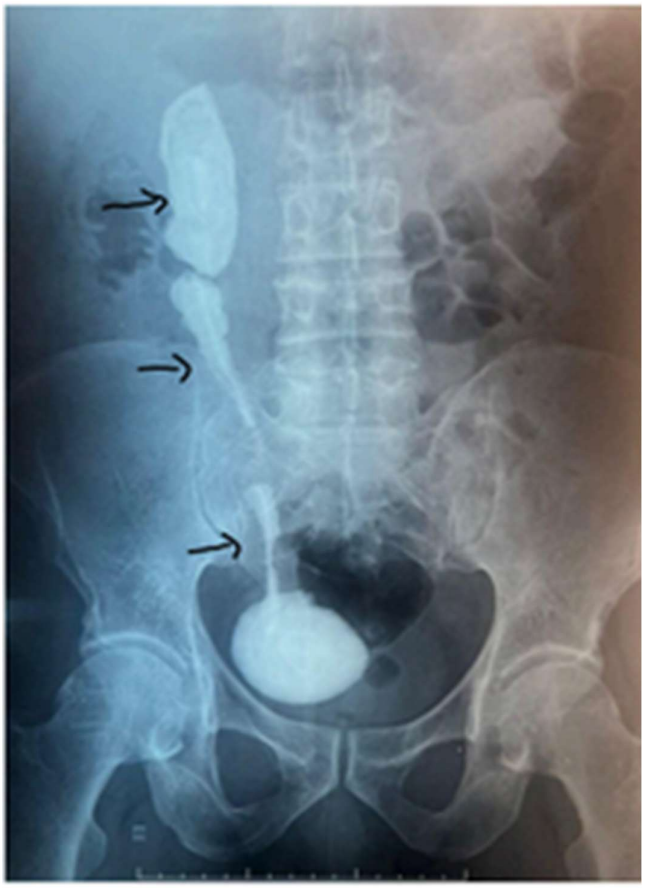

Figure 3: Image 3 depicting the 3 parts heavily encrusted ureteric and bladder stent.

Figure 4: Image 4 showing the 4-part fragment of the right ureteric stent fragments.

	Case 1	Case 2	Case 3	Case 4
Age /Sex	40/Male	50/Female	68/Male	40/Female
Indication for stent insertion	Post operative edema	Right ureteric obstruction	Relief obstructive uropathy secondary to rectal malignancy compression	Relief obstructive uropathy secondary to endometriosis compression
Stent Material	Polyurethrane	Silicone	Polyurethane	Polyurethane
Duration of stent neglect(years)	6	5	6	4
Presentation	Left flank pain ,fever	Heamaturia and stenturia	Right flank pain and dysuria	Stenturia
Renal Function(Chronic Kidney Disease Stage)	Deranged (3a)	Normal	Deranged(3a)	Deranged(2)
Forgotten Encrusted Classification (FeCAL)	4	1	5	4
Technique of retrieval	Ureteroscopy & percutaneous nephrolithototomy	Ureteroscopy	Percutaneous vesicolithotripsy and nephrectomy	Vesicolithotripsy, percutaneous nephrolithotomy and open removal of distal ureteric fragment and ureteric reimplantation
Post operative complication(clavien dindo)	4	3b	3b	3b

Table 1: Patient summary containing demography, stent indication, stent material, presentation to emergency, renal function at presentation, level of encrustation, operative technique of retrieval & post-operative complications.