

Article

# A 10-Year Multicentre Experience of Australian Penile Fracture Repair Outcomes

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**Abstract: Objectives and Methods:** Penile fractures are a urologic emergency involving the rupture of the tunica albuginea of the corpora cavernosum. Geography is known to impact fracture aetiology, and higher impact aetiology is thought to predispose patients to complex trauma. To review long-term urinary and sexual outcomes following fracture repair in Australia, a retrospective analysis of data from three metropolitan hospital services over 10 years was performed. Only patients with intraoperatively confirmed fractures were included. Patients were contacted by clinicians to complete a survey, which utilised validated questionnaires, including the International Index of Erectile Function-5 (IIEF-5) and the International Prostate Symptom Score (IPSS). Perioperative data were analysed against survey responses. **Results:** We identified 55 confirmed penile fractures. Twenty-one patients completed questionnaire follow-ups, comprising the study cohort. The median age at the time of the injury was 44.8 years (range: 25–65). The median time from injury to questionnaire completion was 4.0 years (range: 1–10). Furthermore, 95.5% (20) of the injuries occurred during sexual intercourse. The median IIEF-5 score was 23 (range: 5–25); the median IPSS score was 5 (range: 0–22). Seven patients (33.3%) sustained a bilateral cavernosal injury, and eight (38.1%) sustained a urethral injury. Upon conducting a Mann–Whitney U test, no significant relationships were found between bilateral cavernosal injury and IIEF-5 scores ( $p = 0.7377$ ) or urethral injury and IPSS scores ( $p = 0.5338$ ). **Conclusions:** The Australian aetiology of penile fractures appears consistent with that of other Western countries, with subsequent high rates of bilateral cavernosal and urethral injuries. The long-term erectile and urinary function outcomes observed are promising. A larger prospective study would further illuminate the relationship between injury factors and outcomes, revealing information not presented herein due to study limitations relating to the cohort size and follow-up rates.



**Citation:** Yii, M.; Gan, C.; Qin, K.R.; Bolton, D.; Blecher, G. A 10-Year Multicentre Experience of Australian Penile Fracture Repair Outcomes. *Soc. Int. Urol. J.* **2024**, *5*, 10–15. <https://doi.org/10.3390/siu5010005>

Received: 30 April 2023

Revised: 27 August 2023

Accepted: 2 September 2023

Published: 13 February 2024



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**Keywords:** erectile dysfunction; urologic surgical procedures; penis/injuries; rupture/therapy; rupture/diagnosis; male

## 1. Introduction

Penile fractures are uncommon surgical emergencies, defined as the traumatic rupture of the tunica albuginea encasing the corpora cavernosum [1]. They are characterised by a sudden cracking noise, pain, rapid detumescence, and deformity [2]. The early exploration and repair of this pathology is acknowledged as the standard of care [1]. The aetiology of these injuries is understood to be subject to geographical and cultural variance [3], and greater impact mechanisms have been found to predispose patients to more complex trauma, namely, urethral and bilateral cavernosal injury [4]. We followed up 21 patients identified in three Australian metropolitan hospitals over a 10-year period via questionnaires to review the corresponding long-term sexual and urinary outcomes. Additionally, we aimed to investigate associations between injury factors and long-term outcomes.

## 2. Methods

A multicentre retrospective analysis was performed. Ethical approval was granted by the Australian National Health and Medical Research Council. Data were collected from three large metropolitan Victorian hospitals over a 10-year period between 2011 and 2021. Patients were identified using Medicare Benefits Schedule item coding and unit audits. The Medicare Benefits Schedule code used to identify patients was 37408—“PENIS, repair of laceration of cavernous tissue, or fracture involving cavernous tissue”. We reviewed operative reports via our medical records system and only included patients with intraoperatively confirmed penile fractures. All patients who were diagnosed as having penile fractures underwent operative management. Patients were contacted by clinicians from corresponding urology units to voluntarily complete a survey, primarily composed of validated questionnaires including the International Index of Erectile Function-5 (IIEF-5) and International Prostate Symptom Score (IPSS) [5,6]. There was a choice to complete the survey either via phone or an online survey system (REDCap v10.0.15, Nashville, TN, USA). Of the 55 patients identified, 21 patients completed questionnaire follow-ups. Once patients had consented to participate in this study and completed the follow-up, further perioperative data were gathered from the medical records. Data points captured included age at time of injury, mechanism, pre-operative imaging results, presence of urethral injury or unilateral/bilateral cavernosal injury, and length of stay. We then analysed the data against the questionnaire responses to explore the relationship between injury factors and postoperative outcomes.

Data were analysed with Graphpad Prism 9 software. Normality was assessed using D’Agostino and Pearson tests. To evaluate binary groups (e.g., presence vs. absence of urethral injury) with continuous outcomes (e.g., IPSS scores), the non-parametric Mann–Whitney U test was used due to a combination of a non-Gaussian distribution of outcomes and low case numbers. When comparing ordinal variables, Spearman analysis was used to determine the strength of a correlation.

## 3. Results

Fifty-five patients were identified over a 10-year time-period as having suffered penile fractures. All patients underwent repair and had intraoperatively confirmed penile fractures. In total, 38.2% ( $n = 21$ ) completed the questionnaire follow-up (Table 1). The median age at the time of the injury was 44.8 years (range: 20–65). The median time until the completion of the questionnaire was 4.0 years (range: 1–10). In total, 95.5% ( $n = 20$ ) of cases were secondary to sexual intercourse. A single case occurred from a gunshot wound that ruptured the corpus cavernosum.

**Table 1.** Presentation factors and operative findings regarding patients completing the questionnaire follow-up.

| Presentation Factors                     |                |                    |
|------------------------------------------|----------------|--------------------|
| Age at Presentation                      | median (range) | 44.8 (25–65) years |
| Aetiology                                | % ( $n$ )      |                    |
| Sexual intercourse                       |                | 95.5% (20)         |
| Gunshot                                  |                | 4.5% (1)           |
| Operative Findings                       |                |                    |
| Urethral injury                          | % ( $n$ )      | 38.1% (8)          |
| Bilateral cavernosal injury              |                | 33.3% (7)          |
| Urethral AND bilateral cavernosal injury |                | 23.8% (5)          |

For surgical access, subcoronal degloving incisions were used for 18 patients (85.7%), and targeted incisions were used for three patients (14.3%). There was significant heterogeneity in the suture material used for tunica albuginea repair, with polydioxanone (PDS II) being used in six cases (28.6%), Ti-Cron being used in five (23.8%), Prolene being

used in four (19.0%), Vicryl being used in three (14.3%), nylon being used in two (9.5%), and Ethibond being used in one (4.8%). Of the eight patients requiring urethral repair, only absorbable suture materials were used, with Vicryl being used in four cases (50.0%), Monocryl being used in two (25.0%), and PDS II and Vicryl Rapide being used in one case (12.5%) each.

The time from the moment of injury to arrival at an operating theatre could not be determined in four cases due to a lack of documentation. Of the 17 remaining cases, the median time taken to arrive at a theatre was 14.2 h (range: 3.7–86.0). Eight patients (38.1%) suffered a urethral injury when their fractures occurred, and seven (33.3%) had a bilateral cavernosal injury. Five (23.8%) had both urethral and bilateral cavernosal injuries. The median length of stay was one (range: 1–13) day. All the patients denied having prior issues with urinary and erectile function. Four patients reported penile curvature prior to their injury, and all four patients reported that pre-existing curvature did not affect sexual intercourse.

In the questionnaire follow-up, the median IIEF-5 score was 23 (range 5–25) (Table 2). Six (28.6%) patients were classified as having mild or more severe erectile function (IIEF-5 < 22). Two (9.5%) were found to have severe erectile dysfunction (IIEF-5 5–7). Eight (38.1%) subjectively described their erectile function as worse compared to that pre-injury. The median IPSS reported was 5 (range 0–22). Moderate or more severe urinary symptoms (IPSS > 7) were reported by 38.1% ( $n = 8$ ) of the patients; moderate symptomology (IPSS 8–19) was reported in seven cases, and severe symptomology was reported in one case. The patient whose injury was secondary to a gunshot wound had unilateral cavernosal disease without urethral injury; they described mild-moderate erectile (IIEF-5 = 16) and moderate urinary (IPSS = 19) symptomology. Of the 18 patients who denied having penile curvature prior to their injury, 11.8% ( $n = 2$ ) reported bent erections at the follow-up. Only one patient reported that the bend impeded sexual intercourse. A palpable penile lump was reported by 57.1% ( $n = 12$ ). Two (9.5%) patients were found to have developed urethral stricture, one of whom had suffered a urethral injury when their fracture occurred.

**Table 2.** Reported outcomes regarding urinary and sexual function following penile fracture repair.

|                                  |                |                 |
|----------------------------------|----------------|-----------------|
| Time to questionnaire completion | Mean (SD)      | 4.8 (2.7) years |
| IIEF-5 *                         | median (range) | 23 (5–25)       |
| No ED (22–25)                    | % ( $n$ )      | 66.6% (14)      |
| Mild ED (17–21)                  |                | 9.5% (2)        |
| Mild-moderate ED (12–16)         |                | 9.5% (2)        |
| Moderate ED (8–11)               |                | 4.8% (1)        |
| Severe ED (5–7)                  |                | 9.5% (2)        |
| IPSS *                           | median (range) | 4 (0–22)        |
| No/mild urinary symptoms (0–7)   | % ( $n$ )      | 61.9% (13)      |
| Moderate urinary symptoms (8–19) |                | 33.3% (7)       |
| Severe urinary symptoms (20–35)  |                | 4.8% (1)        |
| Palpable penile lump             |                | 57.1% (12)      |
| Urethral stricture               |                | 9.5% (2)        |
| New penile curvature             |                | 11.8% (2)       |
| Curvature impeding intercourse   |                | 5.9% (1)        |

\* IIEF-5 = International Index of Erectile Function-5. IPSS = International Prostate Symptom Score. \* All patients denied pre-injury urinary/sexual dysfunction. Four patients had pre-injury penile curvature.

For patients with a urethral injury ( $n = 8$ ), the median IPSS was 6.5 (range: 1–15). In the absence of urethral injury ( $n = 13$ ), the median IPSS was 4.0 (range: 0–22). The Mann–Whitney U test did not reveal any significant relationships between the presence of a urethral injury and IPSS scores ( $p = 0.5338$ ). Similarly, there were no significant relationships found between IIEF-5 scores and bilateral (median IIEF-5 = 22, range: 13–25,  $n = 7$ ) or unilateral (median IIEF-5 = 23.5, range: 5–25,  $n = 14$ ) cavernosal injury ( $p = 0.7377$ ).

No significant correlation was found between age and IPSS ( $\rho = -0.30$ , 95% CI:  $-0.66$ – $0.16$ ,  $p = 0.0934$ ) or IIEF-5 ( $\rho = -0.39$ , 95% CI:  $-7.1$ – $0.07$ ,  $p = 0.0844$ ) via Spearman

analysis in our cohort. No significant relationship found between IPSS and the presence (median IPSS = 6, range: 2–22) or absence (median IPSS = 4, range: 1–11) of penile lumps ( $p = 0.1981$ ). Additionally, IIEF-5 scores were found to have no significant relationship with the presence (median IIEF-5 = 22.5, range: 7–25) or absence (median IIEF-5 = 24, range: 5–25) of penile lumps ( $p = 0.8585$ ).

#### 4. Discussion

Early operative management has been established as the standard of care for penile fractures [7]. The results of meta-analyses of outcomes including long-term erectile function, curvature, and painful erections significantly favour early surgery over conservative management [1].

Surgical exposure is conventionally achieved via a subcoronal degloving incision [7]. However, some advocate for the use of pre-operative ultrasound to localise the tunica albuginea defects, allowing for smaller, targeted incisions to avoid degloving-related morbidity and circumcision [8]. In cases of urethral injury, primary urethroplasty may be performed with an absorbable suture over an in-dwelling catheter [9]. In these cases, the catheter may remain in for a period of weeks prior to a trial of void and a subsequent urethrogram.

A complicating factor when applying the pre-existing penile fracture data to a local population is the geographical variance of aetiology. The greatest volume of studies of long-term outcomes have come from Iran, which is reported to have the highest incidence of penile fractures in the world [10]. This is largely due to Taqaandan, a practice of intentional bending the shaft of the erect penis to achieve rapid detumescence. In an Iranian study of 352 patients, 76.4% of cases were secondary to Taqaandan, and only 7.9% were due to coital injuries [11]. In Western countries, the vast majority of penile fractures occur secondary to sexual intercourse [7]. Coital injuries accounting for 95.5% of the cases in this study is in keeping with this trend.

The importance of the varying aetiology is that higher impact mechanisms, such as sexual intercourse as opposed to manual manipulation, are thought to predispose patients to more complex trauma, such as urethral and bilateral cavernosal injuries [4]. This is reflected in the discrepancy between urethral injury rates, ranging from 0 to 3% in the Middle East to 30% in Western countries [7]. In a similar vein, a Brazilian study described a significant relationship between sexual position and fracture severity, with “man on top” and “doggy style” being found to be most associated with urethral and bilateral corpus cavernosal injuries [12]. In addition, it has been noted that the population of men in Western countries suffering penile fractures appears to be older, which may be reflective of Taqaandan practices in Middle Eastern countries being popular with adolescents [7]. Our median patient age of 44.8 years remains consistent with the dominant mechanism of our injuries. Despite no correlation being found between age and IIEF-5 or IPSS, the age of our cohort may account for some of the variation in our erectile and urinary outcomes in comparison to populations from other studies.

Whilst long-term data regarding erectile and urinary function have been reported previously, the prognostic impact of concomitant urethral or bilateral cavernosal injury on these outcomes is yet to be clearly defined. A systematic review found the rate of erectile dysfunction of any severity to be 21% following surgical repair [7]. Our marginally increased rate of 28.6% for six patients appears consistent with the worldwide cases considering the proportion of our cases caused by high-impact trauma and our rates of bilateral cavernosal injury—33.3% in our study compared to 21% internationally [7].

Similarly, the impact of urethral injury on long-term urinary outcome is not well established. It has been observed that around 30% of patients have urinary deterioration as assessed via IPSS following urethral reconstruction during penile fracture repair [4]. However, in contrast to erectile function, data on long-term urinary outcomes investigated via validated questionnaires or uroflowmetry are scarce. A London-based study following up 71 patients that observed a 27.6% rate of urethral injury found that only 2.6% of patients had voiding dysfunction (IPSS 5–19) at a median follow-up time of 13 weeks [8]. This

contrasts with our 38.1% rate of moderate or more severe urinary symptoms (IPSS > 7). Our median time for questionnaire completion, namely, 4.0 years (range: 1–10), may indicate an element of progressive urinary dysfunction.

The reported incidence of urethral strictures following penile fracture is low. Three per cent of cases were found to develop stricture post-fracture repair in a systematic review [7]. It is uncertain whether urethral injury significantly increases the risk of this complication. In a study involving 13 patients who underwent primary urethroplasty for a fracture with an associated urethral injury, no patients were found to develop stricture. All patients with abnormal IPSS > 7 or a reduced maximal urinary flow rate as determined via uroflowmetry underwent retrograde urethrography [9]. We found two patients (9.5%) that had urethral strictures following repair. Evaluation of this complication is likely impeded by poor follow-ups, lack of routine uroflowmetry, and inconsistent assessments of urinary symptoms. The true incidence may be underestimated.

In contrast to urethral strictures, the rate of penile nodules is high. In Zargooshi et al.'s study of 352 patients who underwent repair, 93.7% were found to have palpable lumps in a follow-up examination; nylon was used for repair in 47.2% of these cases, while the rest were treated with Vicryl [11]. It is still debated whether certain suture materials predispose patients to the formation of penile nodules. However, it must be noted that patients managed non-operatively for their fractures have still been found to commonly develop palpable nodules [11]. Our finding of penile lumps in 57.1% may be an underestimate in the absence of a physical examination. Regardless, this is a common complication that patients should be counselled on preoperatively.

The rarity of penile fractures makes it a difficult pathology to study. We acknowledge the limitations of our study secondary to its retrospective nature, follow-up rate of 38.2%, and variable follow-up times. Additionally, the subjective measurement of outcomes via questionnaire introduces the risk of recall bias. Another limitation is that the questionnaires only consisted of postoperative IIEF-5 and IPSS scores. However, the assessment of preoperative scores during the follow-up would have introduced the risk of further recall bias, as pre-existing urinary or sexual dysfunction may be under-recognised. Objective measurements such as uroflowmetric readings were not routinely acquired for patients in this study. Further, the health services' shift from paper-based to electronic documentation during the study period prevented the uroflowmetry results, if uroflowmetric analysis was performed, from being readily available to our researchers.

We contend that a prospective study including an evaluation of pre-morbid function at the time of injury in comparison to post-operative questionnaire/uroflowmetry would allow us to better appreciate the impact of injury factors on long-term outcomes.

## 5. Conclusions

Australian penile fracture aetiology and rates of urethral or bilateral cavernosal injury are in keeping with those of other Western countries. We found no significant relationships between urethral injury and urinary function or bilateral cavernosal injury and erectile function. We recommend performing a prospective study including an evaluation of pre-morbid function at the time of injury in comparison to post-operative questionnaires and uroflowmetry data. Also, patients should be informed that residual urinary and sexual dysfunction may occur despite surgical repair.

**Author Contributions:** Conceptualisation G.B. and M.Y.; methodology G.B., D.B. and M.Y.; software M.Y.; validation, G.B.; formal analysis, M.Y.; investigation M.Y., C.G. and K.R.Q.; resources M.Y., G.B. and D.B.; data curation, M.Y., C.G. and K.R.Q.; writing—original draft preparation, M.Y.; writing—review and editing, G.B. and D.B.; visualisation, M.Y.; supervision, G.B. and D.B.; project administration, M.Y., G.B. and D.B. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.



**Institutional Review Board Statement:** This study was conducted in accordance with the National Statement of Ethical Conduct in Human Research (2007) and was approved under the Victorian Streamlined Ethical Review Process by the Ethics Committee (approval number 69593, 27/09/21).

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** The datasets generated during and/or analysed during the current study are not publicly available due to the risk of patient identification in a small cohort with a rare pathology. However, data may be made available on reasonable request from the corresponding author.

**Acknowledgments:** We acknowledge the Urology units at Alfred Health, Monash Health, and Austin Health.

**Conflicts of Interest:** The authors declare no conflict of interest.

## Abbreviations

|        |                                            |
|--------|--------------------------------------------|
| IIEF-5 | International Index of Erectile Function-5 |
| IPSS   | International Prostate Symptom Score       |

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