



National Patterns of Urethral Evaluation and Risk Factors for Urethral Injury in Patients With Penile Fracture

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OBJECTIVE	To examine the epidemiology and timing of penile fracture, patterns of urethral evaluation, and risk factors for concomitant urethral injury.
MATERIALS AND METHODS	The National Inpatient Sample (2003-2011) was used to identify patients with penile fractures. Clinical data included age, race, comorbidity, insurance, hospital factors, timing, hematuria, and urinary symptoms. Rates of formal urethral evaluation (cystoscopy or urethrogram) and urethral injury were calculated. Multivariate logistic regression was used to identify predictors of urethral evaluation and risk factors for urethral injury.
RESULTS	A weighted population of 3883 patients with penile fracture was identified. Presentations during weekends (37%) and summers (30%) were overrepresented (both $P < .001$). Urethral evaluation was performed in 882 patients (23%). Urethral injury was diagnosed in 813 patients (21%) with penile fracture. There was an increased odds of urethral evaluation with hematuria (odds ratio [OR] = 2.99; 95% confidence interval [CI], 1.03-8.73; $P = .045$) and a decrease for Hispanics (OR = 0.42; 95% CI, 0.22-0.82; $P = .011$). Older age (32-41 years: OR = 1.84; 95% CI, 1.07-3.16; $P = .027$; >41 years: OR = 2.25; 95% CI, 1.25-4.05; $P = .007$), black race (OR = 1.93; 95% CI, 1.12-3.34; $P = .018$), and hematuria (OR = 17.03; 95% CI, 3.20-90.54; $P = .001$) were independent risk factors for urethral injury.
CONCLUSION	Penile fractures, which occur disproportionately during summer and weekends, were associated with a 21% risk of urethral injury. Urethral evaluations were performed in a minority of patients. Even in patients with hematuria, 55% of patients underwent formal urethral evaluation. On multivariate analysis of patients with penile fracture, hematuria as well as older age and black race were independently associated with concomitant urethral injury. UROLOGY 86: 181–186, 2015. © 2015 Elsevier Inc.

Penile fractures occur when the tunica albuginea of the corpora cavernosum ruptures. Certain sexual positions are associated with increased risk,¹ and immediate operative repair is considered standard of care. The incidence of penile fracture in the United States has been estimated at 500-600 cases per year.² Perhaps due to mechanism of penile fracture, estimates of concomitant urethral injury in the setting of penile fracture have been reported as low as 1% in the Middle East and Asia with rates as high as 38% in the United States.¹⁻⁸ Sequelae of urethral injuries in the setting of penile fracture can include urethral stricture or pseudodiverticula.^{9,10}

Evaluation of the urethra can be performed with a variety of techniques including cystoscopy or urethrography. Magnetic resonance imaging, which is occasionally used to confirm penile fractures, can also identify urethral injuries.¹¹ If severe or readily apparent, direct intraoperative

visualization can also identify urethral tears during exploration. With grade B evidence, the AUA Guidelines for Urotrauma recommend urethral evaluation in patients with blood at the meatus, gross hematuria, or inability to void,¹² yet controversy persists regarding urethral evaluation in the majority of patients without these particular signs or symptoms.

Whereas numerous case studies and single-institution series regarding urethral injury during penile fracture exist, few specifically address or are powered to identify risk factors for urethral injury. By using a national database, we sought to describe patterns of urethral evaluation and add to the management strategy by focusing on risk factors for concomitant urethral injury. We hypothesized that certain patient demographic factors or clinical signs may be associated with a higher risk of urethral injury during penile fracture.

MATERIALS AND METHODS

The National Inpatient Sample (NIS) represents roughly 20% of all inpatient admissions in the United States and represents the largest all-payer inpatient care database. It is a portion of a

Financial Disclosure: The authors declare that they have no relevant financial interests.

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Submitted: January 27, 2015, accepted (with revisions): March 10, 2015

group of datasets managed by the Healthcare Cost and Utilization Project. The dataset is weighted to allow population-level estimates of the sampled observations. The International Classification of Diseases, Ninth Edition Clinical Modification (ICD-9) was used to identify diagnoses and procedures.

The 2003-2011 NIS database was queried to identify patients with the diagnosis of penile fracture (ICD-9: 959.13). Institutional review board approval was not required as no identifiable patient information was used. The ICD-9 codes used for analysis are shown in [Appendix A](#). Only patients who underwent surgical repair were included in the analysis. Urethral evaluation included performance of cystoscopy or urethrography. Clinical signs and symptoms included hematuria or lower urinary tract symptoms (LUTS; obstruction, retention, incontinence, frequency, oliguria, or other urinary symptoms). Urethral injury was defined as having a formal diagnosis of urethral injury or undergoing urethral repair (including any patient undergoing urethroplasty).

Demographics examined included age, race, insurance status, and timing of admission. Age categories were created using three equally distributed tertiles. For race, "other" consisted of patients who were Asian, American Indian, and those coded "other" in the NIS dataset. Timing was defined in terms of weekend or weekday admission as well as season of presentation. Winter included December to February, spring was March to May, summer was June to August, and fall was September to November. Comorbidity was calculated utilizing the Elixhauser method, which has been well validated and is incorporated into the NIS.¹³ Hospital characteristics included bed size (small, medium, or large based on NIS criteria), teaching status, and region. Length of stay was categorized as ≤ 2 days or > 2 days, with the latter representing the 90th percentile.

All statistical analyses were performed using Stata 13.1 (Statacorp, College Station, TX). Survey-weighting was used for all analyses where applicable. Comparison of means according to urethral injury status was performed using an adjusted Wald test. To compare categorical variables, a chi-squared test with Rao-Scott correction was used.¹⁴ A one-sample *t* test of proportion with the weighted proportion was used to test whether weekend admission was significant against an expected 2 of 7 (28.6%) days representing weekend days. A chi-square goodness of fit test was used to test whether season of admission showed an unequal distribution against an expected distribution of one-quarter of admissions in each season. Weighted multivariate logistic regression was used to identify independent factors associated with undergoing urethral evaluation and similarly, independent risk factors for urethral injury. Tests were considered significant if $P < .05$.

RESULTS

The study included 791 records, which represented a weighted study population of 3883 patients. Over the 9-year study period, the median incidence was 459 (IQR, 449-517) cases/year. No meaningful trends in incidence were observed over the study period (data not shown).

[Table 1](#) shows the baseline characteristics of the study population with comparison of patients based on the presence of urethral injury. The overall mean age was 37.0 ± 0.4 years with a higher mean age for patients with urethral injury (39.4 ± 0.8 years) compared to patients without urethral injury (36.4 ± 0.5 years, $P < .001$). As

such, a greater proportion of urethral injury patients were categorized in the oldest age tertile (42% vs 33%, $P = .003$). The most common race among all patients with penile fracture was white (41%); however, there was a greater proportion of patients of black race in the urethral injury group (31% vs 20%, $P = .003$). Most patients ($n = 3058$, 79%) had no comorbidities, and only 185 patients (5%) had an Elixhauser comorbidity of 2 or more. The majority of patients were treated in large hospitals (2841 patients or 73%) and teaching hospitals (2199 patients or 57%). The largest proportion of the patients was seen in hospitals located in the South (37%) with the Midwest as the least represented (15%). When comparing patients based on the presence of urethral injury, there was no difference in terms of comorbidity or hospital characteristics, including region (all $P > .6$). Insurance status varied by the presence of urethral injury. Patients with urethral injury were more likely to have private insurance (55% vs 41%) and less likely to have Medicaid (7% vs 13%, $P = .002$). A higher proportion of men with urethral injury had a prolonged hospital stay of > 2 days (15% vs 7%, $P = .002$). Overall, weekend (1438 patients or 37%) and summer (1025 patients or 30%) presentations were overrepresented compared to expected distributions ($P < .001$ for both). There was no relationship between timing of admission and urethral injury ($P > .2$ for both weekend and season).

Overall, a small proportion of patients were diagnosed with hematuria (3%) or LUTS (2%). Hematuria was more common in patients with urethral injury (10% vs 0.5%, $P < .001$), but there was no difference in urinary symptoms between groups ($P = .071$). In total, 882 patients (23%) underwent urethral evaluation and 813 patients (21%) were diagnosed with a urethral injury. Urethral evaluation was more commonly performed for patients with urethral injury (34% vs 20%, $P = .002$). The majority of urethral evaluations included a cystoscopy (79%) as opposed to urethrogram (24%). Of the 882 patients who underwent a formal urethral evaluation, 279 (32%) were diagnosed with a urethral injury. The majority (66%) of patients who were found to have a urethral injury did not undergo formal urethral evaluation. Of the patients with hematuria, 55% underwent formal urethral evaluation and 85% were diagnosed with urethral injury.

Multivariate logistic regression was used to determine independent factors associated with urethral evaluation ([Table 2](#)). There was no association of undergoing urethral evaluation with age, comorbidity, hospital size, hospital teaching status, hospital region, insurance, or timing (all $P > .1$). Compared to whites, Hispanics (OR = 0.42; 95% CI, 0.22-0.82; $P = .011$) and other race (OR = 0.33; 95% CI, 0.11-0.98; $P = .046$) were less likely to undergo urethral evaluation with a cystoscopy or urethrogram. The presence of hematuria increased the likelihood of undergoing urethral evaluation (OR = 2.99; 95% CI, 1.03-8.73; $P = .045$). As a predictor for urethral evaluation, urinary symptoms did not reach significance (OR = 2.02; 95% CI, 0.61-6.73; $P = .252$).

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