

# The effect of sexual dysfunction on health-related quality of life in men following traumatic pelvic fractures

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|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>BACKGROUND:</b>        | Pelvic trauma disproportionately affects a younger population and has the potential to cause long-term sexual dysfunction. We hypothesized that the presence of sexual dysfunction after traumatic pelvic fracture negatively impacts health-related quality of life (HrQOL) in men.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>METHODS:</b>           | A total of 228 patients with traumatic pelvic fractures treated at a level 1 trauma center between 2012 and 2017 completed a survey that evaluated postinjury HrQOL and sexual function. Inverse probability weighting was used to adjust for survey nonresponse. Pelvic fracture characteristics were classified based on the Orthopedic Trauma Association classification system. Sexual function was evaluated using the International Index of Erectile Function, and HrQOL was evaluated using the EuroQol 5 Dimensions Questionnaire (EQ-5D). Quality-adjusted life years were determined based on calculated EQ-5D utility indices. Multiple regression models were created to evaluate the association between sexual health and HrQOL.                                                                                         |
| <b>RESULTS:</b>           | After inverse probability weighting and adjustment for potential confounders, a decrease in International Index of Erectile Function was associated with a decline in overall HrQOL as measured by the EQ-5D visual analog scale ( $\beta = 0.28, p = 0.02$ ). No association was identified between Orthopedic Trauma Association pelvic fracture configuration and risk of postinjury erectile dysfunction (ED) ( $p = 0.99$ ). Furthermore, 53.3% of men reported persistent ED at a median of 42.6 months (interquartile range, 28.0–63.3 months) following injury. The presence of ED was independently associated with a decrease in HrQOL ( $\beta = 10.92, p < 0.001$ ). This difference equates to a loss of 1.6 quality-adjusted life years per 10 years for men with ED following pelvic fracture relative to those without. |
| <b>CONCLUSION:</b>        | Sexual dysfunction is an independent risk factor for decreased HrQOL in pelvic trauma survivors. Further work is needed to create appropriate patient-centered survivorship care pathways that incorporate sexual health evaluation. ( <i>J Trauma Acute Care Surg.</i> 2021;91: 325–330. Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>LEVEL OF EVIDENCE:</b> | Prognostic, level IV.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>KEY WORDS:</b>         | Pelvic fracture; sexual dysfunction; health-related quality of life; survivorship; urotrauma.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

The population-adjusted incidence of traumatic pelvic fracture in the United States is estimated to be as high as 34.3 injuries per 100,000 capita per year.<sup>1</sup> While these injuries affect both the young and elderly populations, high-energy traumas disproportionately affect men under the age of 45 years.<sup>1–5</sup> With continued improvements in motor vehicle safety and interdisciplinary trauma care, survival rates are high and life-altering morbidities following injury can be long term.<sup>6,7</sup>

The impact of sexual dysfunction (SD) on quality of life has been well documented in multiple conditions that affect the pelvic organs, nerves, and vasculature. Accordingly, these concerns are regularly addressed both before and after treatment.<sup>8,9</sup> The emphasis on survivorship and the importance of addressing the sexual health needs of patients and their partners have similarly been well established.<sup>10–12</sup> However, despite data indicating that greater than one third of men with traumatic pelvic fractures will develop some degree of SD, this condition is often overlooked in the postinjury care period.<sup>13</sup>

The majority of the current literature related to sexual health after pelvic trauma has focused on men with overt lower urinary tract injuries, as these patients are at highest risk for posttraumatic SD because of the proximity of the cavernous nerves and penile vasculature to the injury.<sup>14–16</sup> However, this group comprises a small minority of the total pelvic fracture population, with one

study finding that only 4.2% of men with pelvic fracture had concurrent lower urinary tract injury.<sup>17</sup> To develop appropriate multidisciplinary survivorship care pathways for these patients that incorporate the evaluation and management of sexual health, it is important to understand the impact of SD on quality of life in this population. Therefore, we aimed to evaluate sexual health and health-related quality of life (HrQOL) in men following traumatic pelvic fracture, hypothesizing that the presence of SD is independently associated with HrQOL outcomes.

## PATIENTS AND METHODS

### Study Design

After institutional review board approval, the institutional trauma registry from Harborview Medical Center at the University of Washington was queried to identify patients treated for traumatic pelvic fractures over a 6-year period (January 1, 2012, and December 31, 2017). A cross-sectional survey was then performed to evaluate the impact of SD on patient-reported quality of life measures. The details of the survey methodology and patient population have been previously described.<sup>13,18</sup> Harborview Medical center is the level 1 trauma center for the state of Washington and is a primary level 1 referral center for patients in Wyoming, Montana, Idaho, and Alaska.

### Study Subjects

During the accrual period, potential study participants were identified from the institutional trauma registry based on *International Classification of Diseases, Ninth Revision*, diagnosis codes for traumatic fractures of the pelvis as a result of blunt traumatic injuries (808.0–808.9). Pelvic fracture characteristics were determined by review of the registry and classified according to the Orthopedic Trauma Association classification scheme.<sup>19</sup> Injury patterns were grouped into four categories: 61-A, lesion sparing (or with no displacement of) posterior arch; 61-B, incomplete disruption of posterior arch, partially stable;

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This study was presented at the 21st Annual Fall Scientific Meeting of the Sexual Medicine Society of North America, November 9–15, 2021, held virtually.

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61-C, complete disruption of posterior arch, unstable; and 62, acetabular injuries. Patients with both acetabular and pelvic ring injuries were categorized for the study based on the pelvic ring injury. Men younger than 18 years or older than 80 years and those with lower urinary tract injuries, spinal cord injuries, or those discharged to jail were excluded.

## Survey

A multicomponent online survey was created and sent to all eligible. Survey composition and distribution methods have been previously described.<sup>13</sup> The survey focused on sexual health concerns and patient-reported quality of life after injury. In the present study, we focused on determining if the presence of SD was associated with generic HrQOL measures. The International Index of Erectile Function (IIEF) was used to assess SD. This questionnaire has been validated as a brief and reliable self-assessment of sexual function in men.<sup>20</sup> The EuroQol 5 Dimensions Questionnaire (EQ-5D) was used to evaluate HrQOL, as this is the most commonly used generic preference-based HrQOL measure used following traumatic injury and provides both a descriptive system as well as a visual analog scale (VAS) scoring system (EuroQol Research Foundation, EQ-5D-5L User Guide, 2019). The EQ-5D measures five quality of life dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) with three levels of response (no, some or severe problem) for each dimension. Participant responses to each of the five dimensions were dichotomized into “no problems” or “some/severe problems.”<sup>21,22</sup> Using previously published methods, these EQ-5D scores were then converted to a single utility index score for each patient utilizing the UK value sets, the most commonly used preference weight used in the literature.<sup>23</sup> Quality-adjusted life years (QALYs) were calculated in standard fashion using these utility indices. In addition, participants were asked to score their overall health state on the VAS component, with 100 being the best health he/she can imagine, to determine an overall summary of HrQOL.

## Statistical Analysis

To limit bias associated with survey nonresponse, inverse probability weighting was applied to all data.<sup>13,24</sup> Logistic regression of the survey response variable on available registry variables common to the entire cohort (age, race, insurance status, Injury Severity Score [ISS], and time since injury) was performed to calculate a propensity score (PS) for response. Weights based on this likelihood to have responded to the survey were then calculated and applied to all data for each responder (1/PS) and nonresponder (1/1 – PS). All analyses used the weighted data and were performed using R version 3.5.1 (The R Foundation for Statistical Computing, Vienna, Austria), specifically using the “survey” package to analyze complex survey data. A *p* value of <0.05 was considered statistically significant. Results are reported in accordance with the Strengthening of Reporting of Observational Studies in Epidemiology checklist.

Bivariate linear regression was used to analyze the association of composite IIEF scores, as well as individual IIEF domain scores, with HrQOL as measured by the VAS. Multivariate linear regression models were similarly created to assess the impact of sexual function on HrQOL as determined by the VAS component of the EQ-5D questionnaire,

adjusting for age, relationship status, EQ-5D utility index scores, and ISS.

The Erectile Function (EF) domain was then specifically analyzed to determine the impact of erectile dysfunction (ED) on HrQOL. Patients were dichotomized into those with (EF domain score, <25) or without ED (EF domain score, ≥25) based on prior determined thresholds.<sup>25</sup>  $\chi^2$  Analysis was performed to evaluate the association of OTA fracture configuration with likelihood of ED, while multivariate linear regression evaluated the impact of ED on HrQOL.

## RESULTS

Of the 1,554 men who met the inclusion criteria for the study and were sent surveys, 277 (17.8%) responded. A total of 228 (82.3%) of the 277 fully completed the IIEF and EQ-5D questionnaires and were included in the final analysis.

**TABLE 1.** Subject Characteristics With Applied Propensity Weighting

|                                               | All              | Nonresponders    | Responders       |                  |
|-----------------------------------------------|------------------|------------------|------------------|------------------|
|                                               |                  |                  | Crude            | Weighted         |
| Registry data                                 |                  |                  |                  |                  |
| Subjects, n (%)                               | 1,505            | 1,277 (84.9)     | 228 (15.1)       | —                |
| Age at injury, median (IQR), y                | 44 (29–57)       | 43 (29–56)       | 48 (33–59)       | 46 (29–58)       |
| ISS, median (IQR)                             | 18 (9–29)        | 18 (9–29)        | 19 (9–29)        | 17 (9–29)        |
| Race, n (%)                                   |                  |                  |                  |                  |
| White                                         | 1,219 (81.0)     | 1,010 (79.1)     | 209 (91.7)       | 83.4%            |
| Asian                                         | 48 (3.2)         | 40 (3.1)         | 8 (3.5)          | 4.5%             |
| Black                                         | 85 (5.6)         | 79 (6.2)         | 6 (2.6)          | 5.3%             |
| Other                                         | 153 (10.2)       | 376 (29.4)       | 5 (2.2)          | 2.6%             |
| Primary insurance, n (%)                      |                  |                  |                  |                  |
| Private                                       | 569 (37.8)       | 429 (33.6)       | 140 (61.4)       | 38.7%            |
| Worker's compensation                         | 153 (10.2)       | 130 (10.2)       | 23 (10.1)        | 18.9%            |
| Medicaid                                      | 428 (28.4)       | 397 (31.1)       | 31 (13.6)        | 20.2%            |
| Medicare                                      | 193 (12.8)       | 177 (13.9)       | 16 (7.0)         | 8.1%             |
| Uninsured                                     | 100 (6.6)        | 90 (7.0)         | 10 (4.4)         | 8.5%             |
| Other                                         | 62 (4.2)         | 54 (4.2)         | 8 (3.5)          | 5.6%             |
| Time since injury to survey, median (IQR), mo | 43.6 (27.7–63.5) | 44.8 (28.0–64.1) | 36.6 (23.1–52.7) | 42.6 (28.0–63.3) |
| Survey data                                   |                  |                  |                  |                  |
| Relationship status, n (%)                    |                  |                  |                  |                  |
| Single                                        | —                | —                | 62 (27.2)        | 29.1%            |
| Married/partnership                           | —                | —                | 158 (69.3)       | 65.9%            |
| Other                                         | —                | —                | 8 (3.5)          | 5.0%             |
| Education, n (%)                              |                  |                  |                  |                  |
| Grade school                                  | —                | —                | 4 (1.8)          | 3.5%             |
| High school                                   | —                | —                | 43 (18.9)        | 21.4%            |
| Some college                                  | —                | —                | 83 (36.4)        | 35.7%            |
| 4-Year college                                | —                | —                | 55 (24.1)        | 22.5%            |
| Master's degree or higher                     | —                | —                | 38 (16.7)        | 14.3%            |
| Other                                         | —                | —                | 5 (2.2)          | 2.6%             |

**TABLE 2.** Bivariate Linear Regression Models of EQ-5D VAS Score

|                          | Coefficient Estimate | 95% CI         | p      |
|--------------------------|----------------------|----------------|--------|
| IIEF                     | 0.34                 | 0.14–0.54      | <0.001 |
| Erectile function        | 0.66                 | 0.28–1.04      | <0.001 |
| Orgasmic function        | 1.71                 | 0.17–3.26      | 0.03   |
| Sexual desire            | 1.58                 | –0.04 to 3.21  | 0.06   |
| Intercourse satisfaction | 1.27                 | 0.54–2.00      | <0.001 |
| Overall satisfaction     | 2.05                 | 0.89–3.21      | <0.001 |
| Age at injury            | –0.05                | –0.26 to 0.15  | 0.60   |
| Relationship status      | —                    | —              | 0.27   |
| Single                   | Ref                  | —              | —      |
| Married/partnership      | 4.17                 | –3.28 to 11.62 | 0.27   |
| Other                    | –3.60                | –16.03 to 8.82 | 0.57   |
| ISS                      | –0.11                | –0.33 to 0.10  | 0.31   |
| EQ-5D utility index      | 39.29                | 15.18–63.41    | <0.001 |

CI, confidence interval; Ref, reference.

Subject demographics of all eligible participants before and after inverse probability weighting are listed in Table 1. Notably, weighted median time since injury to survey completion was 42.6 months (interquartile range [IQR], 28.0–63.3 months) with a median age at injury of 46 years (IQR, 29–58 years).

On bivariate linear regression analysis, there was a significant association with EQ-5D VAS health state with IIEF and all IIEF domains except for Sexual Desire, such that a decline in IIEF, as well as a decline in any individual IIEF domain other than Sexual Desire, was associated with a decline in the VAS (Table 2). After adjusting for age, relationship status, ISS, and EQ-5D utility index scores, IIEF was similarly found to be independently associated with HrQOL ( $\beta = 0.28$ ,  $p = 0.02$ ; Table 3). In addition, analyses incorporating the individual domains of the IIEF into the model found that the Erectile Function, Intercourse Satisfaction, and Overall Satisfaction domains of the IIEF were all significantly associated with overall HrQOL (Table 4).

Among patients, 11.1% had type 61-A fractures; 27.2%, type 61-B fractures; 20.9%, type 61-C fractures; and 40.8%, type 62 fractures. Using the Erectile Function domain alone to define ED, 53.3% of respondents reported ED at the time of survey. The likelihood of ED was not significantly associated with OTA

**TABLE 3.** Multivariate Linear Regression Model of EQ-5D VAS Score

|                     | Coefficient Estimate | 95% CI         | p    |
|---------------------|----------------------|----------------|------|
| IIEF                | 0.28                 | 0.08–0.48      | 0.02 |
| Age at injury       | –0.01                | –0.20 to 0.19  | 0.91 |
| Relationship status |                      |                | 0.52 |
| Single              | Ref                  | —              | —    |
| Married/partnership | 0.12                 | –7.73 to 7.98  | 0.98 |
| Other               | –6.15                | –17.93 to 5.63 | 0.31 |
| ISS                 | –0.08                | –0.27 to 0.11  | 0.41 |
| EQ-5D utility index | 31.85                | 6.93–56.77     | 0.01 |

CI, confidence interval; Ref, reference.

**TABLE 4.** Multivariate Linear Regression Models of EQ-5D VAS by IIEF Domain

|                          | Coefficient Estimate | 95% CI        | p     |
|--------------------------|----------------------|---------------|-------|
| Erectile function        | 0.54                 | 0.15–0.93     | 0.007 |
| Orgasmic function        | 1.15                 | –0.42 to 2.71 | 0.15  |
| Sexual desire            | 0.91                 | –0.64 to 2.46 | 0.25  |
| Intercourse satisfaction | 1.14                 | 0.41–1.86     | 0.002 |
| Overall satisfaction     | 1.69                 | 0.52–2.85     | 0.005 |

Each model assessed the impact of the designated IIEF domain on EQ-5D visual analog scores, adjusted for age, relationship status, EQ-5D utility index score, and ISS.  
CI, confidence interval.

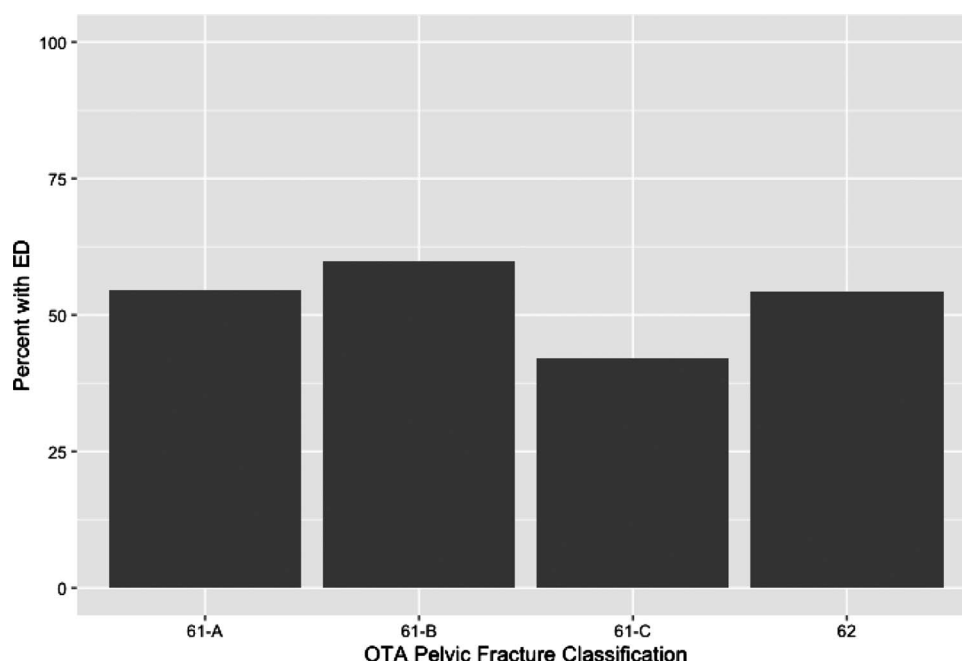
pelvic fracture configuration ( $p = 0.99$ ; Fig. 1). Men with ED reported significantly lower VAS scores (72; IQR, 53.9–85.0) relative to those without (81; IQR, 75–90;  $p < 0.001$ ). Similarly, EQ-5D utility index scores differed significantly between men with (0.84; IQR, 0.79–1.00) and men without ED (1.00; IQR, 0.83–1.00;  $p = 0.03$ ). After adjustment, the presence of ED was found to be independently associated with decreased overall HrQOL on the VAS ( $\beta = 10.92$ ; 95% confidence interval, 5.31–16.54;  $p < 0.001$ ). The difference in reported HrQOL as measured by utility indices equates to a 1.6 QALYs loss over a 10-year period for men with ED relative to those without.

## DISCUSSION

These data show that SD is significantly associated with a reduction in patient-reported HrQOL following pelvic trauma. In particular, the presence of ED was associated with a loss of 1.6 QALYs over a 10-year span relative to men without ED. Taken together, these data suggest that, although there may be various factors affecting HrQOL in this patient population, untreated SD appears to have a measurable and independent impact on men after traumatic pelvic injuries.

Prior work using the same cohort of pelvic trauma patients has shown that spontaneous return of normal sexual function more than 1 year after injury was highly unlikely and that the negative impact of a failure to address sexual health concerns in this population cannot be understated.<sup>13,18</sup> These findings are similar to what has been reported in men following radical prostatectomy for prostate cancer.<sup>26</sup> However, while there has been tremendous interest in prostate cancer survivorship with numerous prior studies prospectively examining HrQOL and ED, these efforts have been lacking in the pelvic trauma literature.<sup>27</sup> The present study suggests that ED and SD in general should be likewise addressed in routine follow-up of pelvic trauma patients as residual impairment impacts HrQOL.

Quality-adjusted life year analysis incorporates morbidity and HrQOL into a single measure and, therefore, is considered the preferred method of measuring long-term health effects.<sup>28</sup> Quality-adjusted life years are calculated from health utility indices, and although the utility index can vary based upon the specific value set used, research design, and instrument selected, these preference-weighted estimates can be used to make comparisons across different disease states. A pooled study of more than 38,000 adults in the United States calculated the EQ-5D health utility index for a wide variety of health conditions. This



**Figure 1.** Percentage of respondents reporting ED by OTA pelvic fracture configuration.

study found that men with prostate cancer had a median health utility index of 0.82, while other conditions such as cerebral vascular accident or heart failure were associated with lower health utility indices (0.78 and 0.77, respectively).<sup>29</sup> In the present study, we found that men with ED had a health utility index of 0.84, compared with 1.00 in men without ED after pelvic trauma. Although ED does not appear to affect QALYs to the same extent as some of these other conditions, the change and effect in HrQOL are still significant, as previous studies have shown that a 0.03 change in health utility index scores should be considered as clinically important.<sup>30</sup>

While the EQ-5D utility index scores are used for calculating QALY, its metrics likely fail to account for certain disease-specific morbidities that patients might experience. The five questions of the EQ-5D, which specifically address mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, likely do not capture unrelated HrQOL issues, such as sexual function limitations or concerns. However, the EQ-5D VAS score is designed to capture a more overall HrQOL state and is not limited to these five categories. As such, we chose to use the VAS as our primary study endpoint. Furthermore, while we did find a significant association between utility index scores and VAS scores, both the composite IIEF score and the presence of ED remained independently associated with VAS scores even when adjusting for EQ-5D utility index scores. These data suggest that, even for patients who have significant psychological and/or functional limitations that are captured by the EQ-5D utility index calculation, sexual function is and remains independently associated with their overall HrQOL and should not be overlooked.

There are a number of limitations to the present study. Surveys were sent to patients admitted to the University of Washington, which mainly treats patients in the Pacific Northwest region, and our results may not be representative of the national pelvic trauma patient population. In addition, the majority

of patients were White and insured. Differences in access to follow-up care based on insurance status and resources may have impacted our results. Given the differences in health outcomes of minority patients and cultural differences, more research is needed to determine if the association between SD and HrQOL is valid across various sociodemographic groups. We acknowledge that many factors outside of pelvic trauma can affect sexual function and HrQOL. We attempted to control for these confounding variables, as listed in our analysis, by using multivariate models incorporating these factors. However, there may be other variables that were not assessed that could have affected our estimates. In addition, after weighting the data, the average time from injury to time of survey was 3½ years. While this likely provides a strong representative view of sexual health and quality of life at this time point, there is likely variability in the role that sexual health concerns play in patient preferences over time following major injury. Calculation of utility indices and QALY are dependent on the HrQOL instrument used and may differ from those calculated here if calculated with another method. However, the EQ-5D does allow comparability between disease states and is widely used as a generic HrQOL measure in traumatic injury populations. Lastly, subjects with more polarizing experiences may have been more likely to respond to the survey, which may have influenced the results.

In summary, SD is a disability that has been shown to significantly affect quality of life and the present evidence supports that this holds true in pelvic trauma patients. Patients with lower sexual function scores and patients with ED in particular were more likely to report lower overall HrQOL than those without. Given that many of these patients will have to manage these life-altering morbidities for many years to come, it is becoming increasingly important that providers acknowledge and address sexual health as a major component of patient care following pelvic trauma so that we can better develop appropriate survivorship care models.

## AUTHORSHIP

N.V.J. contributed in the conception and design. N.V.J., M.S.V., and F.P.R. contributed in the acquisition of data. N.V.J. and A.Y.W. contributed in the analysis and interpretation of data. A.Y.W. and N.V.J. contributed in the drafting the article. A.Y.W., N.V.J., M.S.V., and F.P.R. contributed in the revising of the article for intellectual content. N.V.J. contributed in the final approval of the complete article. M.S.V., and F.P.R. performed the supervision.

## DISCLOSURE

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