What Are Predictors for Patients' Quality of Life After Pelvic Ring Fractures?

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Abstract

Background Data from literature on predictors for patients' quality of life after pelvic ring fractures are conflicting and based on small study populations.

Questions/purposes We therefore evaluated predictors for health-related quality of life in patients with pelvic ring injuries at a minimum of 1 year postfracture.

Methods We surveyed 172 patients of the German Pelvic Trauma Registry admitted to four medical centers between February 3, 2004, and May 11, 2011. The median age of the followup cohort was 47 years (range, 8–88 years); 69 of 172 (40%) patients were female. Patients were characterized by a median Injury Severity Score of 17. There were 31 Tile Type A fractures (18%), 77 Type B fractures

(45%), and 64 Type C fractures (37%). The incidence of complex fractures and multiple traumas was 34 of 172 (20%) and 116 of 172 (67%), respectively. One hundred twenty-five (73%) patients were treated operatively. We obtained the EQ-5D™ score to assess patients' health-related quality of life. For the analysis of predictors for quality of life, a multivariate linear regression model was built. The median followup was 3 years (range, 1–6 years). **Results** The median EQ-5D™ score was 0.78 (interquartile limits, 0.63 and 1.00). Age, complex trauma, and surgery independently predicted the EQ-5D™ score.

Conclusions We conclude patients with higher age, complex trauma, and surgery had a higher likelihood for a reduced quality of life after pelvic ring injuries.

Level of Evidence Level III, therapeutic study. See Instructions for Authors for a complete description of levels of evidence.

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All ICMJE Conflict of Interest Forms for authors and *Clinical Orthopaedics and Related Research* editors and board members are on file with the publication and can be viewed on request. Each author certifies that his or her institution approved the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research. Data were collected at University Hospital Freiburg (Freiburg, Germany), University Hospital Jena (Jena, Germany), University Hospital Münster (Münster, Germany), and University Hospital Homburg (Homburg, Germany) and analyzed at the University of Saarland (Homburg, Germany) and University of Bern (Bern, Switzerland).

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Introduction

Pelvic ring fractures in young individuals are most commonly caused by high-energy trauma such as falls from a height or traffic accidents [20, 21]. In the elderly, however, low-energy impacts often lead to fractures of the pelvic ring [4, 21].

Studies from the literature have reported worse functional outcomes after pelvic ring fractures, when compared to population norms [5, 6, 12, 18, 20, 24]. Predictors of outcomes include severity of injury, fracture type, incidence of nerve injuries, and method of treatment. For elderly patients with pelvic ring fractures, several studies have reported substantial mortality, low short-term mobility, and frequent need for community support and institutionalization after discharge from hospital [10, 16, 17]. To our knowledge, only two studies on small populations of 20 and 57 patients have evaluated health-related quality of life after pelvic ring injuries, with conflicting results [2, 24]. The impact of age on quality of life after pelvic ring fractures is unclear.

We therefore evaluated predictors for quality of life in a followup cohort of more than 170 patients at a minimum of 1 year after trauma.

Patients and Methods

From the German Pelvic Trauma Registry [11, 19], we identified 1479 patients with pelvic ring fractures admitted between February 3, 2004, and May 11, 2011, to four German university hospitals, all of which had Level I trauma centers according to the classification of the American College of Surgery [1] and the German Trauma Society [23]. Each institution committed to include every inpatient with a pelvic fracture in the registry. All patients had clinical and radiographic examinations on initial admission. Radiographic examination included pelvic radiographs and, depending on the fracture type and medical condition of the patient, additional CT scans. The age range of the study population was 4 to 105 years (median, 54 years; interquartile limits, 32 and 77 years); 784 of 1479 (53%) patients were female. Eighty-nine patients died in hospital. According to the guidelines of the registry, all of the remaining patients were asked for regular followups after discharge from hospital. A total of 172 of the 1479 patients (12%) attended the followups at 1 year postfracture or later; 1308 patients could not be assessed because they died in hospital or did not appear for regular followups. The age range of the followup cohort was 8 to 88 years (median, 47 years; interquartile limits, 26 and 63 years); 69 of 172 (40%) patients were female. This cohort study was conducted according to the recommendations and guidelines of the STROBE initiative [29]. The minimum followup was 1 year

(median, 3 years; range, 1–6 years). No patients were recalled specifically for this study; all data were obtained from the database and routine followups.

Data were collected and processed using a secured Internet interface hosted by a professional service provider (MEMDoc®; Institute for Evaluative Research in Medicine, Bern, Switzerland) [9, 11]. Demographic data and parameters indicating the pattern and severity of injuries were extracted from the basic dataset of the German Pelvic Trauma Registry [11, 19]. The pattern and severity of injuries were characterized by the Injury Severity Score (ISS) [3], the type of pelvic ring fracture, and the incidence of multiple traumas. According to the classification system for pelvic ring fractures of Tile [25], stable pelvic ring fractures were classified as Type A, fractures with only rotational instability as Type B, and fractures with both rotational and translational instability as Type C. Fracture classification was performed by an orthopaedic trauma surgeon. Pelvic ring fractures that had major visceral, neurovascular, or soft tissue injuries were classified as complex fractures [26]. Patients of the followup cohort were characterized by a median ISS of 17. There were 31 Type A fractures (18%), 77 Type B fractures (45%), and 64 Type C fractures (37%). The incidence of complex fractures was 34 of 172 (20%) and that of multiple traumas was 116 of 172 (67%). One hundred twenty-five (73%) patients were treated operatively. The health-related quality of life of the patients was evaluated by the EQ-5D™ Questionnaire in all 172 patients during the routine followups at least 1 year after trauma. The EQ-5D™ measures health-related quality of life on five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression [7, 22].

For the analysis of predictors for patients' quality of life, a multivariate linear regression model was built. We considered the following demographic and clinical characteristics relevant adjustment factors for the present analysis: patient age (years) and sex (male/female), ISS (points), fracture type (A versus B/C), complex trauma (yes/no), multiple trauma (yes/no), and surgery (yes/no). All statistical analyses were performed using the SigmaPlot® software package (Version 11.0 for Windows®; SYSTAT Software Inc, Chicago, IL, USA).

Results

The median EQ-5D™ score was 0.78 (interquartile limits, 0.63 and 1.00). The multivariate linear regression model showed three predictors for EQ-5D™ score. Patients with higher age ($p < 0.001$), complex trauma ($p = 0.03$), and

surgery ($p = 0.02$) had a higher likelihood for a reduced quality of life (Table 1).

Discussion

Data from literature on predictors for patients' quality of life after pelvic ring fractures are conflicting and based on small study populations. The impact of age on quality of life after pelvic ring fractures is unclear. We therefore evaluated predictors for quality of life in a followup cohort of 172 patients at a minimum of 1 year after trauma.

We note several limitations to our study. First, the study population included only patients of Level I trauma centers.

This fact might have limited the external validity of the study because the severity and pattern of injuries might have been different in patients treated in lower-level trauma centers. Therefore, our data refer particularly to large trauma centers. Second, there is high potential for selection bias, as less than 20% of patients underwent followup. Thus, patients may have died during the followup or may have not appeared because they found followup inconvenient or were doing sufficiently well. Although surveys with low response rates (near 20%) reportedly do not yield substantially less accurate responses than surveys with high response rates ($> 50\%$) [14, 28], we are aware the potential for selection bias in our study limits the general importance of the study. Third, comorbidities not related to the pelvic injury may have affected the findings. However, this is a general limitation in clinical studies assessing health-related quality of life as an outcome parameter that cannot be completely excluded.

Most studies evaluating the long-term outcome of pelvic injuries have reported worse functional and subjective outcomes after pelvic ring fractures, when compared to population norms (Table 2) [5, 6, 12, 18, 20, 24]. Predictors of outcomes include severity of injury, fracture type, incidence of nerve injuries, and method of treatment. Our data showed patients with complex pelvic fractures and patients treated operatively had a higher likelihood for a reduced quality of life. A literature search revealed two previous studies analyzing health-related quality of life in

Table 1. Predictors of quality of life as indicated by the EQ-5D™ score

Variable	Beta value	p value
Age	−0.262	< 0.001
Male sex	0.032	0.66
Injury Severity Score	0.068	0.50
Fracture Type B and C	0.054	0.53
Complex trauma	−0.176	0.03
Multiple trauma	−0.151	0.10
Surgery	−0.213	0.02

Table 2. Reports from the literature on followup of patients with pelvic ring fractures

Study	Followup (months) (mean or range)	Number of patients at followup	Group of patients	Data assessed for age	Health-related quality of life
Ayvaz et al. [2]	24–48	20	Patients with unstable pelvic fractures treated by closed reduction and percutaneous fixation	No	SF-36 score comparable with that of the population norm
Draijer et al. [5]	23	26	Patients with stable and unstable pelvic fractures	No	Not assessed
Eid et al. [6]	59	112	Patients with sacral fractures	No	Not assessed
Kabak et al. [12]	21–116	36	Patients with unstable pelvic fractures treated operatively	No	Not assessed
Morris et al. [16]	29–75	Not reported (n = 148 at admission to hospital)	Patients with stable and unstable pelvic fractures older than 65 years	Yes	Not assessed
Pohlemann et al. [18]	28	58	Patients with unstable pelvic fractures treated operatively	No	Not assessed
Pohlemann et al. [20]	24	486	Patients with stable and unstable pelvic fractures	No	Not assessed
Suzuki et al. [24]	24–107	57	Patients with unstable pelvic fractures	No	SF-36 score worse than that of the population norm
Current study	12–72	172	Patients with stable and unstable pelvic fractures	Yes	EQ-5D™ score associated with age, complex trauma, and surgery

patients with pelvic ring fractures (Table 2) [2, 24]. In a study population of 20 patients with unstable pelvic fractures treated by closed reduction and percutaneous fixation, Ayvaz et al. [2] found an SF-36 score at 2 to 4 years postfracture comparable to that of population norms. In contrast, Suzuki et al. [24] reported a worse SF-36 score in a cohort of 57 patients with unstable pelvic ring injuries at a followup of 2 to 9 years. We found EQ-5D™ scores in patients with a history of pelvic ring fractures tended to be slightly lower compared to population norms (0.78 versus 0.7–0.8 in elderly and 0.8–0.9 in younger individuals) [15]. To the best of our knowledge, our study shows for the first time that age is an independent predictor of patients' quality of life after pelvic ring fractures. Studies analyzing hospital databases of patients with pelvic ring fractures have reported higher mortality and blood loss in the elderly compared to younger patients [10, 17]. By characterizing 148 geriatric patients with pelvic ring fractures, Morris et al. [16] demonstrated higher rates of community support and institutionalization after discharge from hospital than before admission. Demographic aging affects the incidence of pelvic ring fractures [4, 8, 13, 27]. Data from the German Pelvic Trauma Registry revealed an increase of 23% in the mean age of patients with pelvic ring fractures between the early 1990s and the late 2000s [27]. In a study population of more than 5000 patients with pelvic ring fractures, we recently showed approximately 40% were 70 years of age or older [11]. These data highlight the increasing relevance of pelvic ring fractures in the elderly.

In conclusion, our data indicate patients with higher age, complex trauma, and surgery had a higher likelihood for a reduced quality of life after pelvic ring injuries. Considering the rapidly increasing number of elderly patients with pelvic ring fractures, this finding highlights the need and challenge for the future to develop and implement novel treatment strategies for improved outcomes in these patients.

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