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# Pelvic ring fractures in the elderly now and then – a pelvic registry study☆

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ABSTRACT

*Objectives:* To analyze the changes in demographic data stratified for age, sex and type of injury of elderly patients suffering from pelvic ring fractures over a 22-year observation period.
*Design/Setting:* Data has been collected prospectively, multi-centrically in hospitals participating in the German Pelvic Trauma Registry.
*Patients:* We analyzed the data of 5665 patients with an age ≥60 years included in the German Pelvic Trauma Registry from 1991 to 2013.
*Key results:* Over the 22-year study period the frequency of type A fractures decreased significantly from 84.8% to 43.9%, while type C and, in particular, type B fractures significantly increased from 7.0% and 8.2% to 14.3% and 41.8%. In patients between 60 and 70 years of age the frequency of type B and C fractures was higher compared to patients >70 years. The proportion of female patients, who represent the majority of the cohort (75%), was stable over the entire observation period. Interestingly, type A fractures were found more frequently in females, while type B and C fractures were found more frequently in males.
*Conclusions:* With the predicted demographic change and a shift toward more severe injury patterns (type B and C pelvic fractures) in the elderly population, trauma departments will need to develop specific surgical concepts for geriatric patients with pelvic ring fractures.
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## 1. Introduction

Predictions about the demographic change state that the proportion of people over the age of 65 will increase by 51% in more developed countries, and even up to 140% in less developed countries. Thus, the worlds elderly population will double by the year 2030 (National Institute of Health, 2008). Facing these dramatic demographic changes, the treatment of elderly patients becomes more and more important. The specific challenges of treating elderly patients include existing comorbidities, lack of physical fitness and mental diseases such as dementia (Baker and Grochow, 1997; Blair et al., 1995; Jorm and Jolley, 1998).

Despite the fact that the majority of pelvic fractures (68–73%) occur in elderly patients (Court-Brown & Caesar, 2006; Fuchs, Rottbeck, Hofbauer, Raschke, & Stange, 2011), there is a lack of studies examining the change in injury pattern which may result in a particular challenge of treating these injuries in elderly patients. To demonstrate the importance of shifting the focus toward this age group, we analyzed the data of 5665 patients with an age of 60 years and older included in the German Pelvic Trauma Registry from 1991 to 2013.

## 2. Patients and methods

### 2.1. Study group

We retrospectively analyzed the prospectively collected data of patients that were included in the German Pelvic Trauma Registry of the German Association of Trauma Surgery (DGU) and the German Section of the AO Foundation. The registry collects the data on patients treated for acetabular and pelvic fractures since 1991 (Pohlemann, Tosounidis, Bircher, Giannoudis, & Culemann, 2007). All patients included in this registry had clinical and radiological examinations at the time of admission and during the course of hospital stay.

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In the present study we were able to include 5665 patients based on our inclusion and exclusion criteria. The eligibility criteria included age greater or equal to 60 years and pelvic ring fracture.

Patients were stratified according to age at the time of injury into 4 different groups: group 1: 60–70 years, group 2: 71–80 years, group 3: 81–90 years and group 4: >90 years. The registry is divided into four time periods: $t_1$ = 1991–1993, $t_2$ = 1997–2000, $t_3$ = 2001–2008, $t_4$ = 2009–2013.

### 2.2. Fracture classification

In the German Pelvic Trauma Registry all fractures are classified according to the AO/OTA classification of pelvic fractures by Tile (Isler & Ganz, 1996). Stable pelvic ring fractures are classified as type A fractures, fractures with only rotational instability as type B fractures and fractures with rotational and translational instability as type C fractures. Fractures were classified by a trauma surgeon based on conventional radiographic images of the pelvis and, if available, on CT scans.

### 2.3. Statistical analysis

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) (Diel, Thier, Aghayev, & Preis, 2010; Holstein, Culemann, Pohlemann, & Working Group Mortality in Pelvic Fracture Patients, 2012; Holstein, Pizanis, Kohler, & Pohlemann, 2013). Descriptive analyses were performed to display the demographic and clinical characteristics of the selected patients. Data are given as percent of the individual populations. To show significant differences in age, sex and fracture type Chi-square test or Fisher's exact test were performed. Furthermore data of five centers that included patients into the registry over the whole observation period were separately analyzed and compared to the whole study population. All statistical analyses were conducted using SigmaPlot 13.0 software (Systat Software GmbH, Erkrath, Germany). A $p$-value $<0.05$ was considered to indicate significant differences.

## 3. Results

The majority (96.9%) of the included patients were treated in level 1 trauma centers in Germany. Over the observation period the number of participating trauma centers rose from 10 to 33. The number of patients included from $t_1$ was 474, from $t_2$ was 795, from $t_3$ was 1790, and from $t_4$ was 2606. Five centers included patients during all study periods. These centers included 1473 patients corresponding to 26% of the study population.

During the $t_1$ time period (1991–1993) 84.8% of the patients had a type A fracture, while only 8.2% and 7.0% showed a type B or type C fracture, respectively. Over the 22-year observation period this relation changed substantially. During the $t_4$ time period (2009–2013) the frequency of patients with type A fractures was found significantly reduced to 43.9%, while type B and C fractures increased to 41.8% and 14.3%, respectively. There was no significant difference between the whole study population and the study population included by the five centers that continuously included patients throughout the whole study period except during the third time period where significantly less patients with type A fractures (57.1% vs. 52.0%) were included by these centers (Fig. 1).

Interestingly, during all study periods the frequency of type A fractures was significantly lower in patients with an age between 60 and 70 years compared to patients with an age >70 years (Fig. 2). In contrast, the frequency of type B fractures was significantly higher in younger patients (60–70 years) compared to patients over the age of 80 years (Fig. 3). Also the frequency of type C fractures was significantly higher in patients with an age between 60 and 70 years compared to patients with an age >70 years (Fig. 4).

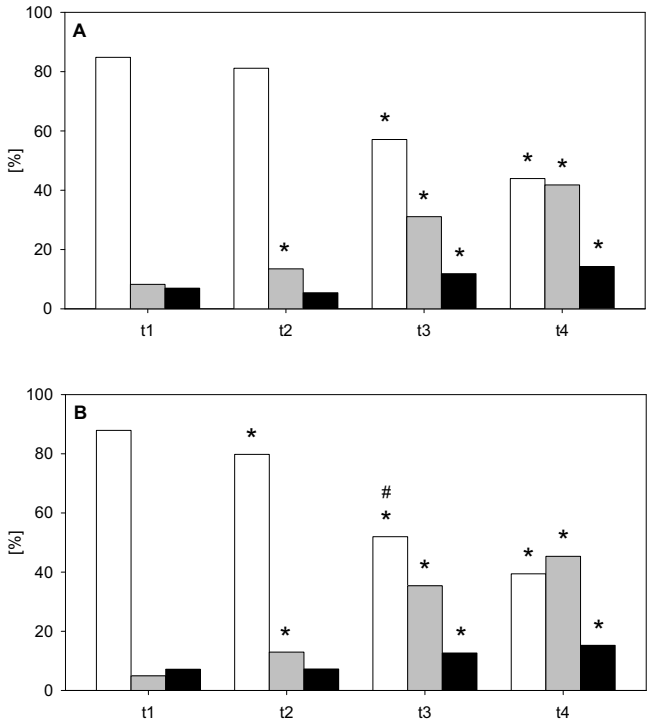


**Fig. 1.** Frequency of type A pelvic ring fractures (white columns), type B fractures (grey columns) and type C fractures (black columns) during different time periods ($t_1$: 1991–1993; $t_2$: 1997–2000; $t_3$: 2001–2008; $t_4$: 2009–2013). (A) represents the whole study population while (B) represents the study population of the five centers that continuously included data during the whole observation period. $^*p < 0.05$ vs. $t_1$, $^\#p < 0.05$ vs. corresponding time point and fracture type of the whole study population (A).

During the $t_1$ time period 75.7% of the included patients were female. The overall proportions of female and male patients did not change over the 22-year observation period. During the $t_4$ time period 75.4% of the patients were female. This represents a constant overall male:female distribution pattern of 1:3. However, considering only type A fractures the male:female distribution pattern ranged between 1:3.7 and 1:5.3 over the 22-year observation period, while the male:female distribution of type B fractures increased from 1:1.0 during $t_1$ to 1:3.3 during $t_4$ (Table 1). The male:female distribution of type C fractures varied from 1:0.7 to 1:2.3 during the 22-year observation period (Table 1).

Interestingly, the decrease of type A fractures and the increase of type B and type C fractures over time were observed in both female and male patients (Fig. 5). Nonetheless, the frequency of type A fractures was found significantly higher in females compared to males during all time periods studied. In contrast, the frequency of type C fractures was significantly higher in males during the last three study periods. During the early study period (1991–1993) 17.4% of the male patients but only 5.3% of the female patients had a type B fracture. This significant difference vanished completely over time. During the latest study period (2009–2013) 39.7% of the male patients and 42.5% of the female patients presented with a type B fracture (Fig. 5).

In both female and male patients the proportion of type A fractures increased significantly with age (Table 2). While in the earlier time periods significantly more female compared to male patients between 60 and 80 years were diagnosed with type A fractures, there was no difference in the frequency of type A fractures detectable between the male and female age groups during the $t_4$ study period (Table 2).

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