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Increased age is not associated with higher incidence of complications, longer stay in acute care hospital and in hospital mortality in geriatric hip fracture patients

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ABSTRACT

The number of agile patients in the 10th decade with a strong need for postoperative mobility will increase in the following decades. The present prospective study sought to prove if very old patients with hip-related fractures are disadvantaged according to incidence of complications, length of ICU and in-hospital stay, and in-hospital mortality. We included 402 patients, age 60 years and older, with hip related fractures. Operative treatment consisted of osteosynthesis or endoprothesis. ASA score, body mass index, Charlson Comorbidity Index, Barthel Index and Mini-Mental-Status were documented. We noted length of in-hospital stay and ICU stay as well as readmission to ICU and complications, including their dispersal according to Clavien–Dindo Classification. After univariate analysis, a multivariate analysis was performed. The examined cohorts were 85 patients aged 60–74 years, 253 75–90 years old and 64 >90 year old patients. In-hospital periods (13–14 days) mean stay on ICU (2 days) and frequency of readmission on ICU did not significantly differ statistically. Most complications were grade II, with comparable frequency and modality, displaying no significant difference throughout age-related groups ($p = 0.461$). In-hospital mortality showing significance ($p = 0.014$) only between 75–89 (4.4%) and >90-year-old (12.5%) cohort. Nevertheless, according to multivariate analysis, including the common risk factors, increased age was not an independent risk factor for dying ($p = 0.132$). Patients at an advanced age with hip-related fractures showed neither a prolonged in-hospital nor ICU stay. There was no significant relation of advanced age to number and type of complications.

1. Introduction

The number of individuals at extreme old age is predicted to increase dramatically over the next decade [1]. Hip-related fractures are typical geriatric fractures. As shown in several studies, substantial femoral bone loss continues throughout the old age, followed by an exponential increase in the risk of hip fracture [2,3]. Although osteoporosis plays a prominent role in the pathogenesis, there are many more factors of impact like atrophia of the musculoskeletal system, insecurity in coordination and walking and loss of sensorial skills [4].

In 2008, nearly 140,000 fractures (ICD 10 S.72.0–72.2) were registered in Germany [5]. These injuries display one of the most serious healthcare problems affecting the elderly, contributing to estimated costs of 2–4 billion euros per year in Germany [6]. Due to demographic transition, global incidence of hip related fracture is increasing [7–9].

Hip-related fractures are typically followed by a large number of peri- and postoperative complications. Specifically, the amount of outpatient care significantly rises after a femur fracture [10].

Most patients with fractures of the proximal femur are in the 8th decade. Until age 85, 11% of women and 5% of men are hospitalized because of femoral fractures [11]. Mortality in this cohort, compared to people the same age without fracture, is increased by 1.15–1.20 [4].

Considering that age-related mortality in patients >90 years is near 50%, the risk of suffering femoral fracture does not seem high. Literature addressing the outcomes of patients in the 10th decade is limited. The Scottish Hip Fracture Audit, a prospective, national, multicenter study, showed an age-related decrease of survival and favorable outcomes after surgery for the treatment of a hip fracture [12].

The present study was conducted to prove if patients in the 10th decade with hip-related fractures are disadvantaged according to incidence and type of complications, length of ICU stay, possible

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readmission to ICU, length of in-hospital stay, and short-term mortality.

2. Patients and methods

402 patients of at least 60 years old with proximal femoral fractures (ICD 10 S.72.0–72.2) were included in this prospective single center observational study. Criteria for exclusion were multiple traumas (injury severity score ≥16) and malignoma-associated fracture. All patients were surgically treated either with osteosynthesis or hip arthroplasty. The inclusion period lasted from the 1st of April 2009 to the 30th of September 2011. Approval from the University of Marburg's Ethics Committee was obtained (AZ 175/08). Each patient provided written consent. Patients were grouped according to their age: 60–74, 75–89, and >90 years old patients.

Hip fractures were differentiated according to the International Statistical Classification of Diseases and Related Health Problems 10th Revision into intracapsular femoral neck fractures, trochanteric fractures, and subtrochanteric fractures.

BMI, gender, ASA classification, pre-hospital habitation and age were documented. Patients were requested to give information about their pre-fracture functional status using the Barthel Index (BI) according to the Hamburg Classification Manual. Furthermore, the Charlson Comorbidity Index (CCI) and Mini-Mental State Examination (MMSE) were accomplished. A pre-existing documented osteoporosis or the intake of medication against osteoporosis was noticed additionally.

The interval between admission and surgery, cutting/suture time, and type of surgery were documented, length of ICU-stay and readmission to the ICU were noticed as well.

Complications were documented and differentiated using the Clavien–Dindo classification based on the type of therapy needed to correct the complication [13]. In-hospital mortality was noted and related to well-known risk factors of decreased outcomes.

Financial costs for in-hospital stay were calculated by using the DRG rating of each case.

2.1. Data entry and statistics

Data were collected in a Filemaker® database (FileMaker Inc., Santa Clara, CA, USA). Double entry with a plausibility check was performed to improve data quality. Predictive Analysis SoftWare (PASW®) version 18.0 (SPSS Inc., Chicago, IL, USA) was used for descriptive statistics and explorative data analysis. Chi-square test was performed for dichotomous variables and a *t*-test was performed for continuous variables for the univariate analysis.

The covariates that were controlled during multivariate analysis for outcome analysis were age >90, gender, BI, CCI, type of surgery, pre-hospital habitation, and the MMSE. Binary logistic regression was performed for dichotomous variables and linear regression for continuous variables. For all tests, statistical significance was assumed at $p < 0.05$.

3. Results

In the observational period we were able to include 402 patients. 293 (73%) were females and 109 (27%) were males. The average age of patients was 81.4 years (range 60–99).

Examined cohorts showed 85 patients between 60 and 74 years, 253 patients from 75 to 90 years old, and 64 patients over 90 years with a ratio (f:m) of 2.7:1.

Further baseline data is shown in Table 1. Time from admission to operative treatment showed no statistically significant difference. The in-hospital period was similar, 13–14 days, for all cohorts. All groups had a mean stay on ICU of 2 days. Readmission to ICU did also not significantly differ statistically. Frequency and character of complications are listed in Table 2. Financial cost of age related groups are shown in Fig. 1. It seems like the younger patients' cohort

Table 1
Baseline data and *p* values.

	60–74 year old cohort	75–89 year old cohort	<90 year old cohort	*p*-Value
Number of patients	86	252	64	
Gender	m: 34 f: 52	m: 60 f: 192	m: 15 f: 49	
BMI	23.8 (SD 9.3)	24.4 (SD 6.2)	21.4 (SD 10.6)	60–74/75–89, $p = 0.54$ 60–74/>90, $p = 0.16$ 75–89/<90, $p = 0.03$
Inhabitation in a nursing home	*5 (5.9%)*	*38 (15.1%)*	*25 (39.1%)*	
ASA classification	2.7 (SD 0.7)	2.92 (SD 0.57)	3.15 (SD 0.45)	60–74/75–89, $p = 0.013$ 60–74/>90, $p \leq 0.001$ 75–89/<90, $p = 0.005$
MMS < 25	33.1%	57%	73%	
BI on admission BI[a]	$m = 86.6$ (SD 23)	$m = 24.4$ (SD 6.2)	$m = 21.4$ (SD 10.6)	60–74/75–89, $p = 0.034$ 60–74/>90, $p \leq 0.001$ 75–89/<90, $p = 0.001$
CCI	2.51 (SD 2.7)	2.36 (SD 2.2)	2.34 (SD 2.4)	60–74/75–89, $p = 0.6337$ 60–74/>90, $p \leq 0.845$ 75–89/<90, $p = 0.886$
Time: admission until operative treatment	19.09 h (SD 15.78)	18.47 (SD 12.63)	16.544 (SD 11.55)	60–74/75–89, $p = 0.753$ 60–74/>90, $p \leq 0.276$ 75–89/<90, $p = 0.259$
Fracture type: femoral neck	49 (57%)	114 (45%)	32 (50%)	
Fracture type: trochanteric	32 (37.2%)	123 (48.8%)	31 (48.4%)	
Fracture type: subtrochanteric	5 (5.8%)	15 (6.0%)	1 (1.6%)	
Osteosynthesis	45 (52.35)	156 (61.9%)	36 (56.3%)	
Endoprothesis	41 (47.7%)	96 (38.1%)	28 (43.8%)	
Cutting to suture time	73.16 (SD 38.9)	57.11 (SD 23.6)	58.89 (SD 33.4)	60–74/75–89, $p \leq 0.001$ 60–74/>90, $p \leq 0.17$ 75–89/<90, $p = 0.689$
Diagnosed osteoporosis	19 (22.40%)	78 (30.8%)	23 (35.9%)	p = 0.171
Preexisting medication for the treatment of osteoporosis	2 (2.4%)	10 (4%)	2 (3.1%)	p = 0.77