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Research Article

Routinely Monitoring of The Geriatric Trauma Patient at an Intensive Care Unit. Is it Necessary? Patients Safety vs. Overtriage

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Abstract

Due to demographic change, the needs of geriatric patients are increasingly becoming the focus of scientific research. Although some areas of geriatric traumatology are already the subject of intensive research, there is still a lack of knowledge in other areas. This also applies to the underlying admission criteria and the course of geriatric trauma patients at the intensive care unit. **Material and methods**: We conducted a retrospective observational study covering the period 2013-2019. Inclusion criteria were older trauma patients (≥ 65 years) who were treated postoperatively at our trauma surgery intensive care unit. We collected descriptive parameters such as the underlying fracture entities, age, gender, Charlson-Comorbity-Index (CCI), ASA-score and the number of intraoperatively transfused red blood cell concentrates (RBCs), as well as our defined parameters of ICU dependency, such as non-invasive/invasive ventilation and the necessity of catecholamine therapy. **Results**: During the observation period, 1022 (84%) fulfilled the inclusion criteria. The mean age was 83 years. 67% (n=685) of the patients were female. 26.1% of patients had a need for intensive care. Significant factors of influence were gender($p<0.001$), CCI(age excluded)($p=0.012$), type of fracture($p<0.001$), number of intraoperatively transfused RBCs($p<0.001$) and ASA score($p<0.001$). Only 26% of patients required intensive care treatment according to defined parameters. Age alone does not justify postoperative monitoring in the intensive care unit. On the contrary, in terms of delir prevention, we now know that this is rather detrimental. In times of chronic shortage of intensive care beds, a targeted pre- & intraoperative assessment of patients should be carried out.

Keywords: Intensive Care Treatment; Geriatric Trauma Patient; Intensive Care Unit; Trauma Patient.

Introduction

The demographic change leads to a rising number of geriatric trauma patients. Already in 2013 3 million older adults presented in the USA to emergency departments with fall-related injuries [1]. Although geriatric trauma patients and in particular patients with hip fractures are already the focus of today's research, little is known about the course of geriatric trauma patients in the intensive care unit (ICU). We were already able to show that hip fracture patients account for only half of the geriatric trauma patients at an intensive care unit. The fracture pattern itself shows no influence on the mortality at the ICU. In contrast, it is the patient's own factors that influence mortality [2].

The GBA (Gemeinsamer Bundesausschuss/Joint Federal Committee) resolution "Hüftgelenksnahe Femurfraktur" in Germany states that many patients with trauma-related femur fractures near the hip joint require perioperative intensive monitoring due to their critical general condition. This applies in particular to those who were already functionally and cognitively impaired and 'frail' before the fall [3]. Not only, but at the latest during the COVID-19 pandemic, it became clear that the resource of intensive care beds is limited. The question also arises in which cases routine monitoring of geriatric trauma patients is indicated. Especially in view of the fact that a stay in the intensive care unit can also lead to an increased rate of complications, such as the occurrence of delirium [4]. There are already authors who question the need for routine postoperative monitoring [5]. Other authors showed that patients that were overtriaged at the ICU had similar outcomes but lead to higher costs [6].

Primary goal of this study was to analyze the necessity of intensive care treatment of geriatric trauma patients who were monitored on a routine basis in the intensive care unit after the operation. Secondary goal was to identify influencing factors that caused the need for treatment in the intensive care unit. Additionally, we performed a subgroup analysis of hip fracture patients. The high prevalence and serious consequences of proximal femur fractures in older people require careful consideration of postoperative treatment strategies. The question of routine intensive care monitoring specifically points to the need to balance the intensity of care with the individual needs of the patients and the available resources. This suggests that a generalized approach may not be optimal and a more nuanced, risk-stratified strategy is required-especially in this vulnerable group of patients. We would like to take a step in this direction with this study

Material and Methods

We performed a retrospectively analysis of patients treated at our surgical intensive care unit (ICU) between 2013 and 2019. In order to analyze older trauma patients, we chose age ≥65 years as inclusion criterium. All patients had to suffer from a fracture that had to be treated surgically and were postoperatively routinely monitored at the ICU. Patients in need of an elective surgery, staying at the ICU without a fracture or patients that were already treated at the ICU before surgery were excluded. Patients during Covid 19 Pandemic were not included, because of different triage modalities in times of pandemic and rare resources. Therefore, we stopped the analysis of data 2019.

The need to monitor the patient in the intensive care unit was determined by consensus between the anesthesiologists and trauma surgeons.

Ethical written consent was obtained from local ethic commission (ek-mr-30.12.2018-eschbach). Patient were identified on the basis of ward books. Characteristics and outcome parameters were complemented on the basis of our hospital information system. The indication for treatment at ICU was determined by the surgent and anesthesiologist.

The following data was collected retrospectively: Age, Sex, Charlson Comorbidity Index (CCI), mortality, length of stay at ICU, type of fracture, transfusion of erythrocyte concentrates during surgical care. We also subdivided the various types of injury into individual fracture regions and distinguished between the presence of multiple fracture types [2]. The need of intensive care treatment was defined by the use of catecholamines or invasive/non-invasive ventilation postoperatively. Additionally, we performed a subgroup analysis of patient suffering from hip fractures.

Data management and statistics

Data were entered into Microsoft Excel version 16.28 (Redmond, Washington, USA). IBM SPSS Statistics 24 (Statistical Package for the Social Science, IBM Corporation, Armonk, NY) was used for statistical analysis. Data were presented as means, 95% confidence intervals, and frequencies. Bivariate analysis was performed to determine associations between need for intensive care treatment, and its predictive factors. The test for normal distribution was performed using the Shapiro-Wilk test. If no normal distribution was found, either the Mann-Whitney U test or the Kruskal-Wallis test was performed. Nominally scaled variables were evaluated with the Pearson chi-square test.

Results

Baseline characteristics

During the observation period 1224 patients ≥65age were analyzed. 1022 patients fulfilled the inclusion criteria (84%). Mean age of the patients was 83 years (95% Confidence interval (CI) 82-83).

67% of the patients were female (n=685). The mean ASA-Score was 2.9 (95% CI 2.9-3.0). Mean Charlson Comorbidity Score (CCS) was 5.6 (CI 5.5-5.8). Mean duration of stay was 3.7 days (CI 3.4-4.0). Patients suffering from hip fractures (pertrochanteric, subtrochanteric and femoral neck fractures) were the most common ones 50.4% (n=515), followed by patients suffering from humeral fractures 10.2% (n=104) and periprosthetic femoral fractures 7.2% (n=74).

Patients in need of intensive care treatment

26.1% of the patients were in need of intensive care treatment. Significant parameters in regard of predicting necessity of intensive care treatment were gender (p<0.001), CCI (age excluded) (p=0.012), type of fracture (p<0.001), ASA-score (p<0.001) and transfusion of red blood cell concentrates (RBC) intraoperatively (p<0.001). A non-significant predicting parameter was age (p=0.108). Further Information is shown in (Table 1). Patients suffering from pelvis fractures, periprosthetic femoral fractures, fractures of the skull and polytraumatized patients were the ones that were more likely to be in need of intensive care treatment.

	Need of intensive care treatment	No intensive care treatment	p-value
Gender			p<0.001
- female	22.2% (n=152)	77.8% (n=533)	
- male	34.1% (n=115)	65.9% (n=222)	
Age (years)			p=0.108
- Mean (95%CI)	83.45 (82.10-84.80)	83.50 (82.78-84.21)	
CCI			p=0.151
- Mean (95%CI)	5.98 (5.63-6.33)	5.57 (5.40-5.74)	
CCI-age excluded			p=0.012
- Mean (95%CI)	2.31 (1.98-2.63)	1.91 (1.74-2.08)	
Type of fracture			p<0.001
Transfusion RBCs			p<0.001
- 0 RBCs	22.9% (n=206)	77.1% (n=693)	
- 1 RBC	36.4% (n=16)	63.6 (n=28)	
- 2 RBCs	42.0 (n=21)	58.0% (n=29)	
- 3 RBCs	71.4% (n=5)	28.6% (n=2)	
- 4 RBCs	66.7% (n=6)	33.3% (n=3)	
- >= 5RBCs	100% (n=13)	0% (n=0)	
ASA			p<0.001
- Mean (95%CI)	3.02 (2.90-3.14)	2.93 (2.87-2.99)	

Table 1: Patients needed or no intensive care treatment.

Subgroup analysis

We performed a subgroup analysis of patients suffering from hip fractures. 19.4% of the female and 29.4 of the male patients were in need of intensive care treatment (p=0.010). Further parameters predicting necessity of intensive care treatment were CCI (age excluded) (p=0.019 transfusion of erythrocyte concentrates intraoperatively (p<0.001). 22.9% of patient with hip fractures were in need of intensive care treatment. Additional information is shown in (Table 2).

	Need of intensive care treatment	No intensive care treatment	p-value
Gender			p=0.010
- female	19.4% (n=65)	80.6% (n=270)	
- male	29.4% (=53)	70.6% (n=127)	
Age (years)			p=0.963
- Mean (95%CI)	83.45 (82.10-84.80)	83.50 (82.78–84.21)	
CCI			p=0.038
- Mean (95%CI)	5.98 (5.63-6.33)	5.57 (5.40-5.74)	
CCI-age excluded			p=0.019
- Mean (95%CI)	2.31 (1.98-2.63)	1.91 (1.74-2.08)	
Transfusion RBCs			p<0.001
- 0 RBCs	20.7% (n=99)	79.3% (n=380)	
- 1 RBC	61.1% (n=11)	38.9% (n=7)	
- 2 RBCs	27.3% (n=3)	72.7% (n=8)	
- 3 RBCs	100% (n=2)	0% (n=0)	
- 4 RBCs	33.3% (n=1)	66.7% (n=2)	
- >= 5 RBCs	100% (n=2)	0% (n=0)	
ASA			p=0.060
- Mean (95%CI)	3.02 (2.90-3.14)	2.93 (2.87-2.99)	
OP-Dauer			

Table 2: Subgroup analysis of patients suffering from hip fractures.

Discussion

The Joint Federal Committee of Germany stated in 2019 that many patients with trauma-related femoral fractures close to the hip joint require intensive perioperative monitoring due to their critical general condition [3]. Nevertheless, the number of intensive care beds is limited and therefore a scarce resource. In addition, it has been proven that patients at ICU have a high risk of suffering from delirium [4]. Delirium, in turn, is well known as a significant factor in the deterioration of the outcome. Therefore, unnecessary monitoring of a patient in an intensive care unit should be avoided. In this investigation, we studied the need of intensive care treatment of older trauma patients at the ICU. Additionally, we identified risk factors that may influence the need for intensive care treatment. Furthermore, we performed a subgroup analysis regarding hip fracture patients, as typical geriatric trauma patients, which in deed showed similar results to the main analysis. The main difference was a minor need for intensive care treatment (26.1% vs. 22.9%).

There is a high variation regarding the need of intensive care treatment of ICU admissions between different countries. This is of course also due to the availability of intensive care beds. While Germany has 24 intensive care beds per 100,000 inhabitants, the UK has only 3.3 [7]. Therefore, patients in Germany are more likely being treated at an ICU compared to the UK [7]. In this study we evaluated only patients suffering from a fracture that had to be treated surgically and which were postoperatively routinely monitored at the ICU. Only 26.1% of those patients were in need of an intensive care treatment, according to our defined ICU criteria. For this reason, it is not surprising that there are authors who question the need for routine postoperative monitoring. Wunsch et al. examined the frequency of admission to an ICU between different hospitals of patients undergoing selected major surgical procedures. They stated that there is little consensus regarding the need for intensive care for patients undergoing major surgical procedures and no relationship between a hospital's use of intensive care and hospital mortality [5]. Loftus et al. showed that low-acuity postoperative patients who were overtriaged to ICUs had similar outcomes compared with risk-matched ward patients but had higher costs and lower value of care [6]. Dogruyol et al came to a similar conclusion in their retrospective study, in which they divided patients with major thoracic surgery

into 2 groups using propensity score matching. One group was monitored postoperatively in an intensive care unit, the other in a normal ward. They found no significant differences in terms of complications (classified according to Clavian and Dindo), early morbidity and mortality. Only long-term morbidity was higher in the patients who were routinely monitored in the intensive care unit [8].

This could be explained by a patient appearing frail, who is not recorded as having a significant pre-existing condition in the critical review of medical factors - but who appears to the experienced examiner to be a high-risk patient due to the visible frailty. These patients with pronounced frailty have been shown to have a significantly increased risk of death.

Factors that influenced the patients' need for intensive care in our study are sex (female 22.2% vs male 34.1%; $p<0.001$), CCI (age excluded) ($p=0.012$), type of fracture ($p<0.001$), transfusion of red blood cell concentrates ($p<0.001$) and the ASA-Score ($p<0.001$). A closer look at gender reveals that women suffer more frequently from proximal femur fractures, while men have a poorer outcome in the short and long term [9,10]. Therefore, an increased rate of need for intensive carte treatment in male patients also seems to follow this trend.

The ASA score and the CCI both represent the patient's pre-existing conditions. The fact that patients with a higher ASA score and a higher CCI are sicker and therefore have a higher risk of needing intensive care also seems understandable, as this increases the risk of secondary complications. In this sense, the ASA score and the CCI are already parameters that are used to determine the need for post-operative monitoring in an intensive care unit [11]. Gezer et al studied the need for postoperative Intensive Care Unit transmission in hip fracture patients. Besides the already mentioned CCI and ASA score, the presence of comorbidities like hypertension and diabetes mellitus as well as age were influencing factors [11]. In everyday clinical practice, age also appears to have an influence on whether patients are routinely transferred to an intensive care unit postoperatively. Nevertheless, in our study age was not able to predict the necessity of an intensive care treatment. It turns out that age alone does not say much about the patient's risk in this context. This is similar to the definition of the geriatric patient. Here, too, a geriatric patient cannot be defined by age alone. In this context, comorbidities and frailty also play an important role in the assessment. Unfortunately, the Frailty Index was not recorded in our patient group, so we are unable to make any statement about this. According to our results, there are patient-specific factors as well as operation-specific factors that influence the need for intensive therapy. Therefore, we are in need of a score that combines both of these parameters. Taking a closer look at the current literature there are several scores that have been examined regarding their ability to predict the need of Intensive care monitoring. Gezer et al analyzed in their retrospective performed study the predictive power of ASA-Score. Surgical Outcome Risk Tool (SORT) and age-adjusted Charlson Comorbidity Score (ACCI) for ICU admission of older patient suffering from hip fracture.

In their study neither ASA-Score nor SORT provided meaningful information in determining the need for ICU admissions. They stated that ACCI scores could be a valuable prognostic tool in predicting the need for postoperative admissions to the ICU [11]. In contrast to Gezer et al Vahapoğlu et al stated in their prospective study a high efficiency of SORT regarding the prediction of post-operative ICU admission [12]. Zhan et al showed in the study that the Charlson Comorbidity Index is an important predictor of ICU admission after surgery in patients with unruptured thoracic aortic aneurysm [13]. Jerath et al were able to show similar results. Analyzing elective noncardiac surgeries they showed that patients transferred to the ICU had a higher CCI than patients admitted to a ward. Additionally, they showed, that the necessity of ICU admissions is depending on the type of surgery [14]. Our study is not quite comparable to the above-mentioned studies, because we analyzed the need of intensive care treatment and not only the ICU admissions. The CCI showed in our cohort showed only a significant prediction for intensive care treatment when excluding age. In our study we were able to show, that there is a significant difference between different surgery/fractures regarding the need of intensive care treatment. This is similar to the findings of Jerath et al regarding ICU admission [14].

The question whether there is need for planned admission of post-operative patients to the intensive care unit is still challenging. Bertges were able to show, that most of the patients (89%) after elective infrarenal abdominal aortic aneurysm repair do not need to be admitted to an intensive care unit [15]. Nevertheless, a proper preoperative assessment is necessary for the selection of the postoperative treatment of these patients [15]. Sobol concluded in their review regarding the triage of high-risk surgical patients for intensive care as a task still being difficult [16]. While unnecessary overuse of ICU admissions and prolonged length of stay need to be minimized, there is still a potential risk for the underuse of intensive care resources and harming a patient. Kose et al evaluated severity-scoring systems as predictors of intensive care unit need. In their study criteria for a "necessary admission" were death, length of stay more than 48 hours, need for vasoactive agents, or mechanical ventilation for more than 24 hours. In their analysis the Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (POSSUM) as well as the ASA-Score were the best discriminative scores (POSSUM being superior to ASA-Score regarding the predictive power). They showed that high risk patient (patients with ASA scores≥3 and P-total≥35) needed ICU 4.83-fold more than low risk patients [17]. Nevertheless, the POSSUM score seems to have a quite good

predictive power regarding the need of intensive care treatment, but it is complex and need many variables. Therefore, we are in need of a simply tool helping us to decide whether a patient is more likely in need of an intensive care treatment or not.

Limitations of our study are the retrospective design. Additionally, we are not able to cover all aspects of intensive care treatment. Nevertheless, strengths of the study are apart from the large number patients, its focus on the patient collective of geriatric trauma patients at ICU.

It has to be mentioned, that during the period of analysis there was no consistent criteria for ICU admission. The need for ICU treatment was determined by consensus of treating physicians and surgeons. There may therefore have been some over triage in favour of an intensive care stay treatment.

Conclusion

As only 26% of patients treated postoperatively in our ICU required intensive care according to our criteria, more care needs to be taken in triage. Our criteria may not include borderline cases of intensive care and thus somewhat underrepresent this patient population, but nevertheless almost three quarters of patients were transferred to intensive care without a hard indication. As also demonstrated in our study, age alone does not justify postoperative monitoring in the intensive care unit. On the contrary, in terms of delir prevention, we now know that this is rather detrimental. In times of chronic shortage of intensive care beds, a targeted pre- & intraoperative assessment of patients should be carried out in order to avoid transfer to the intensive care unit as far as possible.

Ethical Guidelines: Ethical written consent was obtained from local ethic commission (ek-mr-30.12.2018-eschbach).

Conflict of interest: The authors declare that there are no conflicts of interest

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