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Geriatric polytrauma

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Summary. *Background:* compared to a younger population, the treatment of geriatric trauma victims is known to be associated with a higher mortality and morbidity. The objectives of this study are to assess the clinical course and outcome of multitrauma patients aged 65 years and over. In addition, a direct comparison between the geriatric trauma patients and the younger collective is performed.

Method: our study includes all multitrauma patients treated between 1992 and 2001 at a major urban trauma center. The major issues of this analysis are: injury severity, injury pattern, preclinical hemodynamics and intubation rate, operative treatment, ventilation time, outcome as well as incidence of multiorgan failure (MOF) and adult respiratory distress syndrome (ARDS). Out of these results, adults over 65 years of age (group B, n = 45) are compared to the younger group, ranging from 16 to 64 years of age (group A, n = 369).

Results: The preclinical intubation rate was comparable in both groups (A: 73.2%, B: 68.9%). Significantly more cases of group B were primarily shocked (A: 29.0%, B: 48.9%). The mean ISS was comparable in both groups (A: 34.0; B: 32.1). The younger group showed a significantly higher incidence of spine injuries (A: 21.1%; B: 6.7%). The number of emergency procedures (A: 24.2%; B: 24.4%) and operations during the first 24 hours (A: 70.2%; B: 60.0%) was comparable in both groups. The older group showed a lower number of reconstructive operations (A: 57.6%; B: 35.6%). Geriatric trauma patients had a longer ventilation time compared to their younger counterparts (A: 13.0 days, B: 20.0 days). During ICU-therapy, the ARDS rate was comparable (A: 16.0%, B: 15.6%). In contrast, the incidence of MOF was significantly higher in group B (A: 7.1%; B: 17.8%).

The older group showed a significantly higher mortality rate (A: 26.8%; B: 53.3%) as well as early mortality during the first 24 hours after admission (A: 16.3%, B: 31.11%).

Conclusion: Despite similarity in injury severity and a comparable injury pattern, elderly multitrauma patients initially presented a higher rate of hemodynamic instability, had to be ventilated longer and had a higher mortality.

Key words: Geriatric, polytrauma, injury severity, injury pattern, mortality.

Introduction

It is estimated, that the proportion of elderly people in our population will rise rapidly. In the year 2000, 20.7% of the Austrian population was older than 60 years. In the year 2030, 32.2% will be counted to this age group [1]. Reasons for the increasing rate of older people with multiple injuries are, on the one hand, an increasing life expectancy and declining birth rate, on the other hand, the higher mobility of older people.

The outcome and prognosis of geriatric trauma patients has become a matter of concern in recent years. In a previous study, it was reported that older trauma patients had a higher mortality due to the development of septic complications [2]. One major complicating factor responsible for the bad outcome is the limited physiological reserve in elderly people. Other reasons for the increased mortality rate in elderly trauma patients are preexisting pulmonary and cardiopulmonary diseases.

It was the aim of the present study to analyze injury severity, preclinical state, treatment, ventilation time, complications and outcome of geriatric trauma patients. In addition, we aimed to directly compare this group of multitrauma patients with a younger control group.

Study population and methods

Data were obtained from a level I academic trauma center. Since September 1992, all patients seen at our major urban trauma center are being entered into a computerized trauma database and our study includes patients up to December 2001. We collected data on all polytrauma patients admitted to the hospital for at least one day, as well as all patients declared dead in the emergency department. The study includes all polytrauma patients, defined as injuries of two or more body cavities, or injury of one body cavity and two long bone fractures. Not included are patients with isolated, severe, potentially life-threatening injuries. Out of these data, including all age groups, adults aged 65 years or older (group B) were compared to the younger group aged from 16 to 64 years (group A).

Table 1. Injury distribution per body region (Abbreviated Injury Scale score ≥3) for patients 65 years and more (group B) and the younger group A

	Group A		Group B	
	n = 369	%	n = 45	%
Mean age	36.4		74.8	
Male		73.4		44.4
AIS ≥3				
Head	201	54.5	27	60.0
Chest	248	67.2	25	55.6
Extremities	233	63.1	31	68.9
Spine	49	13.3	2	4.4

Injury severity was classified according to the Abbreviated Injury Scale (AIS) and the Injury Severity Score (ISS) [3]. All patients are treated following the principles of the polytrauma-algorithm presented by Schweiberer [4]. Systemic hemodynamics at admission were scored as unstable (defined as systolic blood pressure ≤90 mmHg) or stable (systolic blood pressure >90 mmHg). In addition to the demographic data (age, sex, ISS and AIS-injury pattern), preclinical intubation rate, hemodynamics at admission, surgical interventions, duration of mechanical ventilation, complications and outcome, were analyzed.

Multiorgan failure (MOF) was defined as ≥2 points for 2 or more organ systems (pulmonary, cardiovascular, hepatic, renal, central nervous, hematological and gastrointestinal systems) over a period of 3 days or longer, according to Goris et al. [5]. Adult respiratory distress syndrome (ARDS) was defined as a PaO_2/FiO_2 ratio of less than 200 for at least five consecutive days and bilateral diffuse infiltrates seen on the chest X-ray in the absence of pneumonia and cardiogenic pulmonary edema [6].

Statistics

Comparisons between group A (16–64 years) and group B (≥65 years) were performed with the Wilcoxon-two-sample-test. To check for differences in dichotomous variables between the two groups Fisher's Exact Test was performed. The method of stepwise logistic regression was used to explain ventilation time and mortality rate whereas the variables age, injury severity and hemodynamic situation were considered as independent variables to model the probability of death. To calculate the duration of ventilation, a stepwise Cox-model with the event "alive-release" was performed. If a patient died, the ventilation time was censored with the maximum (63days).

A p value of <0.05 was considered to be statistically significant. Continuous data are reported as means, with ranges given; non-continuous data are reported as median with ranges.

Results

Demographics

Out of 466 patients that had been entered in our polytrauma database, 369 patients represented the younger group A (16–64 years), and 45 patients (65–91 years) formed group B (Table 1, Fig. 1).

Preclinical state

Preclinical intubation rate and ventilation in both groups was about 70% (A: 73.2%, B: 68.9%; p = not significant). Hemodynamics at admission showed significant differences between the two groups: 29.0% of patients between 16–64 years and 48.9% of the older-group patients were hemodynamically not stable ($p = 0.01$) (Fig. 2).

Injury severity and injury pattern

The mean ISS was comparable in both groups (A: 34.0; range, 13–75; B: 32.1; range, 13–75).

We did not see any differences in the injury pattern between both groups, except for one region: the younger group showed a significantly higher incidence of spine injuries (A: 21.1%; B: 6.7%; $p = 0.02$). Spine injuries with an AIS ≥3 were diagnosed in 13.3% of group A and 4.4% of group B. Three regions with a median AIS ≥3 in both groups were mainly affected: head (A: 54.5%; B:60.0%), chest (A: 67.2%; B: 55.6%) and extremities (A: 63.1%; B: 68.9%). There were also no differences regarding the incidence of head- (A: 67.2%; B: 66.7%), neck- (A: 5.4%;

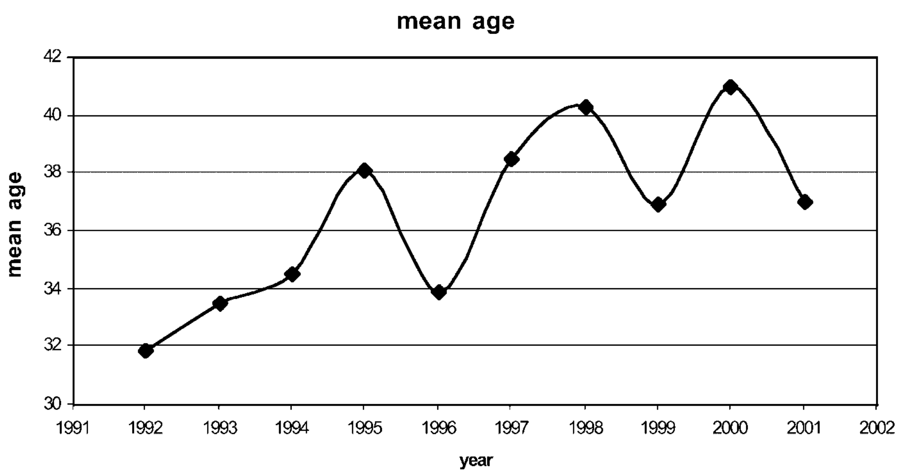

Fig. 1. Age distribution during the 9-year study period

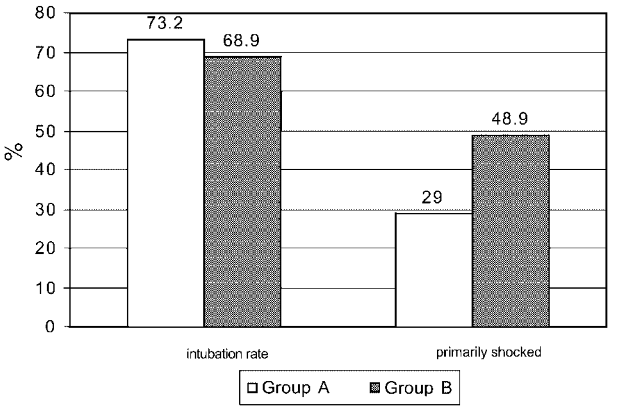

Fig. 2. Intubation rate and hemodynamically instable patients (values are percentages) of the younger group A and patients aged 65 years and over (group B)

B: 0%), chest- (A: 75.9%; B: 73.3%), abdomen- (A: 40.1%; B: 33.3%), extremities- (A: 78.9%; B: 75.6%) and external injuries (A: 52.9%; B: 57.8) (Table 1).

Surgical treatment and ventilation time

Surgical interventions listed following the principles of Schweiberer et al. showed the following pattern [4]: emergency surgery was done 114 times in 89 cases (24.2%) of group A and 14 times in 11 cases (24.4%) of group B; operations in phase III (day I surgery) were performed in 70.2% of the younger group A, 22.5% were treated ≥ 3 times; 60.0% of group B needed operations after stabilization during the initial 24 hours (phase III), 13.3% ≥ 3 times; reconstructive procedures after 24 hours (phase V) were performed in 57.6% of group A, whereas 21.0% were treated ≥ 3 times. 35.6% of the geriatric patients underwent reconstructive surgery after 24 hours (13.3% ≥ 3 times). There was no difference in the average number of surgical interventions for phase Ia and III between the two groups, but the number of reconstructive procedures was significantly higher in group A (Fig. 3). The mean duration of ventilation was significantly higher in the older group B (A: 13.0 days; B: 20.0 days).

Complications and outcome

Patients in group B showed a significantly higher incidence of MOF (A: 7.1%; B: 17.8%, $p = 0.02$). A significant difference concerning the incidence of ARDS was not evident (A: 16.0%, B: 15.6%) (Fig. 4).

Multiple regression analysis revealed ISS, hemodynamics at admission and age to have a significant influence on mortality. Mortality was significantly higher in group B: 26.8% of group A and 53.3% of group B died ($p = 0.00049$). Early mortality during the first 24 hours after admission was significantly higher in group B: 16.3% of group A and 31.1% of group B died ($p = 0.0137$).

Discussion

Increasing life expectancy, decline in birthrate and higher mobility of older people are related to an increasing number of injuries in older people in general, and severe trauma in particular. Advanced age is a well-recognized risk factor for adverse outcome following trauma [7, 8].

Polytrauma care in Austria is well organized and follows standardized protocols to ensure maximum efficacy. In addition to emergency physician ambulances, a countrywide system of rescue helicopters covers the entire country. Specially trained emergency physicians are taken to the scene by helicopter or emergency physician ambulances, different to the paramedic system in the Anglo-American countries [9–11]. Basic concepts include initial checkup, aggressive infusion shock therapy in blunt trauma, preclinical intubation, ventilation and early stabilization of long bone fractures. This consistent management is reflected in the high initial intubation rate of 70% in the present series.

Although these concepts have decreased mortality of polytrauma patients in general, the multiply injured geriatric patient has to be critically evaluated. A study reported by Demetriades et al. showed that geriatric trauma patients occupy a special position during early intensive management [12]. A misleading clinical picture of stability on admission because of the limited cardiovascular and pulmonary reserves in elderly patients is an important complicating factor. Recent studies showed existing cardiac diseases in 33% and cardiorespiratory diseases under medical treatment in 42% of polytraumatized patients aged 65 years and over [2].

One of the major findings of our study was the similar injury severity, using an anatomical scoring system (ISS), in younger and geriatric trauma patients. In a retrospective study of Lehmann et al. it was shown, that the rate of early preclinical intubation can be related with injury severity [13]. Our results confirmed this relationship, with no differences found between the two groups concerning ISS and preclinical intubation rate. Regarding the injury pattern, the most common severely injured body areas were head, chest and extremities. A significantly higher spine-AIS of younger patients in our series corresponded well

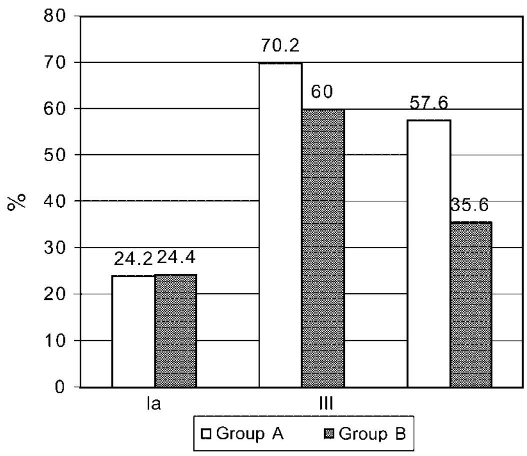

Fig. 3. Emergency surgery (*Ia*), day-one surgery (*III*) and reconstructive treatment (*V*) (values are percentages) of the younger group A and patients aged 65 years and over (group B)

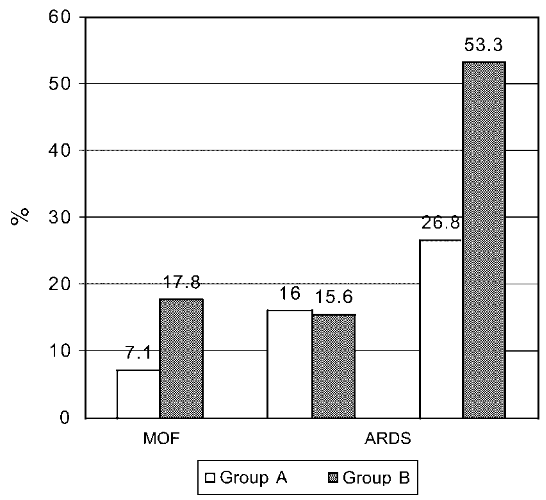

Fig. 4. Incidence of multiorgan failure (*MOF*), Adult respiratory distress syndrome (*ARDS*) and mortality for patients 65 years and over (group B) and the younger group A

with the results reported by Aufmkolk et al. [2]. In their study, severely injured patients were also compared in regard to age. The authors mentioned the higher rate of falls from great height as the cause of spine injury in younger patients. Though not directly addressed by the authors, this difference was statistically significant.

The treatment principles at the scene of injury as well as during resuscitation in the emergency room are the same for all patients, regardless of the age. It was reported that 63% of geriatric trauma patients with an ISS > 15 and 25% of those with an ISS > 30 initially were considered to be stable and therefore did not meet any of the standard hemodynamic criteria for trauma team activation [14]. This data may illustrate that elderly polytrauma patients occupy an exceptional position in the acute setting. Another important finding of our study was that 50% of the older-group and about 30% of the younger patients were hemodynamically unstable upon admission. To our knowledge, there are presently no reports available that directly focus on the optimal treatment of traumatic shock in the elderly. Cautious shock therapy and early monitoring may be helpful to prevent fluid overloading and early decompensation.

No difference in the number of surgical procedures during the first 24 hours was found between the groups. The decreased number of later operations in the elderly group can be explained by the higher early mortality of geriatric polytraumatized patients. Regel et al. noticed an average of 13.7 days controlled ventilation time of multitrauma patients between 1982 and 1992 [15]. In our study, we observed an average of 13.0 days ventilation time in patients younger than 65 years.

Elderly patients showed a remarkably longer duration of ventilation with a mean of 20 days.

Multiple organ failure (MOF) following major trauma occurs in response to perfusion deficits, a persistent inflammatory focus, or a persistent focus of injured tissue. In contrast to Aufmkolk et al., we saw a significantly higher incidence of MOF in the geriatric group; significant differences concerning the incidence of acute respiratory distress syndrome were not evident [2]. It is well known, that the initial treatment of multitrauma patients influences the development of MOF [13]. The major finding of Lehmann et al. in a retrospective study analyzing 1112 multitrauma patients was, that posttraumatic MOF was the most frequent cause of death [13]. It is generally acknowledged, that the overall outcome is adversely affected when the geriatric patient sustains complications during initial hospitalization [16, 17]. This fact must have an influence on the significantly higher mortality rate of elderly patients, as in our series. An important aspect of our study is, that we observed a significantly higher rate of early deaths during the first 24 hours after admission in the geriatric group, despite there being no difference in injury severity. This disparity might be explained by the weakness of ISS, based on anatomic criteria and not incorporating vital signs and clinic conditions. Research has shown that substantial differences can occur between ISSs determined clinically and by autopsy, especially for patients dying soon after hospital admission [18]. A mortality rate of 53% in the geriatric group was found. This is comparable to data published by other authors [12, 19]. One of the earliest studies to focus on the influence of age on outcome in major trauma was the Major Trauma Outcome Study. Data from 3,933 patients 65 years and older were compared to that of 42,944 patients less than 65 years of age. Mortality rose sharply between the age of 45 and 55 and doubled at the age of 75 years. This age-dependent survival decrement occurred at all ISS values, for all mechanisms of injury, and for all body regions [20]. Numerous other studies have supported the findings, that the effect of trauma on the elderly is more serious than that on younger patients.

In summary, the factors responsible for the increased morbidity and mortality seen in geriatric trauma are not entirely clear. It has been suggested that the decreased physiological reserve that accompanies aging as well as the high incidence of pre-existing medical conditions in the geriatric patient accounts for the increased morbidity and mortality in geriatric trauma patients compared to their younger counterparts. Our study will provide evidence-based support for the difficult decisions, which are required to achieve optimal outcomes in this difficult, but growing, patient group.

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