

TRAUMA IN THE AGED

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After accidents, elderly patients (aged 75 years and older) have been demonstrated to have increased mortality rates after trauma, however, the prognosis of those patients surviving their hospitalization is unknown. We hypothesized that surviving elderly patients would also have decreased functional outcomes.

The aim of the study. This study examined the outcome of elderly patients exposed to varying trauma relative to all trauma patients.

Material and methods. This was a retrospective study of 5046 patients with trauma in 2001-2005 treated. 972 of these patients were aged 75 or more. Data included demographics, risks factors, cause of trauma, operative or conservative management and result of treatment.

Results. Mechanisms of injury were falls (almost 90%), motor vehicle collisions (8%) and other. Statistical differences in the mechanisms of trauma between the studied and younger groups were observed. The mortality rate was doubled in the older group. Almost 2/3 of the patients underwent surgery. The strategy of management and treatment of elderly trauma patients has not been studied in the literature. This group may require special management and monitoring, and if possible, noninvasive modes of treatment. There are big advantages by aggressive, operative treatment of oldest patients, but is the „thin red line” in profits and loss in this group.

Conclusions. In our opinion, it is necessity to operate on all elderly patients in good overall condition who were mobile and of good mental status prior to the accident, status, but we do not recommend operations in low-risk patients or those with bad prognosis for successful rehabilitation.

Key words: elderly, functional outcome, risk of operation, trauma in the aged

Similar to other countries, in Poland, as in other countries, the elderly population continues to rise. The percentage of people over 60 doubled within last 50 years (rose from 8.3 in 1950 to 17.6 in 2000), and nowadays, the group of people over 75 constitute 4% of the entire population.

According to statistical data from GUS, a typical Pole suffers from 3.8 chronic diseases, with cardiovascular disorders playing prominent role (1, 2). They are diagnosed in 75% of elderly people. Elderly patients are commonly affected by disease that significantly affect their quality of life, such as degenerative ar-

thropathies, eye and ear dysfunction and mobility problems. Musculoskeletal, respiratory, and digestive disorders affect 68%, 46%, and 34% of the elderly population, respectively. Diabetes mellitus, a disease of modern civilization, affects about 40% of population over 65. It results in an increased risk of infectious complications and delayed bone healing. Obesity affects the same group of patients and worsens prognosis, which results in an increased number of complications, prolongs hospitalization, lengthens mechanical ventilation time and increases mortality (3). Only about 20% of elderly people do not report

memory disorders. The remaining 10% suffer from dementia.

Quantity and value of those risk factors are typically assessed using American Society of Anesthesiologists Physical Status Classification Scale. For burned patients (but with possible use in other types of injury) AGESCORE worked out by Moreau et al was recently introduced (4).

Personal injuries in elderly are caused by summarized influence of age and environmental threats (5). Most commonly they are caused by falls. Fall – event of sudden and unintended drop to the floor, ground or other flat surface (called in Poland “upadek poziomy” and in English-language literature “low velocity fall”) – is very common in the group of oldest patients. According to literature as many as 30% of people over 65 become injured due to falls once a year (and 15% at least twice a year) whereas this proportion doubles in case of institutionalization of the patients (1, 2, 5, 6). Risk of fall increases to 50% for people over 80. As many as 20% of patients after falls require medical aid, and 10% of casualties sustain serious body injuries. Thus falls affect elderly people very often, and their consequences in the form of injuries, fractures, subdural haematomas with subsequent disability and death constitute a great problem (7). The oldest people constitute up to 15% of patients of emergency departments and almost half of them require hospitalization. Almost half of emergency hospitalizations involve elderly with 40% of patients admitted in life-threatening condition (8).

Falls very often results from fainting or syncope. Fainting is defined as a sudden, transient (usually withdrawing spontaneously), momentary loss of consciousness and muscular tension typically leading to fall. Syncope is usually sudden and withdrawal quick, spontaneous and complete (9, 10). Leading cause of fainting is generalized decrease in the brain perfusion.

Elderly very often become injured as a pedestrians struck by cars thus they sustain injuries more serious than younger people typically injured due to traffic collisions. This results in higher mortality rate in the group of elderly patients (11). Some of elderly people become injured (with high morbidity of injuries of heads and hands) during working at home or farming because of decreased skillful-

ness and minor familiarity with modern machinery (12).

Well known model of trauma victim (typically young, healthy male) changed recently by addition of old, ill patient, very often female to it (13, 14). This requires modification of diagnostic and treatment algorithms including concomitant diseases typically affecting elderly people (14).

Management tactics in multiple injuries in patients over 70 requires broad spectrum of monitoring (14, 15) including cardiac output measurement, pulse-oxymetry, early intubation if needed (sometimes before radiological assessment), admission to ICU (with introduction of Swan-Ganz catheter) even in case of minor injuries. Such management allows for improvement of treatment results. Elderly patients sometimes do not respond to severe injury and loss of blood with marked tachycardia (due to inefficient reaction or prolonged use of β -blockers). They are more vulnerable to decreased blood pressure (due to very common hypertension) with blurred differentiation between adequate fulfillment of vascular bed and its overload. Elderly patients are very prone to develop sudden respiratory insufficiency due to rib fractures or lung contusion, with increase in the mortality rate together with age and number of fractured ribs (16, 17). Intolerance to blood loss (due to poor condition of vessels) together with commonly used drugs affecting clotting system results in very common intracranial bleeding.

Use of anticoagulants (with Acard being the most commonly used such drug in Poland) can cause another problem by precluding use of spinal or epidural anesthesia thus resulting in delayed surgical treatment of fractures. This together with necessity of additional diagnostics or prolonged preparation for surgical procedures results in lengthened hospitalization, delayed return to initial physical efficiency and increased amount of blood transfused. Even so mortality remains unaffected (18, 19) although not in every study (20). To a lesser degree this affects complication ratio. In case of head injuries situation is different. Even initially only slightly increased blood loss results in increase in the mortality threefold reaching 25-50% (21, 22).

Elderly patients are very prone to develop ARDS (adult respiratory distress syndrome) (23). In case of thoracic injuries one of the most

important prognostic parameters is vital capacity (VC) of lungs (23) constituting one of the most important factors for planning of therapeutic tactics.

THE AIM OF THE STUDY

Description of differences in injuries in the group of elderly patients and results of their treatment based on the retrospective analysis of own material constituted the aim of the study.

MATERIAL AND METHODS

972 patients over 75 treated for injuries in our emergency department from 1.01.2001 to 31.12.2005 as emergency cases constituted material for our study. There were 762 female (78%) and 210 male patients included in the study. Retrospective analysis was performed based on the patients' data from clinical data base called "Pacjenci". Statistical analysis was achieved using MS Office tools (average, standard deviation, t-Student's test, χ^2). To define injuries, documented accompanied illness, complications and kind of operations generally accepted medical and anatomical nomenclature was used.

RESULTS

5046 patients were hospitalized for injuries during the study period, including 972 patients over 75. Elderly patients constituted 19.3% of hospitalized trauma victims, while their per-

centage in the entire population was approximately 4% ($p < 0.01$). 762 females (78.5%) and 210 males (21.5%) were included in this study. A similar sex proportion is found in the elderly population (over 75) in Poland. In the entire population of trauma victims, women constitute only about 42.5%, but account for 51.3% in the Polish population.

The mean age of included patients reached 82.9 ± 5.5 with 83.4 ± 5.6 for women and 81.1 ± 5.1 for men. In the whole population of trauma victims, female patients are on average, 14 years older than male patients.

In the whole population of trauma victims falls constituted the most common cause of injuries affecting almost half of the patients. Three-quarters of the patients were injured in traffic collisions and the remaining 25% was due to other accidents. In the elderly population, falls were responsible for almost 90% of all injuries ($p < 0.01$) (tab. 1).

In the whole population of trauma victims, injuries of the head and lower extremities dominated (each found in almost 1/3 of patients), while isolated injuries of abdomen and pelvis were the least common (each found in about 2% of patients). Multiple injuries were diagnosed in about 14% of patients.

Injuries of lower extremities were found in 60% of patients over 75, upper extremities in 16%, head injuries only in 8% and multiple injuries in 5%. These differences were statistically significant (tab. 2).

The mean severity of injuries in the group of patients over 75 reached 9.07 ± 5.5 points according to ISS (while in the whole population of trauma victims reached 7.88 ± 8.49). As

Table 1. Cause of trauma in all patients and in aged over 75 years

Cause of injury	All treated	Age \geq 75
Falls (low velocity falls)	2459 (48,7%)	865 (89%)
Other (non traffic)	1315 (26,1%)	31 (3,2%)
Traffic accidents	1272 (25,2%)	76 (7,8%)

Table 2. Placement of injuries in all patients and in aged \geq 75 years

	Multiple injury	Head	Thorax	Abdomen	Pelvis	Spine	Upper limb	Lower limb
All patients	689	1696	240	94	81	185	529	1607
	13,45%	33,12%	4,69%	1,84%	1,58%	3,61%	10,33%	31,39%
p	<0,01	<0,01	\approx	\approx	\approx	\approx	\approx	<0,01
75+	53	81	29	0	34	25	161	588
	5,46%	8,35%	2,99%	0	3,51%	2,58%	16,56%	60,49%

a result, the elderly sustained statistically significantly more severe injuries ($p < 0.01$), despite the lower incidence of multiple injuries.

In the study group, injuries of the extremities as a result of plain falls dominated (they affected over 75% of included patients), including:

- pertrochanteric femur fractures (288 patients),
- femoral neck fractures (243 patients),
- distal epiphyseal forearm fractures (68 patients) and
- humeral neck fractures (54 patients).

Concomitant diseases were found in 71% of the study patients, with arterial hypertension (356 patients – 37%), CAD (337 patients – 35%), diabetes mellitus (116 patients – 12%) and chronic respiratory insufficiency (70 patients – 7%), as the most common. Arrhythmias were observed in 61 (6%) patients. 223 patients presented with different disturbances of consciousness, 70 (7%) of them had other injuries in the past and 62 (6%) had movement system handicap.

The mean ASA score was assessed between 1 and 5 and the average was 2.81 ± 2.32 points.

The vast majority of patients were treated surgically (644 patients – 66.26%) and another 57 patients underwent minor surgical procedures, such as suturing of the wounds (generally in 61 patients), pleural drainage (7), evacuation of haematoma (8) or direct skeletal traction (9) were performed. In 34 patients, other operations were performed (hand injuries in 10 cases, laparotomy in 4 and tracheostomy in 4). Of course, orthopedic procedures dominated the study group, but precise selection of the technique used depended on the type of orthopedic implant that department was supplied with.

And so:

- from the group of 288 patients suffering from pertrochanteric fractures, 3 were operated using Gamma nails, 27 – using DHS, 49 – using ZESPOL plate and 159 – using AO plate;
- from the group of 243 patients with femoral neck fractures, 14 patients were treated using total hip endoprosthesis, 189 – using partial hip endoprosthesis, 2 – using Garden's screws, 1 – using AO plate and 1 – using ZESPOL plate;
- from the group of 68 patients suffering from distal epiphyseal forearm fractures, 46 pa-

tients were treated with the use of Kirschner's wires;

- from the group of 54 patients with humeral neck fractures, 52 patients were treated with the use of Rush pins.

Only 271 patients (27.9%) were treated conservatively. 31 persons had two to three serious procedures. Complications were observed in 98 patients (10%). Deterioration of cardio-respiratory function occurred in 20 patients, respiratory tract and lung infection occurred in 14, and bleeding from stomach or duodenum occurred in 14. During hospitalization, 6 heart-stroke, 6 pulmonary embolus and 6 renal failures occurred. In 5 patients sprein od endoprosthesis occurred.

The mortality rate in the group of all trauma victims was 2.22%. In the study group of patients over 75 years, 45 patients died (4.63%) and this difference was statistically significant. Patients from the study group were also significantly older (82.9 ± 5.5 vs 50.3 ± 22.5). Within the study group, 27 patients (4.2%) were treated surgically and died as compared to 18 of patients treated conservatively or with the use of only minor surgical procedure (5.49%). The mean age of former patients was 82.7 and of the latter was 84.9. The ASA score in the group of patients treated conservatively was 0.65 points higher and patients suffered from at least two concomitant diseases. Cardio-respiratory failure was the most common cause of death. 6 patients died from pulmonary embolus and 4 from heart-stroke.

Unfortunately, without thorough analysis of every case, it is impossible to assess to what extent different types of management were employed (ie surgical or conservative) and whether this contributed to patient's death or survival. However, the low mortality rate in the study group allows us to formulate a thesis that establishes a therapeutic algorithm that results good outcomes.

DISCUSSION

The incidence of fractures is disproportionately high in the group of oldest patients. Although the aim of the therapeutic process is the same and irrespective of the patient's age, treatment of the elderly patients is still challenging. Elderly patients present many difficulties related to the fracture itself and factors present before the accident. Elderly patients

are more frequently addicted to institutionalized treatment and are usually immobilized by fractures for long periods of time. This happens because of factors related both to the patient (patient's general state of health and patient's efficiency before the accident) and the fracture itself (localization, complexity, state of the soft tissues at the site of fracture and systemic disorders resulting from injury). Those factors also influence selection of the treatment method. Patients suffering from fractures of the proximal epiphysis of the femur who were able to walk by themselves before the accident require surgical stabilization of the fractures. Patients with the same type of fractures who were initially immobilized in bed necessitate only use of analgesics and rehabilitation allowing for the use of wheelchairs. While making decisions about the selection of treatment methods (including surgery), one must consider classification of the surgical risk and patient quality of life.

Every disease affecting intellectual efficiency (Alzheimer's disease, results of strokes and others) and Parkinson's disease can make patients unable to benefit from rehabilitation. In the group of elderly patients, even unsatisfying radiological results after conservative treatment may be sufficient for the obtainment of acceptable limb function. However, in some cases, when taking into consideration impairment(s) that existed prior to the accident, restoration of maximal possible function becomes crucial.

While planning the treatment, one must take into consideration other additional factors, such as the extent of bones demineralization, value and state of soft tissues, type of the fracture including localization (in the shaft or near the joint), character (closed, compound or complicated) and - last but not least - the presence of concomitant injuries.

Generally, surgical treatment should be performed as soon as possible - within 24 hours from admission and right after initial stabilization of vital functions. In cases of patients with more than 3 concomitant diseases, management is strongly contraindicated. Selection of a proper treatment method requires a wide range of implants and instrumentarium that can be adjusted to an actual case. As a result, the vast majority of patients suffering from femoral neck fractures are treated with the use of partial or total hip alloplasty. Few authors

suggest the use of cannulated screws for the fixation of impacted fractures as a shorter procedure that does not require blood transfusions (25). This procedure, however, bears the risk of destruction of fixation, defective bone healing or pseudoarthrosis formation and sometimes necrosis of the femoral head requiring re-operation.

After the procedure, every patient requires thorough care by trained medical staff.

Despite all of these impediments, there is a continuous rise in the percentage of elderly patients treated surgically together with increased quality of their lives and decreased complication and mortality ratios observed. Such results could be obtained due to the modernization of surgical and anesthesiological procedures allowing for the performance of operations even in patients that would have been disqualified from surgical treatment 10 years ago (6).

Thus, diagnostic and therapeutic processes have to be based on anatomical and physiological data to allow for the proper selection of an adequate treatment option, not only from orthopedic point of view. The management algorithm should contain optimal diagnostic options, assessment of surgical risk, selection of adequate treatment options (including surgery), perioperative pharmacological prophylaxis and monitoring, rehabilitation (with proper timing and technique) plus control and protocol of potential mistakes made. After the era of enthusiasm for surgery as the only treatment option (leading to quick rehabilitation thus reducing the risk of complications related to prolonged immobilization), physicians came to believe that indiscriminate qualification of every elderly patient for surgical operation would definitely increase the mortality rate.

Nowadays, it is believed that only patients with proper physical and intellectual efficiency before injury (as a factors allowing for proper rehabilitation) should qualify for surgical treatment (26). "Nursing indications" should not be considered. This point of view is supported by authors from Cornell University that studied the correlation of sex, age, MODS and APACHE III with mortality in the group of elderly patients treated surgically for emergency cases. Some of the patients were initially classified as DNR. The highest correlation was found for women over 75, and in the group of negatively typed patients, the mortality rate

exceeded 82% (27). Similarly, authors from Rhode Island Hospital found the mortality rate to be 42% in the group of patients over 65 who were treated surgically and with the use of Halo-Vest immobilization due to fractures of the atlas compared to the 20% mortality rate in the group of patients treated with the use of a stiff collar. The complication ratio in the former group was also doubled (28).

Osteoporosis constitutes the leading cause of more and more commonly observed fractures of the vertebral column. Treatment of such fractures in elderly patients is extremely difficult because prolonged immobilization (in bed or even in orthopedic brace) can lead to severe complications including death, while the lack of immobilization results in a severe pain syndrome at best. Odontoid fractures constitute particular problems and patients over 65 qualify for surgical treatment despite the high risk related to open reduction and stabilization of such fractures because of the extremely high mortality rate in the group of patients treated conservatively.

Bergeron et al studied 1485 patients aged 65 year or older with injuries after LVF (low velocity fall). 1254 (84.4%) had fractures of long bones (in 795 in the hip region), 155 had head injuries, and 56 had thorax trauma. Median ISS was 9 pts and the mortality rate was 13.4% (compared with 0.9 for young). The severity and placement of traumas were similar to our study, but the mortality was increased threefold.

The outcomes of older patients can be improved through geriatrician expertise. Fallon et al. presented a report of 285 injured patients aged 65 years or older. The median ISS was 9.3. Falls and motor vehicle collisions were the predominate cause of injuries (1/2 and 1/3 of

treated). The mortality rate was 12.6%, and it was 5 times more in the patient not seen seen by geriatric specialist (29).

Witkowski et al. presented a 5.5% mortality rate in a similar study (30).

Intracranial injuries and injuries of the thorax and abdomen bear fourfold higher mortality rates in the group of patients over 65 as compared to younger patients with similar s injury severity. Also, elderly patients develop pulmonary, neurological and septic complications at a greater rate.

Those observations are crucial for planning prophylaxis and programming needs for health care in the future.

CONCLUSIONS

1. The increasing elderly population is more commonly (5x) injured than others.
2. Injuries are more common in males in the younger population, while in elderly patients there, no sex predominance is observed.
3. Falls constitute the leading cause of bodily injury in the elderly (musculoskeletal injuries are the most common).
4. Elderly patients suffer from more severe injuries than other accident victims.
5. In elderly patients with proper pre-operative assessment and adequate treatment – despite the high surgical risk in this group of patients – partial restoration of physical ability can be obtained at a mortality rate twofold higher than the entire population of injured patients.
6. In cases with an unacceptable surgical risk and a small chance for successful rehabilitation, one should consider conservative treatment.

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