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Head Trauma in Elderly Patients: Mechanisms of Injuries and CT Findings

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A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation;
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Abstract

Background. Head injuries in elderly people are a common cause of hospitalization at emergency departments. This group of patients is at high risk of post-traumatic intracranial pathology, which is diagnosed by computed tomography (CT) scanning of the head.

Objectives. The aim of this study was to determine the incidence and outcomes of head trauma in older people in different scenarios, on the basis of CT scan findings.

Material and Methods. The study involved a retrospective analysis of medical records of patients treated in the Emergency Department of Copernicus Memorial Hospital in Lodz, Poland, between the years 2010–2012. Patients above 75 years old whose diagnoses were coded with ICD-10 codes S00–S09 were included in the study. The patients' age, gender, the mechanism and cause of injury, their Glasgow Coma Scale (GCS) score at admission and the results of their head CTs were analyzed.

Results. A total of 301 patients were included in the analysis. Intracranial abnormalities caused by trauma were detected in 24 patients (8%). Transient loss of consciousness (TLOC) was a cause of injury in 44 patients (14.6%) and was related to an increased risk of an abnormal CT scan result (OR 4.6, 95% CI, 1.2–18.4, $p < 0.003$). Other mechanisms related to an increased risk of post-traumatic intracranial pathology were high-energy mechanisms of injury and unexplained falls.

Conclusions. Ground-level falls are the most frequent mechanism of head trauma in older people. One of the most commonly identified mechanisms of a fall is TLOC. Head injuries due to TLOC entailed a high risk of intracranial pathology in the elderly population. The risk of trauma-related positive CT scans in patients with unexplained falls is high, and is similar to that observed in patients with TLOC. The highest risk of trauma-related positive CT scans is observed in patients who have suffered a high-energy trauma (*Adv Clin Exp Med* 2015, 24, 6, 1045–1050).

Key words: elderly, head trauma, loss of consciousness, emergency department, computed tomography.

Head injury is a common cause of hospitalization at emergency departments (EDs) [1–3]. As documented in many studies, older people with trivial head injuries are predisposed to develop serious intracranial pathologies, which may even have fatal outcomes [4–8]. The consequences of head trauma are related to the mechanism of injury, the patient's age and medical history. Computed tomography (CT), a sensitive

tool for recognizing post-traumatic intracranial abnormalities, is nowadays widely used in diagnosis [9]. An unexplained fall – a fall of uncertain etiology, which is not unusual among elderly patients – may occur accidentally or may be related to balance disturbances, transient loss of consciousness (TLOC), hypoglycemia or vertigo. Difficulties in determining the exact circumstances of the fall are commonly associated

with dementia and/or post-traumatic retrograde amnesia, which may impede the diagnosis of TLOC [10–11]. The aim of this study was to determine the incidence and outcomes of head trauma in older people, in different scenarios, on the basis of CT scan findings.

Material and Methods

The study was carried out at the Emergency Department of Copernicus Memorial Hospital in Łódź, Poland, which is a tertiary-care hospital for trauma patients. The medical database from 2010–2012 was searched for patients aged over 75 whose diagnoses were given codes S00–S09, which pertain to injuries of the head in the 10th revision of the International Statistical Classification of Diseases (ICD-10). Data regarding the patients' age, gender, Glasgow Coma Scale (GCS) score at admission, results of head computed tomography (CT) and mechanism of injury (such as ground level fall, fall from a height, assault, traffic accident, collision with a still object, etc.) were investigated. All the cases were grouped into the following categories: low-energy coincidental injuries; injuries associated with TLOC, presyncope or vertigo; and high-energy injuries, related to traffic accidents, falling from a height or assault.

The CT scan results were categorized as normal; with intracranial abnormalities related to head trauma (trauma-related positive CT scans); with intracranial abnormalities not related to head trauma; and with extracranial abnormalities (for instance nose fracture).

The study was approved by the Bioethical Commission of the Medical University of Lodz.

Statistical Analysis

The continuous variables were presented as means and their standard deviations, which were next compared using an ANOVA test with the Bonferroni correction. Discrete variables were presented as numbers and percentages and compared with the χ^2 test. A logistic regression analysis was performed to find associations between the CT scan results, the relevant clinical data and the mechanisms of the head injuries. The results were considered statistically significant at $p < 0.05$. All calculations were carried out using STATISTICA software (StatSoft Inc., Tulsa, OK, USA)

Results

Demographics

The study group consisted of 301 patients, 231 women (77%) and 70 men (23%), aged 83.5 ± 5.4 age, who were admitted to the ED due to head trauma. The percentage of women was significantly higher than men ($p < 0.01$).

On admission, most patients (288, 95.7%) had 15 GCS points; five (1.7%) had 14 GCS points, three (1%) had 13 points, one (0.3%) had 10 points, one (0.3%) had 9 and two (0.6%) had 3 points; there was no data about the GCS score of one patient. The percentage of patients with 15 GCS points was significantly higher than the remaining patients ($p < 0.001$).

Most of the injuries occurred at home ($n = 139$). Other locations included public places ($n = 45$) and public transportation ($n = 3$). In 114 cases, there was no data concerning the circumstances of the incident.

High-energy trauma was noted in 41 (13.6%) patients. Low-energy coincidental injuries (mainly due to ground-level falls) were found in 116 (38.5%) patients. Injuries caused by falls related to TLOC, presyncope or vertigo were found in 44 (14.6%), 10 (3.3%) and 19 (6.3%) patients, respectively. In 71 patients (23.6%), the mechanism of injury could not be determined.

Positive trauma-related CT scan results were found in 24 patients (8%), and intracranial abnormalities not related to head trauma in 249 patients (82.7%).

The characteristics of intracranial abnormalities related to head trauma are presented in Table 1. The incidences of particular post-traumatic CT findings in the study group are presented in Fig. 1.

Follow-up

One patient (0.3%) died in the ED and three other patients (1%) died in another ward of the hospital. Among the patients admitted to the ED, 199 (66.1%) were discharged home; 10 (3.3%) were discharged against medical advice; 34 (11.3%) were referred to another ward because of the injuries sustained during the trauma; and 57 (18.9%) were referred to another ward for other reasons. Table 2 presents the characteristics of groups categorized by the cause of the trauma.

In the multivariate analysis, positive CT scan results were related to high-energy accidental injury, TLOC and unexplained syncope (Table 3).

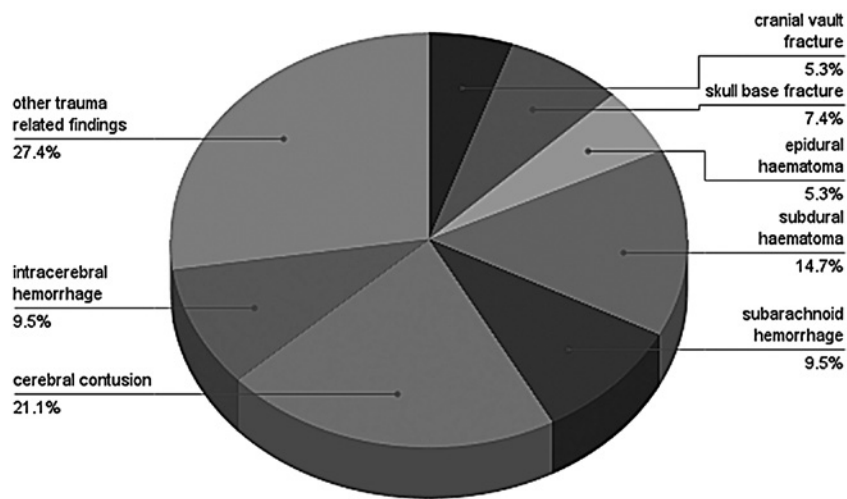


Fig. 1. Percentage of particular CT post-traumatic findings

Table 1. Head CT results in a group of 301 elderly patients who had undergone head trauma (some patients had more than one abnormality in their CT scan)

Head CT results	No. of cases	% of all abnormalities
No abnormalities	44	14.6
Cranial vault fracture	5	1.7
Skull base fracture	7	2.3
Epidural hematoma	5	1.7
Subdural hematoma	14	4.6
Subarachnoid hemorrhage	9	3
Cerebral contusion	20	6.7
Intracerebral hemorrhage	9	3
Other trauma-related findings	26	8.6
Other findings not related to trauma	249	82.7

Discussion

The study shows that elderly patients with head trauma admitted to the Emergency Department had relatively frequent positive CT scan results, but most of the findings were not related to trauma (Table 1). The majority of such incidentally found abnormalities involved benign anomalies such as cortical and subcortical atrophy and did not need further evaluation, but the authors we agree with Barret et al., who made similar observations [12], that patients and their families should be informed of the results. Among trauma-related abnormalities, cerebral contusions and other mild injuries turned out to be the most frequent (Fig. 1). Most of the patients in the study group were in good clinical condition and did not require urgent medical intervention, making their short-term prognosis favorable. In contrast to this observation, other authors have stressed that elderly patients suffering head trauma generally had

Table 2. Clinical characteristics of the studied subgroups

	Vertigo n = 19	Presyncope n = 10	TLOC n = 44	Low- energy accident n = 116	High-energy accident n = 41	Unknown n = 71
Age years \pm SD	85.8 \pm 17.5*	82.6 \pm 4.0	82.5 \pm 4.4	82.9 \pm 5.0	82.7 \pm 5.5	85.6 \pm 5.0*
Male gender n (%)	2 (10.5)	3 (30.0)	8 (18.2)	91 (21.6)	12 (29.3)	19 (26.8)
Positive CT scan n (%)	0 (0)	1 (10)	5 (11.4)	3 (2.6)#	7 (17.5)	8 (11.3)
Home discharged n (%)	12 (63.2)	6 (60)	26 (59.1)	86 (74.1)	23 (56.1)	46 (64.8)
Died n (%)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)	0 (0)

* $p < 0.005$ vs. TLOC, low-energy and high-energy group; # $p < 0.01$ vs. high-energy group.

Table 3. Logistic regression analysis, dependent variable: positive CT scan; $p < 0.005$

	TLOC	High-energy accident	Undetermined
Odds ratio	4.6	7.6	4.8
–95%	1.2	2.1	1.4
+95%	18.1	27.7	16.6
p	< 0.03	< 0.003	< 0.02

a poor prognosis. For example, the mortality rate in a study by Susman et al. was 24% in a group of older patients [7], whereas in the present study only one patient (0.3%) died. However, the patients presented in that report were treated at a trauma center, whereas in the present study the patients were treated in an ED and were not preselected. The elderly patients in the Susman et al. group were above the age of 65, as compared to 75 in the present study, which may have resulted in a different distribution of mechanisms of traumatic injuries and a lower incidence of traffic accidents as a cause of trauma. In fact, in the present study, good clinical condition upon admission to the ED was invariably related to a mechanism of head injury involving insignificant force. This in turn seems to be related to the reduced ability of elderly patients to move, which could be supported by the finding that the most prevalent location of syncope was the home. Other authors have shown that risk factors associated with head injuries include older age, cognitive disorders and physical disability [13, 14].

As expected, trauma related to high-energy accidents was a significant predictor of positive CT scan results. In the present study, high-energy trauma increased the risk of intracranial abnormality in the CT scan eightfold.

Falling down at home was the most common mechanism of injury in the present study group. However, the exact cause of falling may be related to various mechanisms, such as imbalance due to vertigo, presyncope, transient loss of consciousness or an accident. TLOC in elderly patients often occurs in church, but the presence of other people and the possibility to sit down at the onset of symptoms may decrease the rate of traumatic injuries and their severity [10, 14, 15]. In the current group only one patient fainted in church, which is concordant with those reports.

In the current study it was not possible to assess the exact mechanism of fall in 26% of the patients, especially in cases where there was no witness. Dementia and post-traumatic amnesia ac-

count for the difficulties in taking medical histories in elderly patients.

The study also showed that other predictors of trauma-related positive CT scan were a history of TLOC or unexplained falls, whereas slipping or vertigo did not significantly increase the risk. Falling down due to TLOC may be sudden, especially when caused by cardiac arrhythmia [16–18]. Unexplained falls are also common in the elderly [19]. The symptoms of arterial hypotension may be vague, and prodromal symptoms may last for only a short time or even be absent [20, 21]. Neurocardiogenic reflex may also provoke a sudden loss of consciousness, especially due to atrioventricular block or, in less common cases, junctional escape rhythm [22]. It seems that maintaining cerebral blood flow on a reduced level enables partly controlled slow falling rather than rapid falling, which may lower the risk of severe head injury.

The way patients behave during neurocardiogenic reactions may also have an impact on the consequences of a fall. Attempts to move during the prodromal symptom phase may lead to falls and head injuries that could be prevented by immediately assuming a safe body position [23].

Orthostatic hypotension is common in the elderly and is related to an increased risk of injury [24, 25].

Limitations

The main limitation of the study was that only patients who survived until hospital admission were assessed, which may have led to an underestimation of the morbidity and mortality in this patient group.

The other limitation of the study was that it did not investigate whether intracranial bleeding was a cause or a consequence of head trauma. Stroke may present as TLOC that leads in turn to head injury [26]. However, correlations between the location of head trauma and focal signs and symptoms related to stroke may be helpful in distinguishing them.

The authors concluded that ground-level falls are the most frequent mechanism of head trauma in older people, and one of the most commonly identified mechanism of fall is transient loss of consciousness. Head injuries due to TLOC were at a high risk of causing intracranial pathology among the elderly. The risk of trauma-related positive CT scans in patients with unexplained falls is high, and is similar to that observed in patients with TLOC. The highest risk of trauma-related positive CT scan is observed in patients who suffer high-energy head trauma.

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