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THE ROLE OF HEAD INJURIES IN THANATOGENESIS, IN THE CASUISTRY OF THE FORENSIC DEPARTMENT OF SIBIU COUNTY, 2018-2022

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Abstract: Head injuries represent a frequent pathology worldwide, with important morbidity and mortality and a significant impact on public health.

Objective. Our study provides an overview of head injuries with lethal outcomes in Sibiu County, over a period of five years, aimed at identifying the population group at risk.

Material and method. We conducted a retrospective observational-analytical study, carried out during 2018-2022, on the casuistry of the Forensic Department of Sibiu County. We focused on 337 violent deaths, in which head injuries either had a decisive thanatogenic role or had only a contributory role in the lethal outcome.

Results. The analyzed deaths accounted for a third (33.03%) of all violent deaths, and 14.88% of the entire casuistry respectively. We found that the population group at risk had the following characteristics: males (78.93%, gender ratio M/F 3.74:1), aged between over 50 years (with an average of 54.6 years), from rural areas (specific rate of 150.43/100,000 inhabitants, compared to only 63.93/100,000 inhabitants in urban areas), with acute alcohol consumption that preceded the traumatic event (in 33.15% of the cases). Most of them were accidental deaths (96.16%) and the most frequent circumstances of death were falling or falling from a height (51.03%) or road traffic events (40.05%).

Conclusions. The data provided by the present study can suggest specific prophylactic measures aimed at reducing the incidence of these avoidable deaths.

Keywords: forensic pathology, autopsy, head injuries, epidemiology, death circumstances.

INTRODUCTION

Head trauma is the term that includes the variety of cranio-cerebral injuries produced as a result of the action of the traumatic agent [1]. The type of craniocerebral injury and its location are two important aspects of the severity of cranio-cerebral trauma [2].

In an industrialized world, head injuries are a major public health problem, a complex pathology characterized by great heterogeneity regarding etiology, pathophysiology, mechanisms of production, clinical evolution, severity, and treatment. Craniocerebral trauma is ubiquitous, both in low-income and high-income countries, and affects all age groups, being produced in various traumatic contexts, with road accidents and hetero-aggressions representing their main mechanisms [3].

A 2016 study, The Global Burden of Disease 2016, showed an average global incidence of 27.08 million cases of acute traumatic head injury, with an average rate of 369 persons/100,000 inhabitants per year. This study showed that the incidence varies by age, but also by numerous socio-economic factors and geographical region, thus countries with a low and medium level of socio-economic development have a three times higher incidence of cranial-cerebral trauma compared to developed countries, South Asia having the highest incidence [4]. Data reported by the CDC showed that there were approximately 223,135 patients hospitalized for traumatic brain injury in 2019 and 64,362 deaths in 2020. This data represents 611 hospitalizations and 176 deaths each day due to such trauma [5].

Taking into account the severity of traumatic head injuries, cranio-cerebral trauma remains a major cause of death, but also of disabling post-traumatic sequelae, with negative micro and macro social impact.

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Thus, the consequences of traumatic head injuries on health are currently underestimated, and many patients and their families live with consequences that decrease their quality of life.

Objectives

Due to the morbidity and mortality associated with traumatic head injury, this pathology represents an important global public health problem, affecting approximately 10 million people worldwide each year [3].

Our study aims to present an overview of the circumstances that contributed to the occurrence of head traumas with lethal outcomes, but also of those associated with other injuries causing death.

The main objectives of the study are: an epidemiological analysis of the deaths involving head trauma, the delineation of populations at risk, the identification of evolutionary trends, the juridical form, and the main circumstances of occurrence.

MATERIAL AND METHOD

We conducted a retrospective observational-analytical study of the casuistry of the Forensic Department of Sibiu County, during 2018-2022. We selected 337 violent deaths in which head injury either had a decisive thanatogenic role or was associated with another main cause of death, having only a contributory role.

We analyzed the forensic autopsy reports, including the toxicology reports (regarding the blood alcohol levels), and the histopathological findings. We developed a database that included, for each of the selected cases, the following: gender, urban or rural area of origin, age, the place where the traumatic event occurred, the juridical form of death (accident, suicide, hetero-aggression), the circumstance of death, association of acute alcohol consumption (presence and value of blood alcohol levels).

This information was processed using the Microsoft Excel 365 program. The percentage representation was used for comparisons between different investigated parameters.

RESULTS AND DISCUSSION

In the period 2018-2022, within the Forensic Department of Sibiu County, 2265 forensic autopsies were performed, of which 1012 violent deaths, representing 44.68%, and 1253 non-violent deaths, representing 55.32%. The 337 cases of head trauma-related deaths represented 14.88% of all autopsies (Fig. 1), and 33.30% of all violent deaths respectively (Fig. 2).

From the total of 337 deaths that involved head injuries, 135 (40.06%) also presented other traumatic injuries, being polytraumatized people. In 202 cases (59.94%), the cause of death was related only to head injuries (Fig. 3).

Analyzing the evolution of the number of deaths in which head trauma was involved, we observed an undulatory evolution, with an average of 67.4 deaths/year. We noticed a general decreasing trend, with a maximum of 85 cases in 2019 and a minimum of 57 cases in 2022 (Fig. 4).

Out of the 337 analyzed cases, 71 were female, representing a percentage of 21.07%. The male gender predominated, with 266 subjects (78.93%), with a gender ratio M/F of 3.74:1. This is consistent with literature data [6], which also highlights a net prevalence of males in deaths related to head injuries.

Relative to the area of origin, the cases were equally distributed, with 169 cases from urban areas (50.15%), and 168 subjects from rural areas (49.85%). We took into account the fact that Sibiu County has a high degree of urbanization (67.1%) and we found that

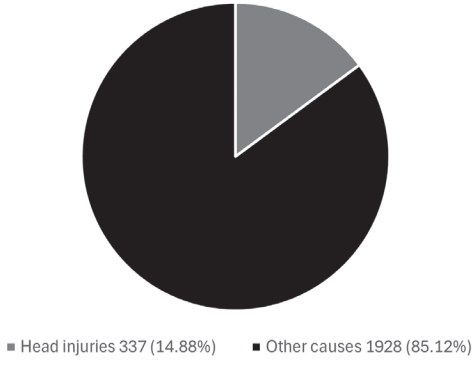

Figure 1. The deaths in which head injuries were involved from all autopsies.

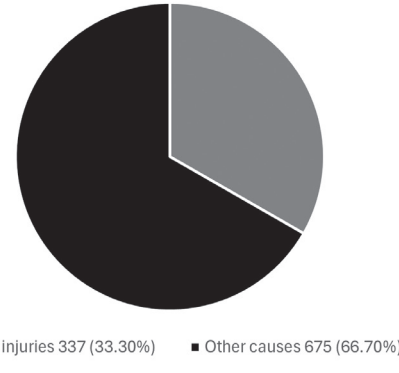

Figure 2. The deaths in which head injuries were involved from all violent deaths.

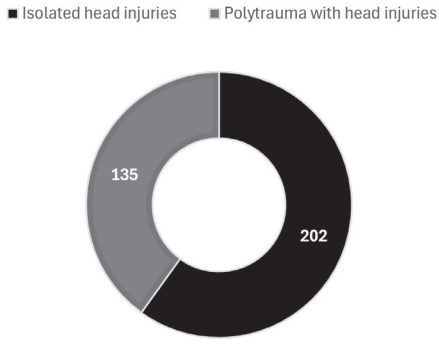

Figure 3. The isolated head injuries *vs.* polytrauma with head injuries.

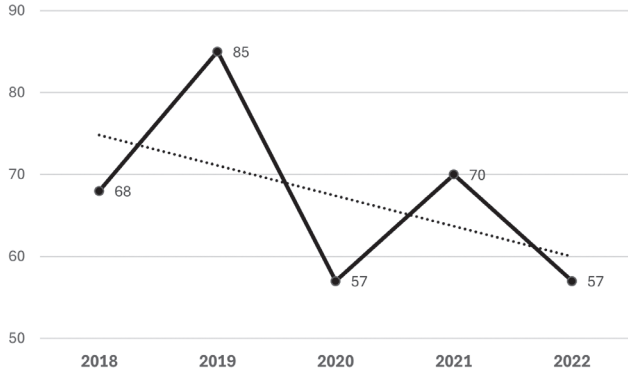

Figure 4. The evolution of head injuries with lethal outcomes.

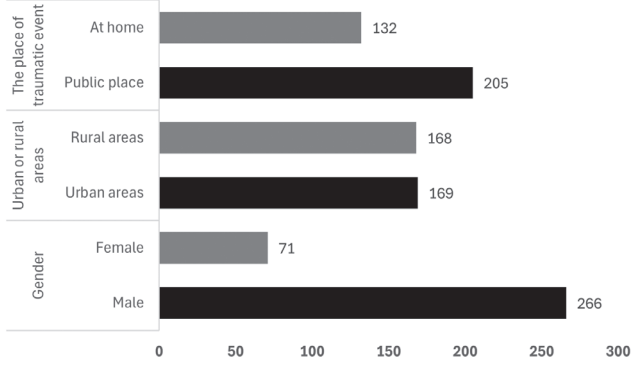

Figure 5. Distribution of cases according to gender, to urban/rural areas of origin, and to place of traumatic event.

in the rural environment the incidence per 100,000 inhabitants is much higher (150.43: 100,000 inhabitants) compared to that of the cases in the urban environment (63.93: 100,000 inhabitants). Thus, we could conclude that the incidence of these deaths was much higher in the rural areas than in the urban areas.

From the point of view of the place where the traumatic event occurred, most of the cases (205 cases; 60.83%) occurred in a public place, and the rest (132 cases; 39.17%) were reported at home (Fig. 5).

The distribution based on the age criterion is described in Table 1.

We noted that the deaths due to head injuries occurred more frequently in the 60-69 decade (69 cases; 20.47%), although all age groups were affected. Approximately two-thirds of the cases (215; 63.80%) were over 50 years old. The average age at which death occurred was 54.6 years. Analyzing the distribution by age and gender, it is found that in men deaths occur more frequently in the decades 50-59 and 60-69, while in women deaths caused by cranio-cerebral trauma occurred more frequently after 60 years, with a maximum over 80 years (Fig. 6).

Based on these findings, gender ratio analysis reveals the highest values in the 40-49 decade (M/F=41:1), with a decrease towards older ages (reaching a M/F gender ratio of only 1.35:1 for people over 80 years). For younger ages (under 40 years) we also noted the predominance of males (with an average gender ratio M/F of 2.07:1), except for children under 10 years old - the only age group where female gender was predominant (Fig. 6).

Next, we carried out an analysis based on the juridical form of death and the circumstances of death. The vast majority of cases (324; 96.14%) were accidental. We identified only 9 cases of homicide (2.68%) and 4 cases of suicide (1.18%) (Fig. 7). The circumstances in which accidental deaths occurred were as follows: road traffic events, falling/falling from a height, railway traffic events, but also agricultural/forestry accidents.

Table 1. The distribution of cases based on age

Age (years)	2018	2019	2020	2021	2022	2018-2022
0-10	3	3	0	1	3	**10**
10-19	1	5	3	2	3	**14**
20-29	3	8	3	4	4	**22**
30-39	7	9	6	6	6	**34**
40-49	9	12	5	9	7	**42**
50-59	12	14	7	14	10	**57**
60-69	13	14	14	20	8	**69**
70-79	8	12	13	6	10	**49**
>80	12	8	6	8	6	**40**
Total	**68**	**85**	**57**	**70**	**57**	**337**

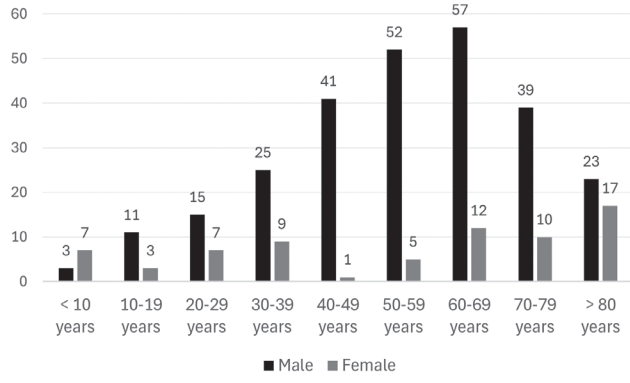

Figure 6. Distribution of cases by age and gender categories.

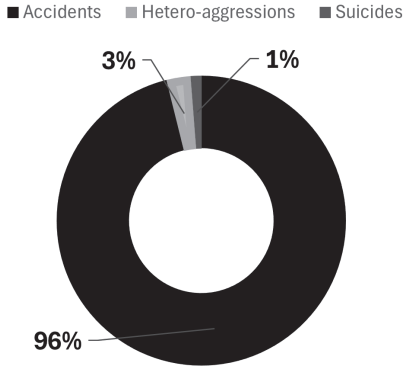

Figure 7. The juridical form of death.

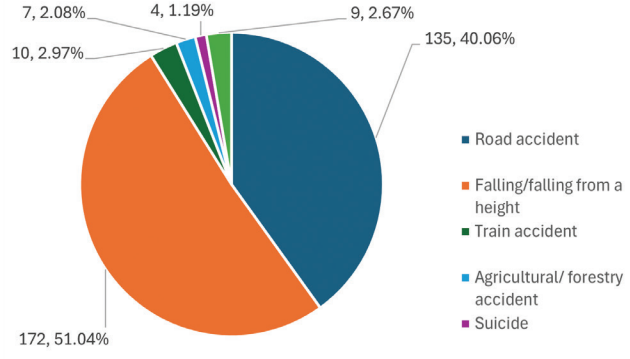

Figure 8. The circumstances of death.

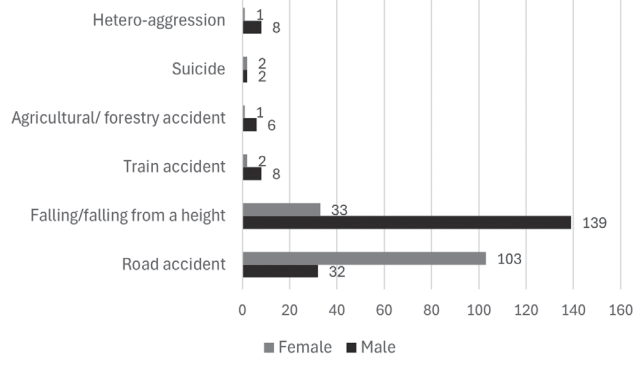

Figure 9. The circumstances of death correlated with gender.

Based on the circumstances of the traumatic event, the most frequent deaths were falls/falls from a height (51.04%), followed by road traffic accidents (40.06%), railway traffic accidents (2.97%), hetero-aggression (2.67%), agricultural or forestry accidents (2.08%), suicide (1.19%) (Fig. 8).

The correlation between the circumstances of death and the criteria of gender and age revealed interesting findings. Thus, both for men and women, the most frequent deaths were related to falling/falling from a height; also, both genders recorded a high frequency of road traffic events. On the other hand, railway traffic accidents, agricultural or forestry accidents and homicide were more common among men (Fig. 9). Gender ratio M/F was 3.76:1 for accidents,

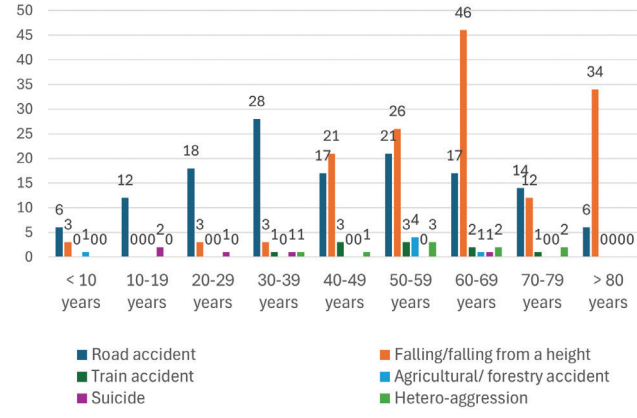

Figure 10. The circumstances of death correlated with age.

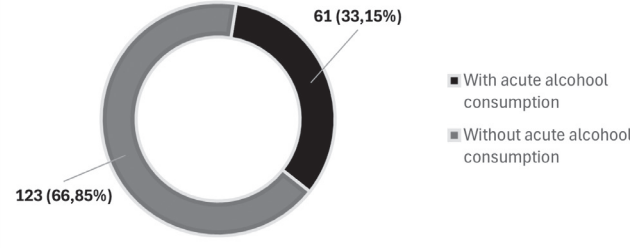

Figure 11. With or without acute alcohol consumption.

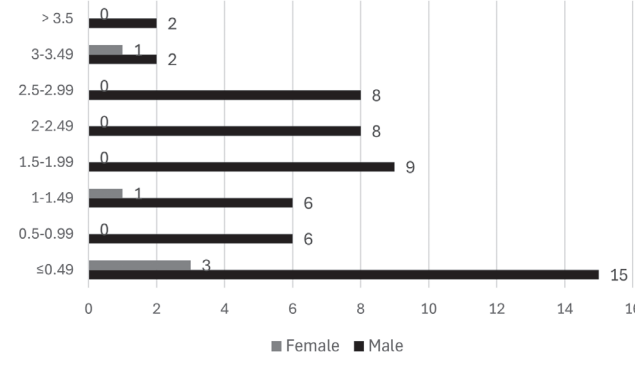

Figure 12. Distribution of cases by value of blood alcohol.

1:1 for suicides, and reached 8:1 for hetero-aggressions.

Regarding the correlation between the circumstances of death and age, we found that falling and falling from a height were more frequent after the 4th decade of life (139 cases; 41.24%), with the peak in the age range 60-69 years (46 cases; 13.64%). Road traffic events occur especially at young ages (64 cases under 40 years; 18.99%), reaching a peak in the 3rd decade of life (28 cases; 8.30%), although they occur in all age categories (Fig. 10).

We were able to determine the blood alcohol level of the deceased in 184 cases (54.59%). In 61 of these cases (33.15%) we were able to detect the presence of alcohol (Fig. 11), allowing us to conclude that acute ethanol intoxication is a factor that favors the occurrence of traumatic events that lead to head injuries.

Figure 12 illustrates the distribution of cases according to the value of blood alcohol level. Most deaths were associated with an alcohol blood level between 0-0.49 grams per thousand, a stage in which the clinical manifestations are minimal (fatigue, slowing down of some reflexes). The distribution based on gender revealed that, out of the total of 61 people who consumed alcohol before the traumatic event, 56 (91.80%) were male, and only 5 (8.20%) were female (Fig. 12).

In conclusion, head injuries represent a frequent pathology worldwide, with important morbidity and mortality and a significant impact on public health.

Our study aimed to provide an overview of head injuries with lethal outcomes in Sibiu County, Romania, over a period of five years (2018-2022), trying to identify the population groups at risk.

The analysis of the 337 violent deaths of focus revealed that these deaths accounted for a third (33.03%) of all violent deaths, and 14.88% of the entire casuistry respectively. We found that the population group at risk had the following characteristics: males, aged over 50 years (with an average of 54.6 years), from rural areas, with acute alcohol consumption that preceded the traumatic event; most of them were accidental deaths (96.16%); the most frequent circumstances of death were falling or falling from a height or road traffic events.

Based on the data provided by the present study, adequate prophylactic measures can be proposed, tailored to the specific characteristics of the population group at risk, and aimed at reducing the incidence of these avoidable deaths.

Conflict of interest

The authors declare that they have no conflict of interest.

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