Central Asian Journal of Medicine

MORPHOLOGICAL CHARACTERISTICS AND EXPERT ASSESSMENT OF CRANIOCEREBRAL INJURY

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ABSTRACT

The article is dedicated to morphological changes occurring in craniocerebral injury. Specifically, they often manifest as epidural, subdural, and subarachnoid hemorrhages. The sources of bleeding, their types, the mechanism of formation, and the morphological characteristics in craniocerebral injury are determined.

Key words: craniocerebral injury, morphological characteristics, forensic medical assessment.

INTRODUCTION

Currently, with the development of technologies, especially in the automotive industry, an increase in population injury is noted. A significant portion of this consists of craniocerebral injury, accounting for 30-50% of all cases. This directly affects both mortality and disability rates, especially among individuals of working age [2, 6, 11, 12].

Craniocerebral injury (CCI) is a mechanical injury to the skull and/or intracranial structures (brain, meninges, vessels, cranial nerves). CCI is characterized by significant polymorphism, linked to the variability of injurytic mechanisms, structural diversity of damaged tissues, and the peculiarities of clinical course. It constitutes 25-30% of all injuries, and among fatal outcomes from injury, its share reaches 50-60%. As a cause of mortality in young and middle-aged individuals, CCI surpasses cardiovascular and oncological diseases.

There is an increasing attention from clinicians and forensic experts to the issues of clinical, morphological and laboratory diagnosis of craniocerebral injury [7, 9]. Determining the severity of closed injury remains one of the most challenging tasks in forensic practice, also due to the complexity of diagnosing injuries that often exhibit a blurred or diverse clinical picture in the acute period [4, 5, 8, 10].

Forensic medical literature places great importance on the morphology and topography of epidural, subdural, and subarachnoid hemorrhages in establishing the mechanism of craniocerebral injury.

Determining the morphological signs of craniocerebral injury is crucial for investigating crimes against the health and life of individuals, which underscores the importance of further detailed study of this issue [1, 3, 12].

Research objective. The aim of the research is to determine the nature, type, and mechanism of morphological changes in craniocerebral injury.

Materials and methods. The material for the study consisted of an analysis of 292 forensic medical examination reports on bodies conducted at the Sirdaryo Branch of the Republican Scientific and Practical Center of Forensic Medical Examination in 2016-2018. The study focused on the structures of craniocerebral injuries from blunt solid objects.

Results and Discussion. The obtained data indicate that craniocerebral injury was more frequently identified in men (226 cases, 77.4%) than in women (66 cases, 22.6%) in terms of gender distribution. When distributed by age groups, it was more commonly observed in individuals of working age from 20 to 59 years (63.9%), with the highest peak occurring in the age range of 41-50 years (24%). The majority of injuries occurred in the summer and autumn months (175 cases out of 292 or 59.9%). The peak of injury was noted in July, while the lowest number occurred in the winter months due to a decrease in the number of falls and automobile injuries during these months. In most cases, the victims (213 out of 292, 72.9%) were in an alcoholic state: 67 were in a severe state of alcohol intoxication (22.9%), while the rest were roughly equally distributed between moderate and mild states of alcohol intoxication.

Craniocerebral injury exhibited a combined nature in 67% of cases, compared to combined (24%) and isolated (9%).

The morphological characteristics of the identified changes in craniocerebral injury were mainly manifested as epidural, subdural, and subarachnoid hemorrhages.

Epidural hematoma is a consequence of craniocerebral injury and represents the accumulation of blood between the dura mater and the bones of the skull.

Specifically, epidural hematomas were more frequently observed in closed craniocerebral injuries, although they were also identified in open injuries. In our observations, out of 292 cases of craniocerebral injury, only 46 cases of epidural hemorrhage were identified, constituting 15.8% of all cases of craniocerebral injury. The volume of epidural hemorrhages averaged 10-35 ml. They were often localized at the site of the injurytic agent, i.e., in the temporal and frontal regions, and were accompanied by depressed fragmentary-fragmentary fractures of the cranial vault bones with extension to the base and damage to the dura mater in criminal circumstances.

In terms of placement, they were located in the temporal (in the majority of cases), parietal, and occipital regions. Upon examination, it was noted that the middle meningeal artery with accompanying veins, as well as the sagittal and transverse sinuses of the dura mater, were more often damaged. The largest volume of epidural hematomas was observed when the source of bleeding was arterial.

Subdural hemorrhages are typically situated between the dura mater and the soft meninges. They arise from both direct and indirect impacts of the injurytic force. In other words, due to the deformation of the skull and rotation of the brain in various directions, stretching of the brain's vessels occurs, especially damage to veins draining into the sinuses. Over the study period, 157 cases of subdural hemorrhages were identified, accounting for 53.8% of all cases of craniocerebral injury. In cases of fractures of the cranial vault and base bones, subdural hematoma was found in 122 cases, and in cases of intracranial injury, it was found in 35 cases. In terms of localization, they were situated both at the site of the injurytic agent's application and on the opposite side, in the temporal-parietal (in 30% of cases) and temporal-occipital regions (in 36% of cases). They were often combined with epidural hematomas. Subdural hemorrhages were particularly significant in volume and thickness. The study revealed that transitional veins between the brain surface and the sagittal sinus were more frequently damaged. Occasionally, injuries to transitional veins draining into the transverse sinus were also noted. In addition, injuries to arteries and veins of the soft meninges were identified.

Subarachnoid hemorrhages were most frequently identified, often associated with injuries to both the soft tissues of the head and fractures of the skull bones. In 275 out of 292 cases of craniocerebral injury (94.2% of all cases), subarachnoid hemorrhages were identified. They were commonly found in cases of fractures of the cranial vault and base bones in 200 instances (68.5%) and in cases of intracranial injury in 75 instances (25.7%). Among fractures of the cranial vault and base bones, the fracture was linear in 212 cases (72.6%), depressed in 49 cases

(16.8%), and fragmentary-comminuted in 31 cases (10.6%). Out of 35 cases of subarachnoid hemorrhages in intracranial injury, in 12 cases (34.3%), the hematoma was accompanied by bleeding into the brain cortex. The frequency of occurrence of subarachnoid hematomas significantly increased in older age groups, especially in the 20-59 years age group, constituting 63.9% of all subarachnoid hematomas.

Subarachnoid hemorrhages occurred due to injuries to small vessels of the arachnoid and vascular membranes. The prevalence of bleeding beneath the soft meninges depends on the extent of vascular injuries. The greatest coverage of the brain surface area was noted at the base. In the area of bone fractures, disruptive injuries to the soft meninges were identified in combination with injuries to the dura mater (resulting from direct impact of the injurytic force). Erosive injuries to the soft meninges were also detected, located both at the site of direct impact and on the opposite side. In cases of severe craniocerebral injury with fractures of the skull bones, extensive subarachnoid hemorrhages were determined, sometimes spreading across the entire surface of the cerebral hemisphere in combination with intraventricular hemorrhages.

Out of 292 cases of craniocerebral injury, 212 cases of fractures of the cranial vault and base bones were identified (72.6% of all CCI cases). There is no predominant fracture of a specific bone in the analysis. Fractures were accompanied by ruptures of the dura mater in 116 cases (54.7%), with 46 cases having ruptures located in the temporal region, 21 cases in the frontal region, and the rest in various variations. Also, in cases of fractures of the cranial vault bones, 69 cases (32.5%) showed suture ruptures: coronal suture in 34 cases (49.3%), sagittal suture in 23 cases (33.3%), and lambdoid suture in 12 cases (17.4%). Fractures of the cranial vault bones were accompanied by fractures of the base bones in 155 cases. Isolated fractures of the base bones were found in 11 cases (7.1%) in the studied material. Fractures of the cranial vault bones extended into the cranial fossae in various variations, more commonly into the anterior and middle cranial fossae (41.7%), and isolated into a separate cranial fossa only in the anterior fossa (8.8%).

In the studied material, 61 cases of facial skeleton fractures were identified (20.9% of all CCI cases).

Conclusions. The results of the conducted research indicate that craniocerebral injurys were most frequently identified in men who were in a state of alcohol intoxication, primarily of working age, predominantly during the summer and autumn periods, and more commonly had a combined nature. Morphologically, craniocerebral injury manifested as epidural, subdural, and subarachnoid hemorrhages. The sources of bleeding, their types, the mechanism of formation, and morphological characteristics have been determined.

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