

Pulmonary Complications as an Immediate Cause of Death at Craniocerebral Injury

Masharipov Azamat Cabirovich

Tashkent Medical Academy, Tashkent, Uzbekistan

Abstract The absence of sufficiently complete and clear information in the literature about the complexes of morphological changes in the respiratory system upon the death from craniocerebral injury in medical institutions indicates the need for in-depth studies in this direction. A study of the respiratory system in the death cases from craniocerebral injury has been carried out. The results showed that the deaths of inpatients at various stages of experiencing a closed craniocerebral injury at the scene are characterized by features of the morphological changes of the lungs, represented by a sequential change in the processes of circulatory disorders and pulmonary ventilation, inflammation.

Keywords Craniocerebral injury, Morphology, Blood circulation, Pulmonary ventilation

1. Introduction

The practice of forensic medicine shows that in a significant number of death cases (up to 23%) from craniocerebral injury (CCI), the death of victims occurs as a result of secondary changes that have developed in a period of time from several minutes to several hours or more from the moment of injury, including the provision of medical care in hospitals. Pulmonary edema and pneumonia as “secondary changes” are diagnosed by forensic experts when examining corpses in 17.5-76.6% of all cases of CCI [5, 8], whereas in general the number of post-traumatic pneumonia reaches 35.1% [6, 9]. A common complication of CCI in neurosurgical practice is pneumonia [1, 4], which is diagnosed in 19.5%-57.1% of CCI cases [2, 3, 12]. Currently, the development of purulent complications is associated with nosocomial infection, excluding the possibility of infection of patients before the start of invasive procedures [7, 10-11]. In this regard, the development of pneumonia as a complication of a closed CCI is of interest. The absence of sufficiently complete and clear information in the literature about the complexes of morphological equivalents of adaptation processes in the respiratory system, data on the influence of exogenous and endogenous factors on the level of structural reorganization of this system at the death cases from CCI in medical institutions indicates the need for in-depth studies in this direction.

Aim of the study was to improve the quality and evidence of expert findings on death from CCI in hospitals in cases of complications of the respiratory system.

2. Material and Methods

The study included only those cases of CCI when the time of injury and death was known as the main criterion in studying the morphological changes of the lungs was the time of death on the scene of the CCI. 140 cases of severe CCI with lethal outcome have been analyzed.

Table 1. The distribution of victims by groups depending on the time after CCI and up to the death onset

Group	Time after CCU (before death)	Victim quantity, absolute (%)
The 1 st	"Immediate death"	53 (37.86)
The 2 nd	Death 2 hours after CCI	11 (7.86)
The 3 rd	Death 12 hours after CCI	11 (7.86)
The 4 th	Death 24 hours after CCI	13 (9.28)
The 5 th	death 48 hours after CCI	11 (7.86)
The 6 th	Death hours after CCI	41 (29.28)
Totally		140 (100)

As it can be seen from Table 1, in 53 (37.86%) cases death occurred quickly on the site of the injury, in 11 (7.86%) cases the death was recorded when admitted to hospital, in the remaining 76 (54.28%) cases the death occurred in the hospital at various time after receiving CCI. The direct cause of death in 75.6% of cases was severe CCI in the form of total contusion and compression of the brain, in 14.4% death occurred from hemorrhage into the ventricles of the brain, in 10% of cases the cause of death was traumatic shock. In 96

cases CCI was received by males, in 44 - by females. A forensic autopsy was usually performed in the first hours after death, but no later than a day. Pieces of the bronchi and lungs were fixed in 12% of neutral formalin, sections of paraffin blocks were stained with hematoxylin and eosin.

3. Results and Their Discussion

A macroscopic examination of the corpses of persons who died in the result of a mechanical injury at the scene and a microscopic examination of the lungs revealed a complex of morphological equivalents of the pathological processes occurring in the lungs at this nosology. All victims in the study group died in the result of severe craniocerebral injury. In 32% of cases CCI was combined with mechanical trunk injury in the form of 1-3 ribs fractures without damage of the parietal pleura and ruptures of the abdominal cavity. In 46% of cases ethyl alcohol was detected in the blood. The severity of CCI was determined by the presence of the skull bones fractures (in 68% of cases), severe and mild cerebral contusions in combination with spotted or restricted diffuse subarachnoid hemorrhages. In 84% of cases hemorrhages to the ventricles of the brain were detected, in 32% of cases injuries of the lower stem section of the brain was diagnosed. Subdural hematomas with no signs of compression of the cerebral hemispheres were diagnosed in 78% of cases and in 26% intracerebral hemorrhages were found in the section. A macroscopic examination of corpses in 9 from 10 studied cases determined the first degree of venous hypertension. It was macroscopically revealed an increase of both lungs mass in 38% of cases with the presence of pulmonary edema signs, detected in just 56% of cases of the studied group; acute emphysema on the section in all lobes of the lungs was determined in 62% of cases. On the incision, the lung tissue in the peripheral regions, as a rule, looked pale, reddish-purple, anemic; the blood filling of the central parts of the lobes was more evident, the tissue was of a dark red-bluish color, with abundant secretion of a dark red frothy liquid. Microscopic examination of a complex of morphological equivalents of pathological processes was represented by changes in all parts of the respiratory system, including reactive rearrangements of the vascular bed, the microcirculatory part, with their accompanying abnormalities of hemodynamics and rheological properties of the blood. The bronchial lumens of large, medium and small caliber in each of the studied lung lobes in most cases (78%) were in a state of moderate and pronounced spasm; protrusion of the lamina propria of the mucous membrane of the bronchi with bundles of muscles has been determined; the epithelium in the form of short garlands and ribbons partially desquamated into the lumen; in the presence of a evident bronchospasm of large and medium caliber, including the presence of sclerosis of the bronchial wall found in 30% of cases, the epithelial layer is completely preserved, lies on the basal membrane (Fig.1).

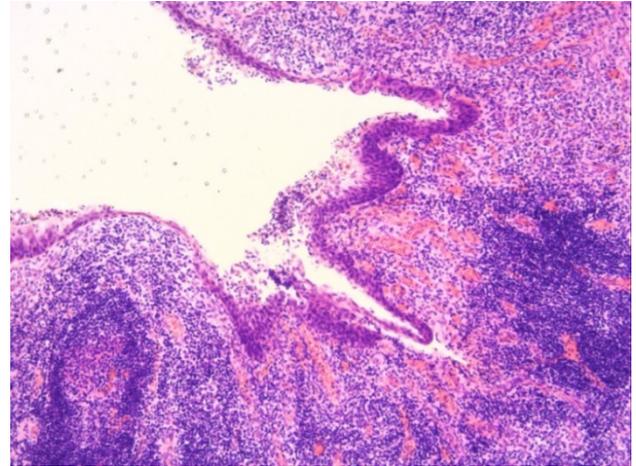


Figure 1. Spasm of the bronchus due to vascular hyperemia, inflammatory infiltration. HE staining. x200

In more than half of the studied cases a large number of goblet cells of the bronchial mucosa have been enlarged, overflowed with mucus. On the surface of the epithelium there is a visible "rim" in some places, passing into the contents of the bronchus lumen in the form of mucus. Own plate of the bronchi mucous membrane has not been mainly loosened. The glands of the submucous layer of the bronchi are of a regular round shape, the epithelial cells are filled with mucus unevenly: some of the glands look empty, in 58% of the studied cases in the glands mucus is detected in moderate and large quantity (Fig. 2).

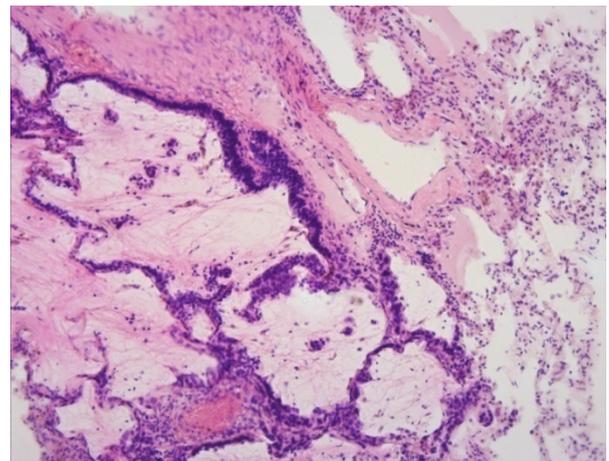


Figure 2. Filling of the peribronchial glands with mucus. HE staining. x200

The vessels of the bronchial walls are predominantly full. The pleura is represented by a layer of connective tissue of uniform thickness with a smooth surface; monolayer squamous epithelium - mesothelium - is completely absent in part of the observations. The lumens of both the right and left lung lobes alveoles are widened in places in most fields of view and free. Inter-alveolar septa in some cases are represented thinned, with ruptures. In most cases - 84% of the total number - focal thickening of the septum occurs due to focal edema of the interstitial tissue, capillary congestion

in a state of evident paresis, atelectasis and mild cell infiltration - single macrophages and white blood cells (Fig. 3).

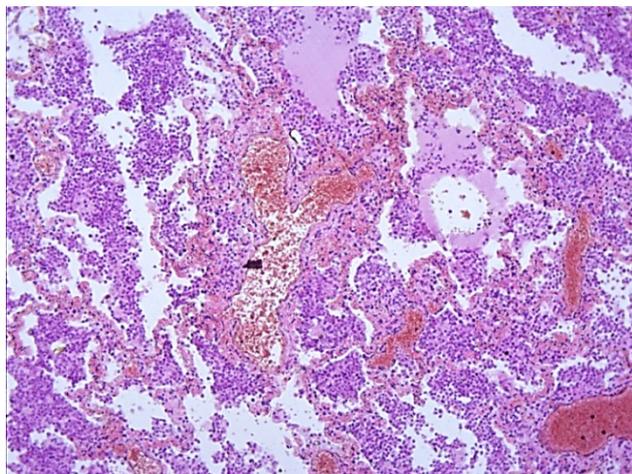


Figure 3. Thickening of the interalveolar septa due to inflammatory infiltration. HE staining. x100

In all cases there are areas of interalveolar septa with capillaries in a state of dystonia, unevenly filled with blood. In the single fields of view, the lumen of the capillaries is filled with leached erythrocytes, a sludge-phenomenon is revealed in the form of gluing red blood cells between themselves and the stasis of formed elements. Most of the vessels of the microvasculature are in the state of dystonia, filled with blood unevenly - there are sharply anemic vessels, part of the arterioles contains a moderate amount of blood. In places in the arterioles lumen isolated leached erythrocytes are visible. In most cases the interlobular arteries are in a state of moderate and evident spasm, sharply full-blooded (Figure 4).

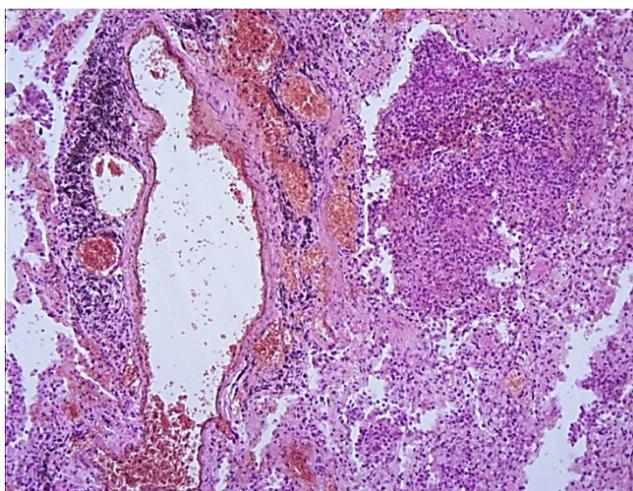


Figure 4. Hyperemia of arteries, vascular stasis of microvasculature. HE staining. x100

There are areas of swelling and homogenization in the walls of the arteries. In middle-aged and elderly people sclerotic changes in the walls of large arteries of varying severity are determined.

4. Conclusions

Death cases of inpatients at various stages of experiencing a closed craniocerebral injury, in contrast to the deaths due to CCI at the scene are characterized by features of the lungs morphological changes represented by successive changes of circulatory disorders and pulmonary ventilation, inflammation.

It has been macroscopically revealed an increase in the mass of both lungs in 38% of cases with signs of the lung tissue edema, in 62% of cases - due to acute emphysema, and on the incision the lung tissue looked pale, reddish-purple with abundant secretion of dark red foamy liquid.

Microscopically, the complex of morphological equivalents of pathological processes was represented by changes in all parts of the respiratory system, including reactive rearrangements of the vascular bed, the microcirculatory part, with their accompanying abnormalities of hemodynamics and rheological properties of the blood.

Most of the vessels of the microvasculature were in the state of dystonia, filled with blood unevenly, the interlobular arteries are in a state of moderate and evident spasm, sharply bloodless. There are areas of swelling and homogenization in the walls of the arteries.

REFERENCES

- [1] Guseinov G.K. About the immediate causes of death at craniocerebral injury. / Guseinov GK, Bogomolov DV, Semenov GG. // Materials of the final scientific conference of the Russian Center for Forensic Medicine, Moscow, Nov. 17-18. 2005 - Moscow: INFRA-M, 2006. - P. 179-184.
- [2] Guseinov G.K. Bogomolov DV, Baranova M.Ya., About the histological markers of dislocation syndrome in traumatic brain injury. / Guseinov G.K., Bogomolov D.V., Baranova M.Ya. // Collection of works of DagMA, - Makhachkala: Lotos, 2007. - P. 117-119.
- [3] Guseynov G.K. Cranial nerve injuries in the prehospital dying from blunt-force craniocerebral injury / Guseynov G.K., Mazurenko MD // Theory and practice of forensic medicine: works / St. Petersburg Scientific Society of Forensic Physicians. Ed. prof. Mazurenko M.D. - SPb., 2002. - Vol.6. - pp. 43-46.
- [4] Guseynov G.K. Macro- and microscopic picture of hemorrhages and necrosis in the brainstem upon death from craniocerebral injury with blunt objects at the prehospital and in acute post-traumatic period / Guseynov GK, Mazurenko MD, Nikolayishvili MG // Theory and practice of forensic medicine: works / St. Petersburg Scientific Society of Forensic Physicians.; ed. prof. Mazurenko M.D. - SPb. 2003 - Issue 7. - pp. 56-58.
- [5] Dolgova O.B. Morphological changes in the lungs of persons who died in hospitals from a closed craniocerebral injury. // Author. Dis ... of PhD. Izhevsk, - 2004.
- [6] Chiun V.I. Mortal traumatic brain injury according to the

- materials of the Bureau of Forensic Medical Examination // Mat. Scientific-practical. conference of forensic physicians of the Krasnoyarsk Territory. - Krasnoyarsk, 1987. - p. 71-73.
- [7] Myakotrykh V.S., Talankina N.Z., Borokova T.A. Clinical, pathophysiological and morphological aspects of the remote period of a closed craniocerebral injury. // Journal. neurology and psychiatry. - 2002. №4. - pp. 61-65.
- [8] Kasumova S.Yu. Dynamics of morphological changes in focal and diffuse brain injury / Kasumova S.Yu. // Trauma of the central nervous system. - Odessa, 1991. - p. 52 – 54.
- [9] Morphological and histo-chemical changes in the pituitary and adrenal glands in severe craniocerebral injury with varying degrees of brain stem damage. / Medical Business, 1977 No. 7 - P. 122-125.
- [10] Proshina Yu.V. Functional morphology of the hypothalamic-pituitary-adrenal system in severe craniocerebral injury: dissertation. ... Candidate of Medical Sciences: 14.00.24 / Russian Center for Forensic Medicine - Moscow, 2007, - P. 25: ill. RSL OD, 9 07-2 / 2554.
- [11] Chiun V.I. Comprehensive morphological and photometric studies in the forensic determination of the duration of craniocerebral injury. Guidelines. - Krasnoyarsk, 2002. - p. 16.
- [12] Chelnokov V.S., Ilina E.V. Pathomorphological changes at craniocerebral injury // Forensic medical examination. - 2001. - №1. - pp. 7-9.