

Morphological Changes in Endocrine Organs during Acute Asphyxia

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The endocrine organs react in many diseases and high-risk conditions. The pathological alterations after acute asphyxia are not investigated in detail. **The aim:** to study the organs damage in acute asphyxia. The present study was performed in 18 men and 6 women dead after hanging, compression of thorax and abdomen, or bolus asphyxia. Tissue specimens from thyroid gland, suprarenal gland and carotid body were examined in the first 24 hours after death. Histopathological alterations in examined endocrine glands are connected with acute changes in the circulation. The established organs showed: expressed blood stasis, haemorrhage, tissue swelling and cell degeneration. The present study supposed that pathological alterations are probably associated with acute asphyxia, but the limited number of studies is yet insufficient to improve that.

Key words: asphyxia, thyroid gland, carotid body, suprarenal gland.

Introduction

Mechanical asphyxia have a fundamental place among the causes of violent death (37%). The mechanisms through which death occurs can be different – disturbances in the brain's blood circulation dominate during strangulations, drowning results in electrolytes disbalance and so on. During strangulations, local changes due to the action of the object used are always found around the neck and there is a picture of sudden death [6, 7]. Non-specific changes are found during histological examination – disturbance in the blood circulation, increased permeability of the vessel wall, acute degenerative changes in the parenchyma organs and so on.

Due to the hypoxic stress and disturbed pathophysiological mechanisms, changes in some endocrine organs could be expected. These changes are associated with neurohumoral regulation of important vital processes — breathing, oxygen balance and so on.

In forensic medicine, changes in endocrine organs associated to series of acute conditions including different asphyxia with acute hypoxia are not studied in detail. The role of the carotid sinus which has baroreceptor function is not cleared. This function is inevitably destroyed in accordance with the level of compression of the neck.

Aim: Forensic medical assessment of the morphological changes in some endocrine glands during acutely occurred asphyxia for the clarification of thanatogenesis.

Material and Methods

Examined are: Carotid bodies, thyroid gland and suprarenal glands from 18 men and 6 women with mean age of 50,8 years. Materials for the morphological examinations are obtained until 24th hour after death. The incidences are: death caused by hanging (14 cases), from compression of the thorax and abdomen (4 cases) and from foreign body in the respiratory pathways (6 cases). Soft and hard noose (rope, cable and so on) are used for strangulation, compression of the trunk is recorded during working accidents and domestic disasters, where as the obstruction of the respiratory pathways is with large food particles (peace of meat and so on).

Medical history – there are no records of a manifested arterial hypertension and chronic obstructive disease of the lungs, as in other individuals, even through recommended investigations; there are no reliable facts on their exclusion. Morphological changes, which establish their previous development, are not found. There are discreet microscopic evidences for an early hypertension only in two cases.

Blood and urine are investigated for volatile reducing substances including ethyl-alcohol, in all of the studied cases. Ethyl-alcohol is found in 19 of them, with concentration that did not exceed 2%. Exception is recorded in only one of the 19 cases in which the concentration is 3, 68%.

Control: cases of the sudden traumatic death from road accidents among young people (1 to 40 years) with different causes of death — traumas incompatible with life, acute post-hemorrhagic anemia and so on.

Retrospective forensic medical examinations and their conclusion are studied. A full histological examination using generally accepted methods is performed.

Paraffin sections are colored with: Haematoxylin-eosin, Azan, Gomori and Orange G.

Results

During external and internal microscopic examination, vital signs for mechanical asphyxia and general asphyxic sign of a sudden occurred death (liquid dark blood, acute venous stagnation in the internal organs, hemorrhages on the serosa, mucosa, and cerebral edema) are found. In three of the four cases of compression of the body there is typical carmine edema of the lungs, where as in the fourth case it is not clearly manifested. Hemorrhages of the tunica adventitia of the aorta and esophagus are found in only one case of hanging.

Histological changes determined by acute disturbance in the blood circulation are found in all of the internal organs examined. Histopathological changes in the examined endocrine glands are also generally related to disturbed blood circulation.

Carotid Bodies (CB): Normal form and size of the carotid bodies are found in all the examined cases. In one case CB are ridged in shape, which is probably an anatomical variant [5].

The number of the lobules in the carotid bodies varies between 5 and 8.

Circulatory changes are observed: mild to severe blood stagnation in the blood vessels and micro hemorrhages. Micro thrombi are purposely looked for, but are not found.

The lobules of the CB compose of chief cells type 1, with reduced number of light cells and predomination of their dark variant. Almost in all of the cases, the connective

tissue in between the lobules in loosed. Mild fibrosis, edema, and hemorrhages in between the lobules are found only in two cases.

Thyroid glands — without changes in their structure. In separate follicles, there is manifested hyperemia and diapedesis hemorrhages.

Suprarenal glands — structural changes are not found during examination. The capsule is preserved. The arterioles located in it are filled with blood and with homogenous walls. Separate zones in the suprarenal cortex are preserved. After coloration for lipids, performed on the cryostatic sections, no changes are recorded in the liquid contents of the cells in the zona glomerulosa.

Hyperemia of the vessels and focal hemorrhages in the stroma are observed.

Discussion

Oxygen's balance in the organism is maintained by a number of complex factors, including neurohumoral and hormonal mechanisms. With the help of non-specific changes in the dead body, we can conclude that the death has suddenly occurred by the mechanism of hypoxia. This conclusion is very important in the forensic medical aspect. In the absence of specific changes, the diagnosis of death will have to be established on the basis of general morphological changes and the signs of an external mechanical action, which has characteristic signs (line of strangulation, foreign body and so on).

Morphological changes in the endocrine glands on the neighborhood shows the pathophysiological mechanisms that are developed during hypoxia. Combination of different factors is possible: place, force and peculiarity of the applied external factor, combination

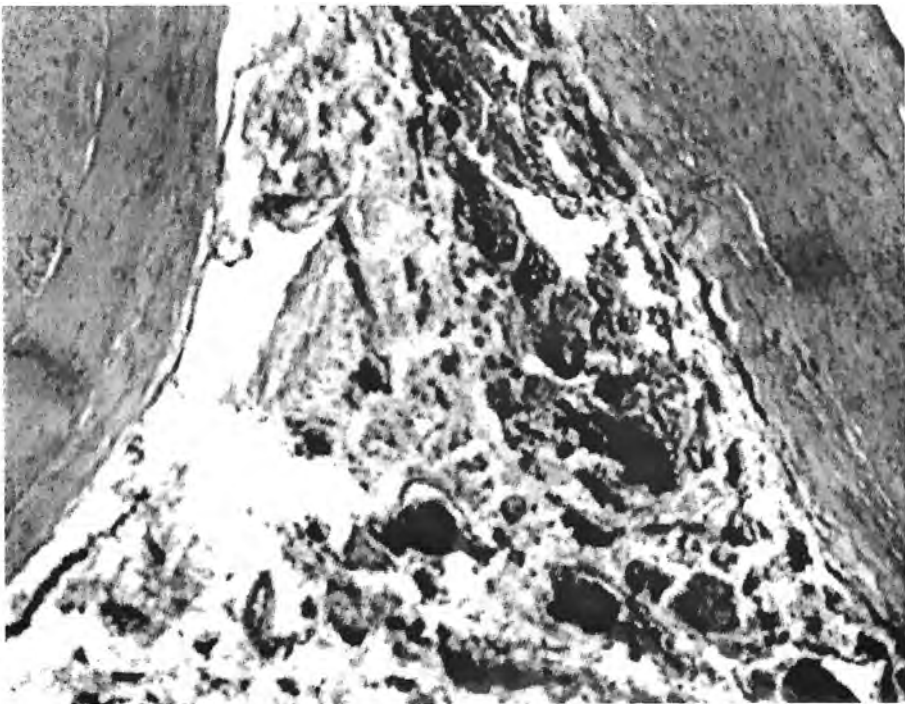


Fig. 1. Severe stasis in the blood vessels. HE, $\times 25$

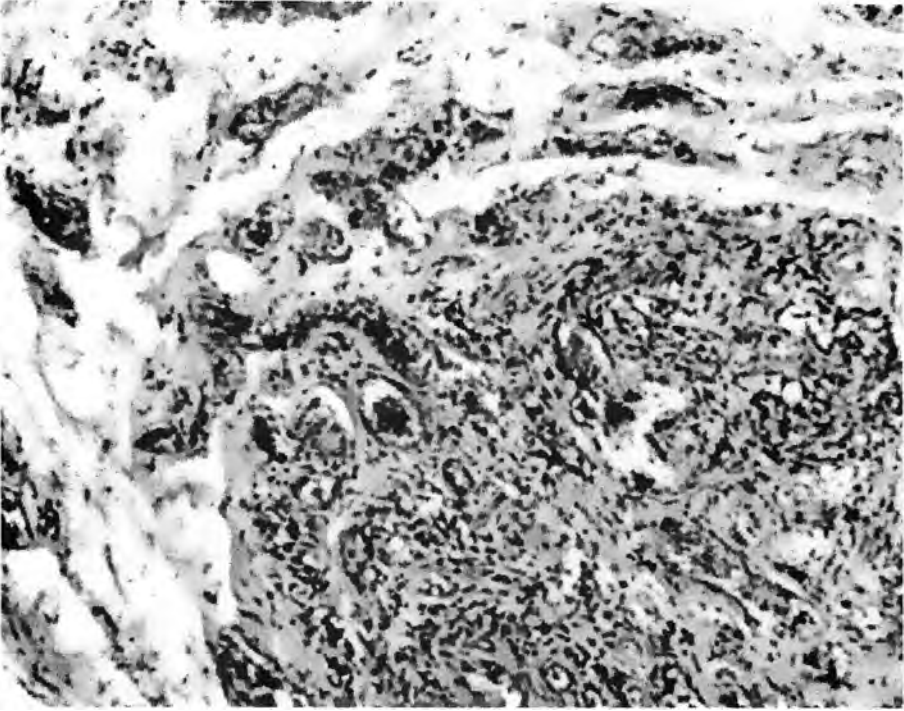


Fig. 2. Carotid bodies — circulatory changes and microhaemorrhages. HE, $\times 40$

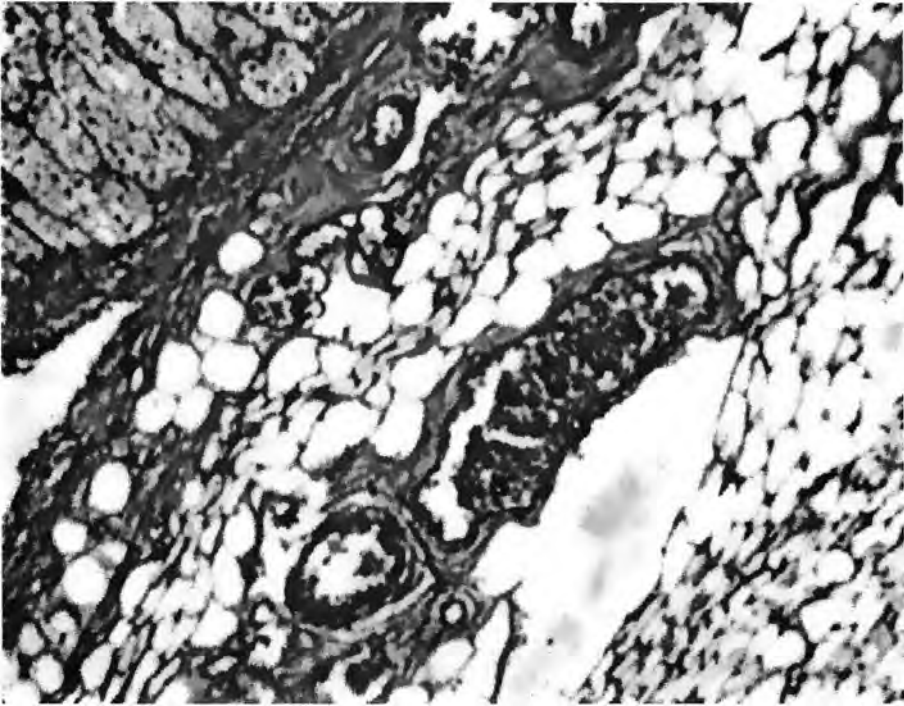


Fig. 3. Thyroid gland — hyperemia and follicles without resorption vacuoles. HE, $\times 25$



Fig. 4. Adrenal glands – without structural changes, hyperemic arterioles with thickening of the arteriolar walls. HE, $\times 25$

of more than one factor, combination with other external action (for example alcohol). Presence of other preceding illnesses is of important.

Carotid bodies are one of the peripheral chemoreceptor organs, which show changes in the oxygen's concentration in the blood, changes in the pH and the concentration of CO_2 . They play a role in the blood's gas exchange that is carried out during breathing and the formation of the ventilation respond during hypoxia.

Mechanical asphyxia is caused, on the one hand, by disturbances in the normal distribution of the blood stream in the carotid bodies, and on the other, by acute hypoxia of the specific chemoreceptor tissue.

Reduction in the number of light cells and increase in that of dark variant of the chief cells is observed during chronic hypoxic condition [1, 2, 3] or diseases with chronic hypoxia. In the examined cases, this observation is explained with sharp and rapid activation of the function of the carotid bodies, which depends on the hypoxic stress.

Thyroid glands – They are without changes in the structure, with manifested hyperemia and diapedesis hemorrhages, without resorption vacuoles.

Suprarenal glands – General morphological changes speaks about veins filled with blood as a result of mechanical asphyxia.

Death during acute asphyxia can also occur by heart's mechanism, on which trauma of the carotid bodies also has an influence. This connection is indirectly shown by hemorrhages in them. The same conclusion is made by other authors [4, 7].

Manifested specific changes in the examined endocrine organs that can direct towards concrete type asphyxia – strangulation, compression of the body or foreign body in the respiratory pathways are not found.

Conclusion

The changes (even though discrete) explained in some endocrine organs shows their participation in the pathogenesis of acute occurred asphyxia.

But the absence of specific changes in them means that the diagnosis of "death from mechanical asphyxia" should be established on the basis of all morphological changes and signs of a concrete external action (line of strangulation, foreign body and so on).

Compression of the baroreceptors can play a leading role in accordance with the height of the object used in strangulation. This is possible especially in the case of strangulation.

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