

## Traumatic Death During Status Asthmaticus

(Case Report)

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This case is about a 36-year-old male, suffering from bronchial asthma, who had an acute asthmatic episode, after consuming alcohol. While getting out of the bed in order to inhale his dose of Ventolin, he fell head foremost from the 2<sup>nd</sup> floor of his house. He had a severe cranio-cerebral trauma, which determined the direct cause of his death. The place and role of status asthmaticus in thanatogenesis is discussed, as well as the morphologic characteristics of this disorder, helping in the construction of a correct forensic report.

*Key words:* asthma bronchiale, status asthmaticus, thanatogenesis, cranio-cerebral trauma.

In forensic medicine practice, particularly in deceased reports on individuals who had been suffering from bronchial asthma during their life, some problems may appear while determining the cause of death. Bronchial asthma is a chronic, relapsing inflammatory disease of the lungs [2, 6], taking course with hypersensitive, reversible bronchial constriction as a result of the impact of different stimuli (allergens). During status asthmaticus the disorder may lead to a sudden death [3, 9]. The main cause usually being asphyxia with respiratory and/or cardiovascular insufficiency [1, 7]. Some authors [4, 7] suggest there's a possibility for the occurrence of inhibitory cardiac death in addition, caused by the  $\beta_2$ -agonist used for symptomatic relief. Direct cause of death may as well be trauma, drowning and other accidents, caused by the severe physical condition during status asthmaticus.

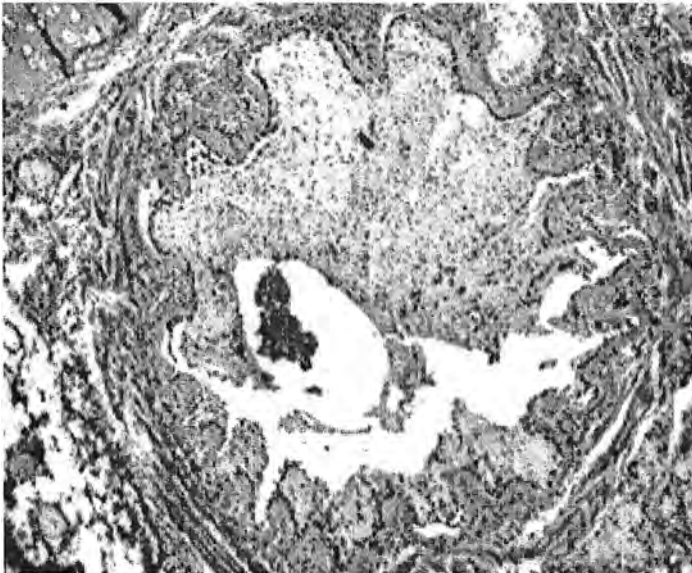
*The aim* of this report is, by presenting a concrete case from practice, to make a detailed morphologic characterization of the changes in the lungs during status asthmaticus, which is not too well-known to the forensic experts from the general practice, as well as to analyse its participation in thanatogenesis, frequently being unsoundly neglected, when constructing precise and correct forensic report.

## Material and Methods

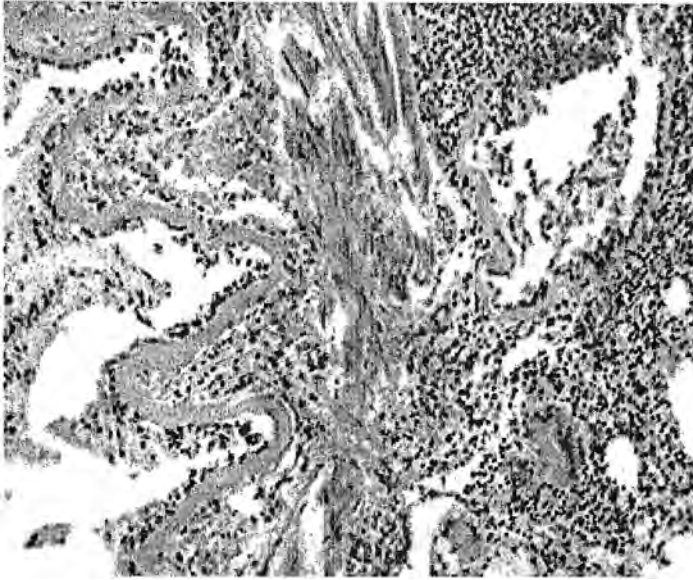
A 36-year-old male (X.M.M., No 129/04), with several years long history of bronchial asthma, for which he had been prescribed Ventolin – spray to treat acute exacerbations. After consuming 300 ml of brandy with his dinner, he went to bed. Around 02:00 a.m. his mother heard him coughing very loudly and noisily – he had developed an acute asthmatic episode. He failed to spray the medicine and began vomiting on the bed, got up and fell from the 2<sup>nd</sup> floor onto a cement landing, head foremost. Due to the impact he had a severe cranio-cerebral trauma and died within a few minutes, even before the arrival of medical aid.

## Results

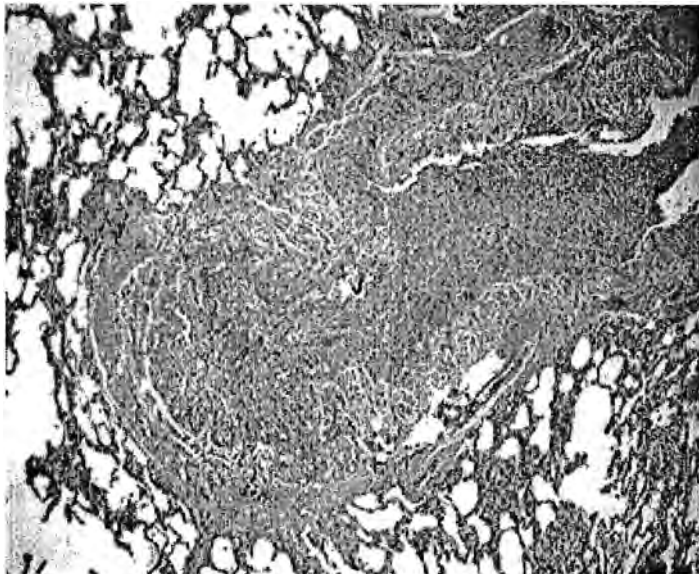
During the forensic investigation it has been macroscopically established: a heavily built male with obesity III-IV degree and expressive features of asphyxia – cyanosis of the skin, plenty of postmortal stains, petechiae on the conjunctivas and partially on the facial skin. On internal examination is found a severe, covered cranio-cerebral trauma, presented by a massive haemorrhage in the soft pericranial tissues of the occipital area, a fracture of the orbital basis, blood in the frontal sinu and in the middle ears, massive subarachnoid haemorrhage with multiple foci of contusion in the temporal parts of the cerebral haemispheres, in basal direction, blood in the cerebral ventriculi, a rupture of the left ear and massive chafes on the neck and thorax. The lungs are strongly bloated out, with light-grayish colour, they fill up the chest and cover up the heart (acute emphysema), with single pleural petechiae. There is a lot of thick secretion in the lumen of the constricted bronchi, which obstructs them almost completely. The heart has the appearance of cor pulmonale. The liver is enlarged (1900 g) as a result of moderate steatosis.



**Fig. 1.** Obturated bronchi by the thick mucus and desquamated epithelii, HE (×63)



**Fig. 2.** Strongly thickened and homogenic basal lamina of bronchial wall, expressed inflammatory reaction HE (×100)



**Fig. 3.** Obturated bronchi and bronchioli, acute emphysema and atelectasis around them, HE (×32)

The other internal organs have the signs of a heavy acute venous congestion. In the blood is found the presence of 3.1‰, and in the urine 3.6‰ of ethyl alcohol.

Histologically was identified that the bronchi and bronchioli are filled with very thick mucus, mixed with desquamated epithelium and inflammatory cells (mainly eosinophylic leucocytes).

The preserved mucosa is columnar, cylindrical or low, cuboidal, with marked hyperplasia of goblet cells. The basal lamina is repeatedly thickened, homogenic. The muscular layer is hypertrophic and consisting of thickened muscular fibres with large nuclei. The mucus-secreting glands are hyperplastic and hypersecreting as well. The vessels have their lumen reduced. The bronchial wall is infiltrated by lymphoid cells, neutrophylic and eosinophylic leucocytes.

Around the obturated by the thick mucus bronchi and bronchioli, zones of atelectasis, different in size, are being outlined.

The rest of the pulmonal parenchyma has greatly dilated alveolar spaces, thin interalveolar septi and blood-filled capillaries.

## Discussion

The presented case shows a very characteristic morphologic picture of status asthmaticus. The described histologic changes in the lungs are diagnostic for this disorder and are introduced as such by the most of the authors and contemporary practical guidances [1, 8, 9]. They reflect the allergic character of the inflammatory process in the bronchial wall, which is presented by increased vessel permeability and oedema in the submucous layers, typical infiltrations, particularly with prevalence of eosinophylic leucocytes in them, the very characteristic strong thickening of the mucous basal membrane, increased mucus production and the typical "plugs" in the bronchial lumen.

The pathophysiologic mechanisms of development of these characteristic features include spasms of the smooth muscles of the bronchi and bronchioli, increased permeability and strongly increased mucus secretion in the glands and the covering epithelium [1, 2]. This determines, as in the specific case, a progression of asphyxia, defining the genesis of death during status asthmaticus. The lack of signs of progression of acute cardiovascular insufficiency are important proof of this [3, 7].

In the described case the progression of the asphyxic syndrome is followed by a severe and incompatible with life cranio-cerebral trauma. It appears to be the direct cause of death. Therefore the mechanism of death is a complex one: on the one hand, is the asthmatic status, causing the severe asphyxic disorder and disorientation, on the other, is the consecutive fall and head trauma.

It follows as a consequence, that it is necessary in every case to differentiate the direct cause of death and the mechanism of death (thanatogenesis), i.e. those mechanisms, that determine structural and functional changes in the life-depending organs, which in this case emerged during status asthmaticus. It is possible that, while the disorder is one and the same, the direct cause of death might be different, which is not always noticed by the experts.

The weakness of cardiac activity is a final stage in thanatogenesis in general, which is why it should not be considered as a direct cause of death during status asthmaticus. In this case the weakness of cardiac activity is not a cause, but a mechanism of the process of dying.

From practical point of view the described case shows, that even if there is no anamnestic data about illnesses during one's life, as it often happens in forensic medicine practice, it is necessary that all internal organs and tissues have a carefull histologi-

cal examination, in order not to miss those changes, that would explain the exact causes and mechanisms for the advancement of death. The learning of the morphology of status asthmaticus, established in the above case, in combination with the cranio-cerebral trauma, allows us to construct correct cause and effect interrelations, a prerequisite for the exact expert conclusion, the main goal of every forensic analysis.

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