

H139 Acute Pulmonary Emphysema (APE) in an Incomplete Hanging

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After attending this presentation, attendees will better understand the occurrence of APE in cases of incomplete hanging and its potential application as a sign of vitality.

This presentation will impact the forensic science community by increasing understanding of pathophysiological mechanisms that lead to death in hanging.

APE has been described in deaths by mechanical asphyxia such as ligature or manual strangulation. In cases of hanging, the role of airway compression in causing death is controversial. Only a few authors have reported APE as a classic sign of hanging, but most studies are based only on standard histological examination of the lung. Morphometric digital analysis of the pulmonary tissue has been proposed to provide objective data on the distention of air spaces more reliably than standard histology.

A recently published study investigated eight cases of complete hanging and eight cases of incomplete hanging, as well as ten cases of freshwater drowning as a positive control group and ten cases of acute external bleeding as a negative control group. Image analysis software (Nikon Elements BR 3.2) was used to detect the alveolar area in histological slides. The results revealed that in incomplete hanging, the Mean Alveolar Area (MAA) was significantly greater ($31,522\mu\text{m}^2$) than observed with complete hanging ($21,325\mu\text{m}^2$) and was similar that one observed in freshwater drowning ($33,175\mu\text{m}^2$). These results suggest that incomplete hanging may cause slower compression of the cervical blood vessels with longer pulmonary distress. Another possible explanation for this observation is that the position of the suspended body causes a greater tensile force on the thoracic cage, thus hindering full expansion and ventilation.

To verify this hypothesis, this study compared eight cases of incomplete hanging where the contact of the body with the ground was minimal (i.e., tiptoes, group A) with eight cases in which the contact was greater (i.e., hanging in a sitting position, group B), using the same morphometric method from the previous study. In order to avoid confusion due to emphysema from another origin, exclusion criteria were: age >65 years, inhalation of blood and/or gastric content, chronic respiratory (in particular chronic emphysema) or cardiac diseases, and cardiopulmonary resuscitation. Postmortem interval at autopsy was <72 hours. Histological slides from each lung lobe were stained with hematoxylin and eosin and examined by optical microscopy (Nikon Eclipse 50i, magnification 10X). The area of every alveolar space was measured using image analysis software (Nikon Elements BR 3.2). The average of the alveolar areas was calculated for each case and the groups were compared.

The results of the present study demonstrated that the MAA of group B ($29,581\mu\text{m}^2$) was significantly higher than that observed in group A ($21,652\mu\text{m}^2$). Furthermore, the MAA observed in group A was similar to that previously observed in the complete hanging group.

These results apparently confirm the hypothesis and suggest that the pathophysiological mechanism leading to death in incomplete hanging with a minimal contact with the ground is similar to complete hanging. In these cases, vascular compression of the neck seems to be more important with possibly less pain and minor respiratory distress. APE is present in incomplete hanging with substantial contact of the body with the ground and could be used as a vital sign.

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