

Ventilator-Induced Lung injury: a preliminary morphological study

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In this study we aimed at characterizing by morphological methods the effect of ventilator-induced lung injury (VILI) on lung structure, and we analyzed collagen and elastin content to understand the possible role of the main components of lung connective tissue in the development of VILI.

For this purpose four female piglets (21.7±4.5 kg) were sedated, intubated and mechanically ventilated with high pressure to induce VILI. After death, lungs were excised inflated; each lung was divided in four regions, and lung fragments were obtained from each region of both lungs: three samples from subpleural regions, one sample from the medial portion of the lung. Lung fragments were immediately fixed in 4% formalin in 0.1M phosphate buffered saline (PBS), pH 7.4, routinely dehydrated, paraffin embedded, and serially cut (thickness 5 µm).

Lung structure was analyzed in haematoxylin-eosin stained sections using a semi-quantitative grading scale to assess the injury grade.

To study collagen and elastin content, sections were stained by Sirius red and Weigert's resorcin-fuchsin, respectively, and analyzed by a specific software. Collagen and elastin content were expressed as a percent of the stained area relative to the lung tissue.

Light microscopy analysis of hematoxylin-eosin stained sections revealed that VILI induced several lung injuries such as hyaline membranes, interstitial and septal infiltrate, vascular congestion and intra-alveolar hemorrhaging, alveoli rupturing and basophilic material deposition. These lesions were diffuse and involved the whole lung parenchyma without any preferential localization.

Image analysis of Sirius red and Weigert's resorcin-fuchsin stained sections showed that lung injury was more evident where elastin was less abundant, but was also evident where elastin content was high and collagen was concomitantly less abundant.

These preliminary data suggest that lung extracellular matrix could influence the response to damaging ventilation, and that both collagen and elastin could play a role in maintaining lung structure during VILI.

Keywords

Ventilator-Induced Lung injury, collagen, elastin.