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THORACOSCOPIC WORKING SPACE DURING CONVENTIONAL MECHANICAL VENTILATION; A PORCINE MODEL

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Aim of the study: Thoracoscopic working space in capnothorax is the result of the competitive balance between intrapulmonary, intra-abdominal, and CO_2 insufflation pressures. Optimizing thoracoscopic working space requires measurement of these pressures and volumes in the context of the patient's cardiopulmonary condition. With this study we aim to provide a first overview of the factors constituting the creation of thoracoscopic working space, using CT scanning in a porcine model.

Methods: This study was approved by the institutional board (protocol 3299). In 10 anesthetized pigs with a mean weight of 21.3 kg (range 17.8-26.3) capnothorax was established in left lateral decubitus position. Both lungs were ventilated with intermittent positive pressure ventilation with a tidal volume guarantee of 10 ml/kg and a positive end-expiratory pressure (PEEP) of 5 cm H_2O. During an incremental series of CO_2 insufflation pressures end-expiratory CT-scans were made in which thoracoscopic working space volumes were measured (figure 1a).

Main Results: The volume-insufflation pressure curve can be divided into two parts (figure 1a and 1b). In the first part the volume increases with increasing insufflation pressures due to caudal displacement of the diaphragm without large changes in pulmonary volumes and peak ventilation pressures. In the second part of the compliance curve the insufflation pressure exceeds PEEP and intra-abdominal pressure. Consequently, diaphragm movement is restricted and lung volume is reduced, progressively impairing ventilation. Both factors contribute to the increase in working space volume. In figure 1c, the relative contribution to thoracoscopic working space of the different components is shown.

Conclusion: This study gives a first insight into the factors involved in the creation of thoracoscopic working space using objectively measured CT volumes in a porcine thoracoscopy model. It stresses the importance of understanding the balance between intrapulmonary, thoracic insufflation and intra-abdominal pressures in efficiently creating thoracoscopic working space without compromising ventilation.

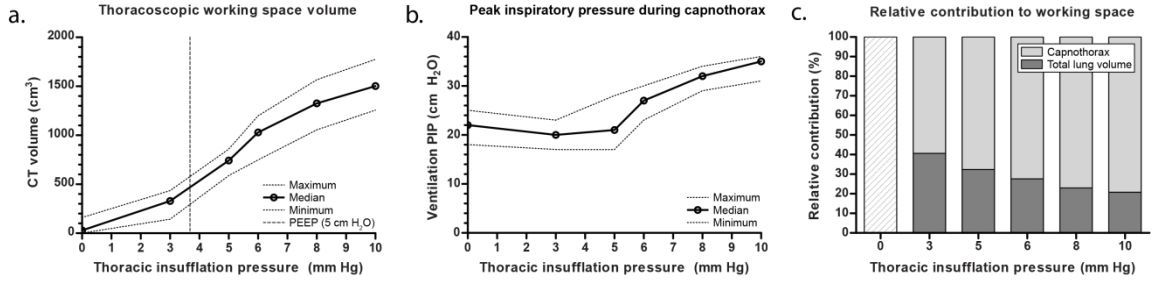

Figure 1. (a) The capnothorax CT volumes resulting from a series of incremental pressure steps in 10 animals. CT scans made at a positive end-expiratory pressure (PEEP) of 5 cm H_2O. (b) Peak inspiratory ventilation pressure (PIP) during incremental insufflation pressures. (c) Relative contribution of different components to working space volume (single animal).