

Lung ultrasound: water, air or both?

Dott. IACOPO PASTICCI (1), Dott. LORENZO GIOSA (1), Dott. MATTIA BUSANA (1), Dott. FRANCESCO VASSALLI (1), Dott. MATTEO BONIFAZI (1), Dott.ssa FEDERICA ROMITTI (1), Dott.ssa ROSANNA D'ALBO (1), Dott.ssa HANNA GRÜNHAGEN (1), Dott. DAVID JEROME AßMANN (1), Dott. MARIA MATTEO MACRÌ (1), Prof. MICHAEL QUINTEL (1), Prof. LUCIANO GATTINONI (1)

(1) UMG, university of Göttingen, Robert-Koch-Straße, 40, Göttingen, Germania.

Argomento: Insufficienza respiratoria acuta e ventilazione meccanica

BACKGROUND: Lung Ultrasound (LUS) is a useful tool in detecting pulmonary oedema, atelectasis, pleural effusions and pneumothorax. The associated visual findings derive from the ratio between water and air in the lung. The aim of our experiment was to evaluate LUS as a monitor for the progression of ventilator induced lung injury (VILI) in the ergotrauma conceptual framework.

METHODS: 37 healthy piglets weighting 24.2 ± 2 kg were ventilated at a high level of mechanical power (21.1 ± 10.7 j/min) for 48h. LUS was performed before starting the experiment and then every 12 hours in 6 different regions of each hemithorax (2 dorsal, 2 lateral, 2 ventral). According to the number of B lines and to the presence of atelectasis we attributed a score between 0 and 3 to each lung region and we divided the pigs in two groups according to the LUS score (LOW or HIGH). As a marker of lung water-air ratio we divided the extravascular lung water (EVLW) by the end expiratory lung volume calculated as FRC + PEEP volume (water-air ratio = $EVLW/EELV$).

RESULTS: All along the experiment, piglets with a high LUS score had a higher water-air ratio ($P < 0.001$) (Fig.1). The single values of EVLW ($p = 0.08$), lung wet to dry index ($p = 0.31$) and total lung weight ($p = 0.28$), however, were not significantly different in the two LUS groups. **DISCUSSION:** Our findings show that a normal LUS does not exclude lung oedema or excessive EVLW as it reflects the ratio between water and aeration instead of their absolute values. **CONCLUSION:** In certain conditions a normal LUS may be coexistent with severe lung oedema to the point that lung aeration can not be overlooked in the interpretation of LUS.

WATER-AIR RATIO, EVLW AND EELV DURING THE EXPERIMENT

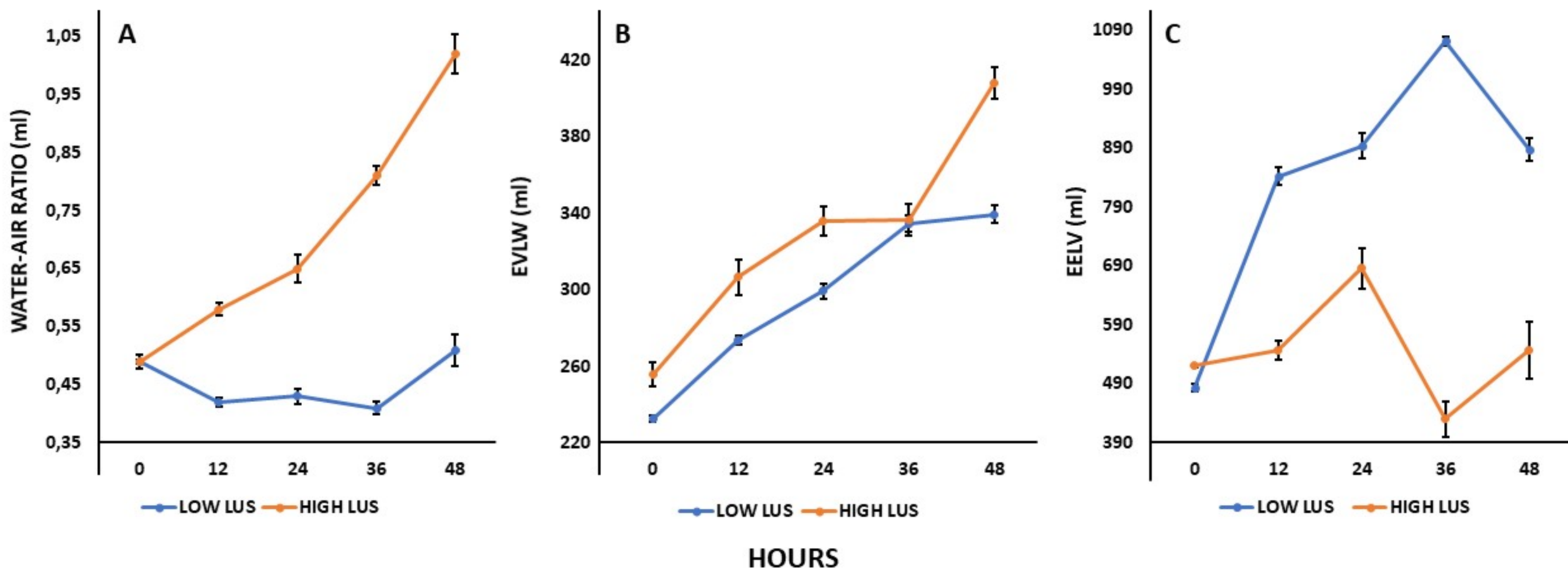


Fig 1: we reported the variations of WATER-AIR RATIO (panel A), extravascular lung water (EVLW, panel B) and end expiratory lung volume (EELV, panel C) during the experiment. Values are reported as mean \pm se. Piglets with an higher LUS score had an higher WATER-AIR RATIO ($p < 0,001$) and a lower EELV ($p < 0,001$). No difference can be found in EVLW between high and low LUS score ($p = 0,08$).