Assessment of regional lung filling characteristics by Electrical Impedance Tomography and dynamic Computed Tomography

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INTRODUCTION

• Monitoring lung function during mechanical ventilation at the bedside is of increasing clinical interest.
• Electrical impedance tomography (EIT) has previously shown its ability to non-invasively detect changes in ventilation distribution [1].
• This study compared regional time delays derived from EIT and dynamic computed tomography (dCT) as reference.

RESULTS

• In both EIT and dCT, t50D was higher than t50V.
• In EIT, mean difference of t50D and t50V was significantly lower (compare Table 1) in H compared to LAV throughout all PEEP levels (0.06 s and 0.19 s; p<0.01).
• These results were also observed in regional dCT analysis (mean Δt50D of 0.04 s and 0.1 s).

DISCUSSION

Since EIT measures relative impedance changes, the described method is limited to the lung areas affected by tidal ventilation. Thus, functionally mute behaving pixels – representing e.g. fixed atelectasis – have no impact on the presented analysis. Further, the analyses were based on CT thoracic boundaries and lung contours. Nevertheless, the assessed time-constants reflect the functional lung behavior during tidal ventilation.

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METHOD

• Three mechanically ventilated (elisa 800, SALVIA Medical, Germany) pigs (25 - 35 kg) with
  • inspiratory pressure ramp of 3 s
  • PEEP levels of 0, 5, 10 and 15 mbar.
• Measurements in healthy (H) and lavaged (LAV) lungs

• EIT (PioneerSet, Swisstom, Switzerland)
• dCT (Emotion 16, Siemens AG, Germany)

• Images were reconstructed using GREIT [2].
• Lung regions in EIT were defined by CT contours
• The times until 50% of the inspiratory peaks (t50) were reached in EIT and dCT for
  • non-dependent (t50V) and
  • dependent (t50D) lung regions and the
• time differences (Δt50) between non-dependent and dependent lung regions were assessed.

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