Abstract 3.

Lung Recruitment Assessment in ARDS – Nitrogen Dilution and Simple Mechanics versus Computed Tomography

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Abstract

INTRODUCTION: Reversibility of lung collapse or lung recruitability (LR) is extremely variable in patients with acute respiratory distress syndrome (ARDS). Quantitative analysis of chest computed tomography (CT) is considered the gold standard for LR assessment.

Respiratory mechanics have also been classically used for this purpose. Agreement between CT and respiratory mechanics for the quantification of LR has been reported as variable.

OBJECTIVES: To compare end-expiratory lung volume (EELV) measurements and LR quantification from CT and nitrogen dilution (ND) in ARDS patients.

Methods: We measured static respiratory system compliance (Cst) and EELV by ND under two PEEP levels, 10 cmH₂O apart, with a lung recruitment maneuver in between. Recruited volume from ND was computed as the difference of PEEP-induced EELV change (ΔEELV) and Cst at the low PEEP level times 10. Thoracic CT scans were performed at end-expiration at both PEEP levels following the same sequence. Gas lung volume and aerated lung tissue mass were computed at both PEEP levels with a -100 HU threshold. LR from CT was defined as PEEP-induced increase in aerated lung tissue mass. Recruitment efficiency was defined as the ratio between recruited volume or mass and ΔEELV. Patients with auto-PEEP greater than 2 cmH₂O were excluded.
Results: We studied 15 ARDS patients with a PaO2/FiO2 ratio of 122 ± 29 at PEEP 5 ± 4 and 15 ± 4 cmH2O. Table 1 shows EELV at both PEEP levels, ΔEELV, LR and recruitment efficiency using CT and ND as well as their Pearson correlations, bias and limits of agreement.

Conclusions: Lung volume measurements and recruitment quantification from CT and ND correlate well with small biases, but large limits of agreement. Bedside EELV measurements in conjunction with respiratory mechanics can be used as a reasonable LR estimate in ARDS patients although not interchangeably with CT.

<table>
<thead>
<tr>
<th></th>
<th>CT</th>
<th>ND</th>
<th>r</th>
<th>p</th>
<th>bias</th>
<th>LOA</th>
</tr>
</thead>
<tbody>
<tr>
<td>EELV1 (ml)</td>
<td>Mean</td>
<td>SEM</td>
<td>Mean</td>
<td>SEM</td>
<td>0.915</td>
<td>&lt;0.001</td>
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<tr>
<td>EELV2 (ml)</td>
<td>1498</td>
<td>25</td>
<td>1378</td>
<td>21</td>
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<tr>
<td>Delta EELV (ml)</td>
<td>716</td>
<td>19</td>
<td>642</td>
<td>15</td>
<td>0.772</td>
<td>&lt;0.01</td>
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<td>LR (ml or g)</td>
<td>384</td>
<td>17</td>
<td>361</td>
<td>15</td>
<td>0.885</td>
<td>&lt;0.001</td>
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<tr>
<td>LR/Delta EELV</td>
<td>0.53</td>
<td>0.5</td>
<td>0.53</td>
<td>0.42</td>
<td>0.815</td>
<td>&lt;0.001</td>
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References