Distribution of ventilation assessed by electrical impedance tomography (EIT) during spontaneous and controlled mechanical ventilation in horses in dorsal recumbency – a pilot study

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Distribution of ventilation assessed by Electrical Impedance Tomography (EIT) during spontaneous and controlled mechanical ventilation in horses in dorsal recumbency – a pilot study

C Marly-Voquer¹, AD Waldmann², SH Böhm², R Bettschart-Wolfensberger¹ & MM Mosing⁴

¹Equine Department, Vetsuisse Faculty, University of Zurich, Switzerland; ²Swisstom AG, Landquart, Switzerland

The aim of the study was to evaluate the center of ventilation (CoV) and percentage of total tidal variation per region of interest (ROI) in horses during spontaneous and controlled mechanical ventilation (CMV) using electrical impedance tomography (EIT).

Five anaesthetised experimental horses (isoflurane in oxygen 50 %, medetomidine continuous rate infusion) were placed in dorsal recumbency. They were breathing spontaneously until PaCO₂ reached 13.3 kPa when volume CMV was started. The EIT signal was recorded for at least 2 minutes immediately before (t₁) and 30 (n = 3) to 60 (n = 2) minutes after CMV was initiated (t₂, same tidal volume as during t₁). Four breaths were analysed for ventilation-induced impedance changes. The mean CoV was identified, and the fraction of total tidal ventilation of four stacked ROI, each covering 25 % of the ventrodorsal height of the lungs, were calculated (Radke et al. 2012). Data are presented as median and range.

After starting CMV, the CoV moved ventrally to the non-dependent lung regions (Table 1). Ventilation in the ventral ROIs increased whereas it decreased in the dorsal ROIs.

In this study, ventilation was essentially centered in the dependent dorsal regions of the lungs during spontaneous breathing and moved towards non-dependent ventral regions during CMV in anaesthetised horses in dorsal recumbency.

<table>
<thead>
<tr>
<th></th>
<th>t₁</th>
<th>t₂</th>
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<tbody>
<tr>
<td>CoV</td>
<td>63.5 (62.5 - 68.5) %</td>
<td>54.4 (45.2 - 60.5) %</td>
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<tr>
<td>ROI ventral</td>
<td>0.4 (0.1 - 0.9) %</td>
<td>3.1 (0.5 - 11.1) %</td>
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<tr>
<td>ROI central-ventral</td>
<td>22.2 (18.8 - 23.9) %</td>
<td>38.1 (27.3 - 52.5) %</td>
</tr>
<tr>
<td>ROI central-dorsal</td>
<td>55.0 (48.2 - 59) %</td>
<td>45.2 (33.2 - 56.9) %</td>
</tr>
<tr>
<td>ROI dorsal</td>
<td>21.9 (18.3 - 33.7) %</td>
<td>12.2 (3.2 - 15.5) %</td>
</tr>
</tbody>
</table>

Table 1. Comparison of the mean center of ventilation, and the fraction of total tidal ventilation of four regions of interest in anaesthetised horses, in dorsal recumbency, breathing spontaneously (t₁) and after initiating controlled mechanical ventilation (t₂).

References

Radke OC, Schneider T, Heller AR et al. (2012) Spontaneous breathing during general anesthesia prevents the ventral redistribution of ventilation as detected by electrical impedance tomography: a randomized trial. Anesthesiology 116, 1227-1234.

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cmarly@vetclinics.uzh.ch
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