

Category : **Respiratory: mechanical ventilation**

A221 - Diaphragm neurostimulation with mechanical ventilation mitigates neuroinflammation and results in microglia cellular characteristics similar to never-ventilated subjects

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Introduction:

Mechanical ventilation (MV) has been associated with neuroinflammation. Microglia are key cells that initiate and control inflammation in the brain, behaving either as pro-inflammatory or anti-inflammatory cells. We investigated whether transvenous temporary diaphragm neurostimulation (TTDN) in synchrony with MV, a hybrid ventilation strategy, mitigates neuroinflammation.

Methods:

Thirty-one healthy juvenile pigs (4-5 months, 48-66 kg) with non-injured lungs were divided into four groups: MV only (MV group, n=10), MV in association with diaphragm neurostimulation delivered either every other breath (TTDN50%+MV group, n=8) or every breath (TTDN100%+MV group, n=7) and never ventilated (NV group, n=6). TTDN targeted a reduction in pressure-time product between 15 and 20%. Volume control MV was set to achieve and maintain a tidal volume of 8 ml/kg with a PEEP of 5 cmH₂O. Hippocampus samples were harvested, and IBA-1 assay was used to stain microglia. Machine learning software classified microglia cells as either pro-inflammatory or anti-inflammatory based on cellular biometric characteristics. Data are expressed as median and interquartile range. The Kruskal-Wallis test and Dunn's multiple comparison test were used for statistical analysis. P-values ≤ 0.05 were considered statistically significant.

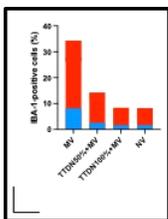
Results:

Microglia percentages were dependent on TTDN dose. Differences in percentages of IBA-1-positive hippocampal cells were statistically significant between groups, $p < 0.0001$ (Figure 1). Microglia from the TTDN100%+MV group had cellular characteristics statistically indistinguishable from the NV group.

Conclusion:

TTDN mitigates neuroinflammation after 50 hours of MV. TTDN every breath results in microglia cellular characteristics similar to the NV group.

Image :



IBA-1-positive cell percentages for all groups; pro-inflammatory in blue and anti-inflammatory in red. The MV group had 36.17% (30.71-48.27) IBA-1-positive cells, consisting of 8.11% (6.74-9.69) with pro-inflammatory and 27.82% (23.63-32.00) with anti-inflammatory characteristics. The TTDN50%+MV group had 16.70% (10.82-22.42) IBA-1-positive cells, consisting of 2.50% (2.02-2.88) with pro-inflammatory and 12.23% (7.36-19.54) with anti-inflammatory characteristics. The TTDN100%+MV group had 9.80% (7.86-11.19) IBA-1-positive cells, consisting of 1.60% (1.10-1.77) with pro-inflammatory and 8.37% (6.86-9.41) with anti-inflammatory characteristics. The NV group had 10.12%

*(8.93-10.65) IBA-1-positive cells, consisting of 1.63%
(1.32-2.06) with pro-inflammatory and 8.20% (7.68-8.50)
with anti-inflammatory characteristics.*