The mechanical power ratio: a possible threshold

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Argomento: VENTILAZIONE

BACKGROUND: Mechanical power is a unifying variable accounting for the total energy unloaded on the respiratory system. The aim of the study is to identify a possible threshold in lung damage for mechanical power, when normalized to an expected value during spontaneous quiet breathing.

METHODS: A retrospective analysis was conducted on 120 healthy pigs, mechanically ventilated for 48 hours, with mechanical power ranging between 2.66 and 60.9 J/min. The mechanical power ratio (MPR) was calculated as the ratio between the real and the expected mechanical power, the latter computed using physiological values during quiet breathing. After dividing into deciles of MPR and after a visual inspection of the relationship between the MPR and the main variables of interest [Fig.1], the population was divided into two groups (High and Low MPR), based on a threshold of mechanical power ratio (=5.31) between 4th and 5th decile. [Fig.2]

RESULTS: The MPR ranged from 0.71 to 30.2. After the division in two groups, the High MPR group showed significant higher mean arterial pulmonary pressure (16±4 vs 24±9.7 mmHg, $p<0.001$), fluid balance (302±303 vs 2477±2791 ml, $p<0.001$), ventilatory ratio (1±0.3 vs 1.4±0.3, $p<0.001$) and wet-to-dry of the lungs (5.62±0.9 vs 6.62±1, $p<0.001$), either overall and during time. The piecewise regression analysis individuated persistently some breakpoints between the fourth and the fifth deciles for all the examined variables.

CONCLUSION: The normalization of mechanical power can help to quantify the possibility of lung damage during mechanical ventilation. The increase of mechanical power up to four-fold to spontaneous quiet breathing proved to be a good threshold value for the worsening of the analyzed variables.

Fig.1

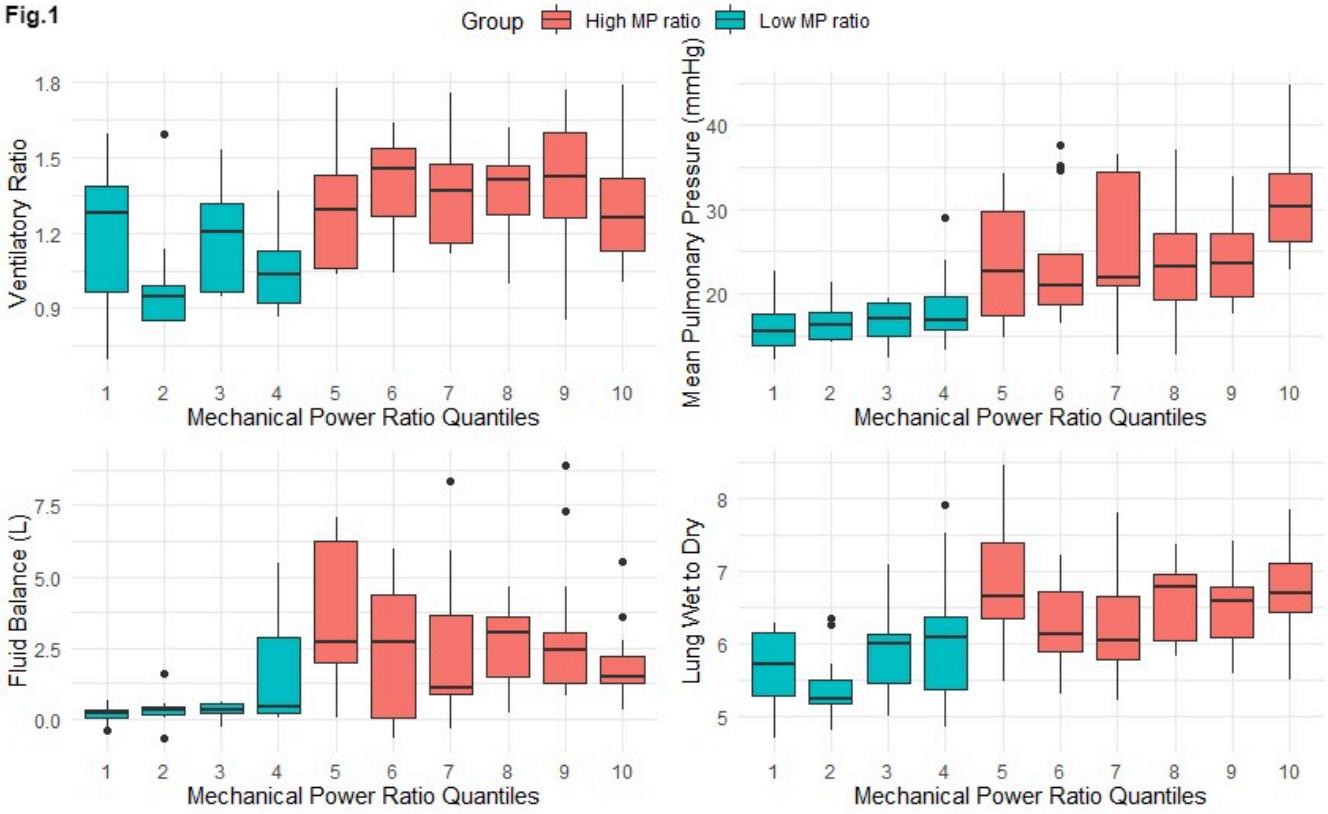
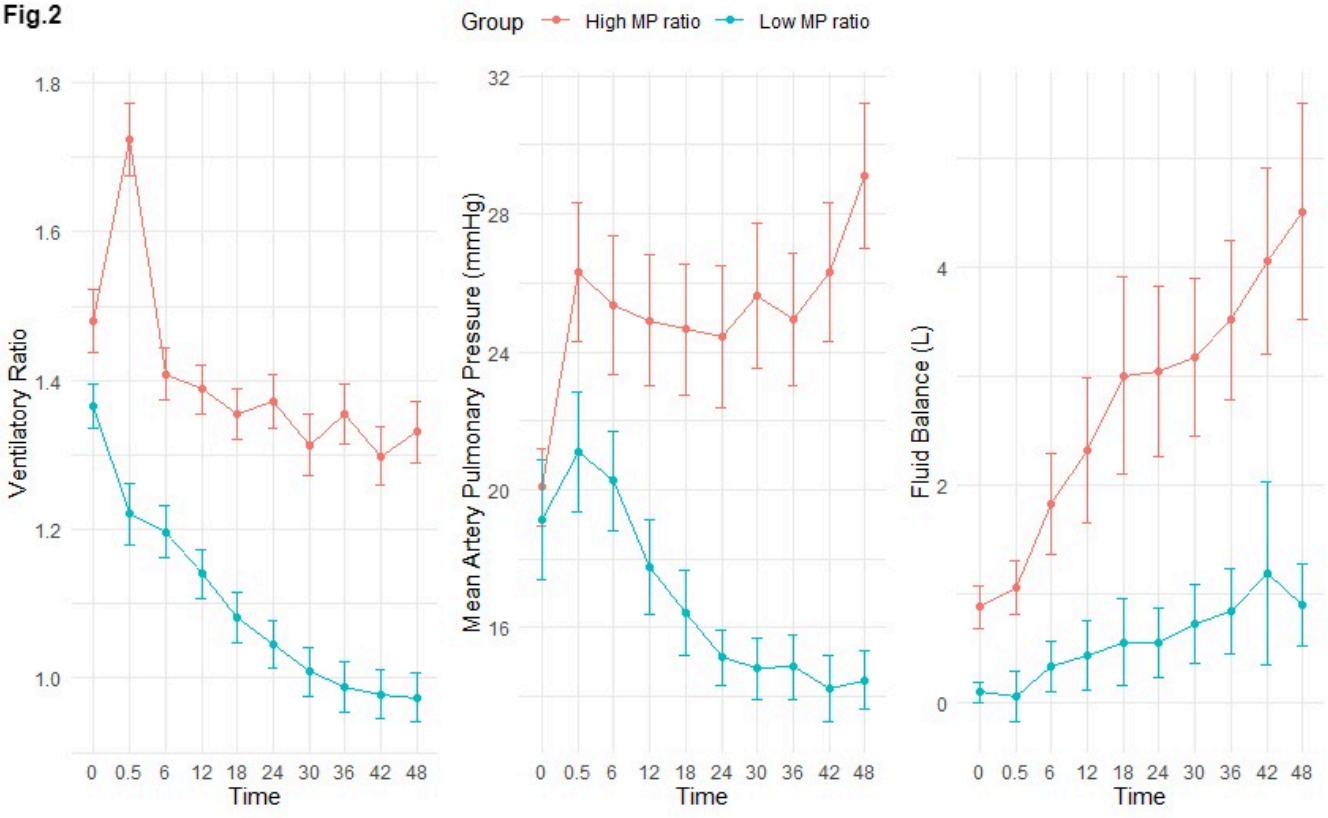

Group
High MP ratio
Low MP ratio
Ventilatory Ratio
Mean Pulmonary Pressure (mmHg)
Fluid Balance (L)
Lung Wet to Dry
Mechanical Power Ratio Quantiles

Fig.2


Group
High MP ratio
Low MP ratio
Ventilatory Ratio
Mean Artery Pulmonary Pressure (mmHg)
Fluid Balance (L)
Time