

Clinical signs of excessive inspiratory efforts in critically ill patients breathing spontaneously: a pooled individual patient data analysis.

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Introduction: Excessive inspiratory efforts can be harmful. Strength of inspiration can be estimated from the swings of esophageal pressure (Δ Pes) which are not routinely measured. We aimed to clarify whether other clinical variables routinely measured in the Intensive Care Unit can help to discriminate between patients with a normal or excessive inspiratory effort.

Methods: This was a pooled analysis of the individual patient data of 7 studies conducted by the authors, where critically ill patients breathing spontaneously were equipped with an esophageal balloon. Inspiratory efforts with a Δ Pes >10 cmH₂O were considered excessive.¹ These other variables were measured with Δ Pes: respiratory rate; heart rate; mean arterial pressure; arterial carbon dioxide tension (PaCO₂); arterial oxygen tension (PaO₂); arterial tension to inspiratory fraction of oxygen (PaO₂:FiO₂); arterial base excess (BEa); arterial lactate; Richmond Agitation Sedation Scale score; and modified Borg dyspnea scale score. Data were analyzed with logistic regression analysis. The outcome was a Δ Pes >10 cmH₂O. Diagnostic accuracy of the final model was assessed using a threshold probability for positive classification of 0.50.

Results: Among 151 patients, 53 had a Δ Pes >10 cmH₂O. At univariate (unadjusted) logistic regression analysis, only respiratory rate, PaCO₂, PaO₂, PaO₂:FiO₂, and BEa were associated with a Δ Pes >10 cmH₂O. When these variables were used to build a multivariable (adjusted) logistic regression model, only PaO₂:FiO₂ and BEa returned significant.

Table. Multivariable logistic regression analysis to predict a Δ Pes >10 cmH₂O.

	Unadjusted odds ratio [95%-CI]	p- value	Adjusted odds ratio [95%-CI]	p- value
Respiratory rate (bpm)	1.072 [1.022-1.124]	.004	1.049 [0.990-1.112]	.103
PaCO ₂ (mmHg)	0.926 [0.879-0.976]	.004	1.022 [0.946-1.105]	.579
PaO ₂ (mmHg)	0.986 [0.976-0.997]	.012	0.992 [0.977-1.007]	.311
PaO ₂ :FiO ₂ (mmHg)	0.994 [0.990-0.998]	.003	0.994 [0.989-1.000]	.036
BEa (mmol/L)	0.890 [0.818-0.968]	.007	0.835 [0.742-0.940]	.003

Sensitivity and specificity of the final model were 55% and 85%. Positive and negative predictive values were 69% and 76%. The overall diagnostic accuracy was 74%.

Conclusions: The probability of an excessive inspiratory effort increases with the severity of lung damage (as reflected by the PaO₂:FiO₂) and metabolic acidosis. Even so, our final model misclassifies approximately one fourth of the patients.

References

¹Goligher EC, Dres M, Patel BK, et al. Lung- and diaphragm-protective ventilation. Am J Respir Crit Care Med. 2020;202:950-961.