





Diaphragmatic excursion and esophageal pressure swing: data from non-intubated COVID-19 patients

<u>I. Steinberg*</u>, E. Chiodaroli°, S. Cappio Borlino°, M. Pitimada°, C. Granata°, M. Busana*, P. Palermo*, S. Gattarello*, S. Lazzari*, F. Romitti*, D. Chiumello°

*Department of Anesthesiology, Intensive Care and Emergency Medicine, Medical University of Göttingen, Göttingen, Germany. *Department of Anesthesia and Intensive Care, San Paolo Hospital, University of Milan, Milan, Italy.

Introduction

Evaluation of patients' effort while spontaneously breathing is one of the challenges of the current COVID-19 pandemic. Pleural pressure swing measured by esophageal balloon quantifies pressure change that the patient has to generate to achieve a given tidal volume, but the procedure requires invasive positioning of an esophageal balloon. We reasoned that diaphragmatic excursion could surrogate the esophageal pressure swing. Consequently, we designed a prospective study to determine the relationship between the two variables.

Methods

Sixteen patients admitted for respiratory failure due to COVID-19 pneumonia requiring noninvasive ventilation were prospectively enrolled. At admission esophageal balloon was positioned, subsequently, esophageal pressure swing and diaphragmatic excursion were measured at both ZEEP and clinical PEEP. Linear regression was performed to model the relationship between continuous variables, p<0.05 was considered statistically significant.

Results

Computing the product of diaphragmatic excursion and respiratory rate and esophageal pressure swing and respiratory rate at ZEEP, a direct relationship between the two variables was found (Panel A, p=0.016). A reduced ratio between diaphragmatic excursion and esophageal pressure swing was associated with a higher respiratory rate (Panel B, p=0.04). Moreover, the change in diaphragmatic excursion from PEEP to ZEEP and the change in esophageal pressure swing were significantly related (p=0.004). Interestingly, diaphragmatic excursion increased with the increase of Body Mass Index (p=0.030).



Discussion

These results suggest a direct relationship between the effort estimated by diaphragmatic excursion and by esophageal pressure swing. The higher the ratio between diaphragmatic excursion and esophageal pressure swing, and hence the efficiency of the system, the lower was the patients' respiratory rate. Therefore, ultrasound measured diaphragmatic excursion resulted to be a valid non-invasive method of effort evaluation in non-intubated patients.