

Acute effects of Positive End Expiratory Pressure on diaphragm activity in adult patients affected by Acute Respiratory Distress Syndrome

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Argomento: Insufficienza respiratoria acuta e ventilazione meccanica

Introduction: Ventilator Induced Diaphragm Dysfunction (VIDD) consists in decreased capacity to produce force and to resist fatigue by the diaphragm; this is associated to reduced diaphragm mass. In animal models, the Positive End Expiratory Pressure (PEEP) is considered a worsening factor for diaphragmatic dysfunction. Purpose of the present work is evaluating, in adult patients with Acute Respiratory Distress Syndrome (ARDS), the acute effects of increasing levels of PEEP on diaphragmatic activity, using ultrasound.

Materials and methods: 15 patients were evaluated, with ARDS diagnosis according to the Berlin criteria. By convex probe from a liver window, we proceeded to measure the diaphragm excursion and, by linear probe, the diaphragm inspiratory thickening in the zone of apposition at the right hemithorax (anterior axillary line, seventh-ninth intercostal space) during pressure support ventilation (8-10 cmH₂O) at increasing PEEP: 0, 5, 10, 14 cmH₂O, maintained for 20 minutes.

Results: For PEEP value greater than 5 cmH₂O a statistically meaningful reduction of the diaphragmatic excursion was found. The diaphragm thickening fraction (end inspiratory diameter- end expiratory diameter / end expiratory diameter %) progressively decreases with increasing values of PEEP (PEEP 0: 16.5% average value, PEEP 5: 14.6%, PEEP 10: 10.3%, PEEP 14: 8.7%). Such a reduction is mainly due to an increase of the end expiratory thickness, with increasing levels of PEEP.

Conclusions: Ultrasound is a suitable and adequate method to study the mechanical activity of the diaphragm. Increasing levels of PEEP lead to a reduction in inspiratory diaphragm thickening. This reduction depends mainly on the increase in the end expiration thickness rather than a reduction of the end inspiration thickness. Increasing levels of PEEP lead not only to a reduction in thickening, but also to a reduction of diaphragmatic excursion. Further studies are needed to verify whether such alteration may contribute to the development of VIDD.