

LETTER

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vvECMO can be avoided by a transpulmonary pressure guided open lung concept in patients with severe ARDS

Philip van der Zee* , Dinis Dos Reis Miranda, Han Meeder, Henrik Endeman and Diederik Gommers

Dear Editor,

The EOLIA trial concluded that vvECMO compared to conventional mechanical ventilation with low tidal volumes and airway pressures ≤ 30 cmH₂O did not improve survival [1]. Although not statistically significant, the 11% absolute reduction in mortality rate and multiple crossovers to rescue vvECMO were considered to be clinically relevant [2]. However, a conventional mechanical ventilation strategy is likely to be insufficient for patients with severe ARDS, as higher airway pressures are required to maintain lung aeration [3]. Grasso et al. measured the transpulmonary pressure (P_L) in patients with severe ARDS and increased PEEP until P_L was 25 cmH₂O. Fifty percent of patients responded to an increase in airway pressure and did not require vvECMO [4]. We hypothesized that a P_L guided open lung concept (OLC) could improve oxygenation and prevent conversion to vvECMO in patients with severe ARDS.

We retrospectively reviewed the records of all patients referred to our ICU between January and May 2018. Eight patients had severe ARDS and had an indication for vvECMO according to the EOLIA trial (demographics are given in the Additional file 1) [1]. Before referral protective mechanical ventilation with low tidal volume

and a plateau pressure of approximately 30 cmH₂O was applied. PaO₂/FiO₂ ratio was 62 ± 7 mmHg despite the use of neuromuscular blocking agents and prone positioning. After referral, a recruitment maneuver was performed and PEEP was increased. P_L was estimated with an esophageal balloon catheter and we aimed for a $P_L \leq 25$ cmH₂O. In addition, respiratory rate and I:E ratio were increased, thereby generating intrinsic PEEP.

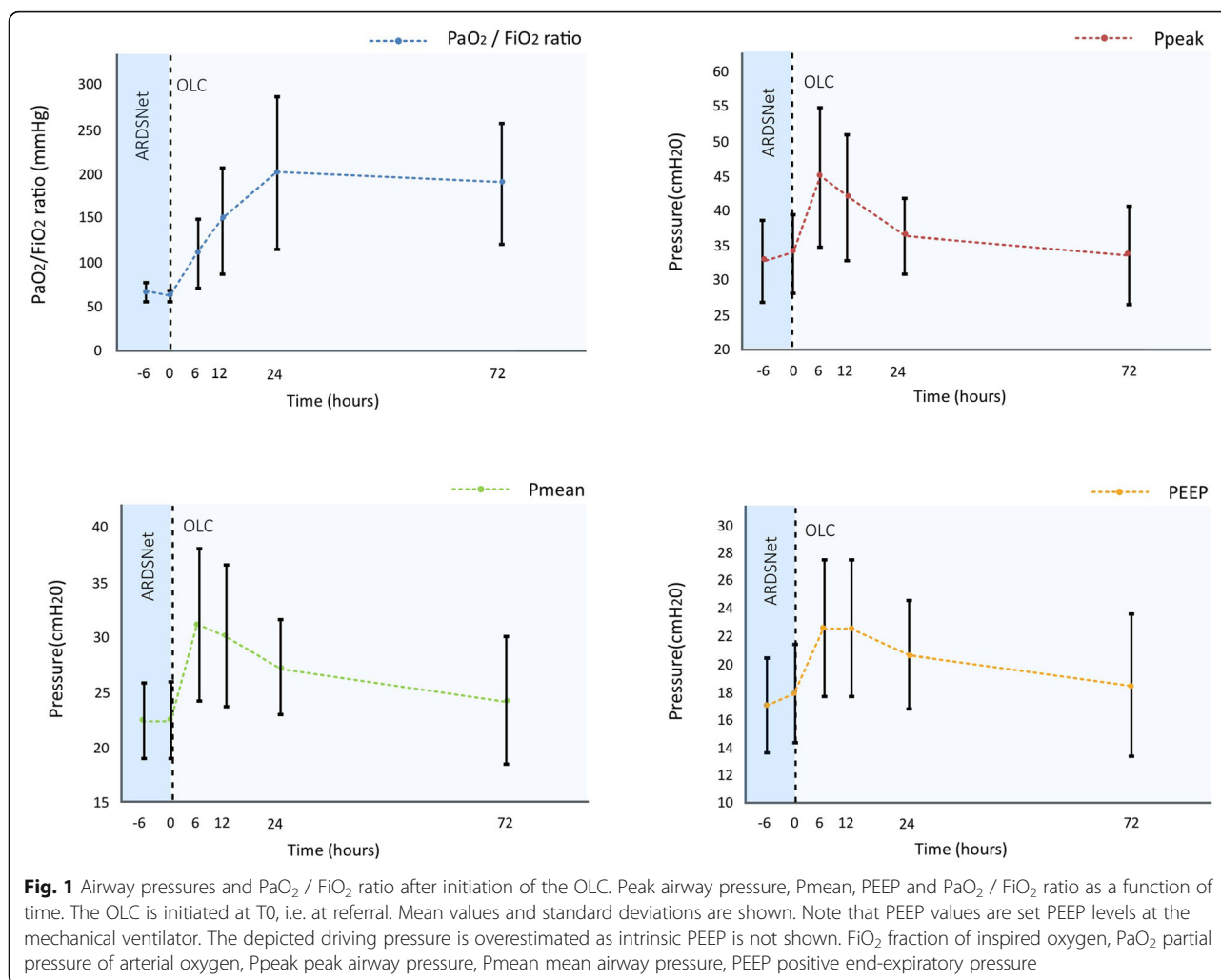
The P_L guided OLC resulted in an increase in PaO₂/FiO₂ ratio to 201 ± 87 mmHg (Fig. 1) and none of the patients required vvECMO. During the first 6 h peak airway pressure was increased to 44.9 ± 10.2 cmH₂O, but was reduced to 36.3 ± 5.6 cmH₂O within 24 h, while PEEP was maintained at 20.6 ± 4.0 cmH₂O. A maximum end-inspiratory P_L of 18 ± 5 cmH₂O was measured. At 72 h both peak airway pressures and PEEP were reduced to baseline values while oxygenation remained stable.

These data suggest that the OLC improves oxygenation and avoids conversion to vvECMO in patients with severe ARDS. We acknowledge that a recruitment maneuver and higher PEEP in patients with moderate to severe ARDS increased mortality in the Alveolar Recruitment Trial [5]. However, the recruitment maneuver was standardized and

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'recruitability' was not assessed. We hypothesize that a recruitment maneuver and higher PEEP is beneficial in patients with large regions of decreased lung aeration. Thus, future research should focus on individual 'recruitability' [6]. Baedorf Kassis et al. introduced a recruitment maneuver based on P_L measurements [7]. Other potential predictors are a decrease in driving pressure, oxygenation response to PEEP-trials, or lung aeration estimated by electrical impedance tomography or ultrasound.

Additional file

Additional file 1: Figure S1. Flowchart of patient inclusion. **Table S1.** Patient demographics. **Table S2.** Patient parameters. Appendix Mechanical ventilation strategy. (DOCX 38 kb)

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Availability of data and materials

The dataset used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

PZ drafted the manuscript, DM, JM, HE, and DG substantially revised the manuscript. All authors approved the submitted version.

Ethics approval and consent to participate

This retrospective study was approved by the medical ethics committee of the Erasmus MC (MEC-2018-1300). According to Dutch law no informed consent was required with anonymous retrospective data.

Consent for publication

Not applicable.

Competing interests

Dinis Dos Reis Miranda received speakers fee and travel expenses from Xenios and Hill-Rom. Diederik Gommers received speakers fee and travel expenses from Dräger, GE Healthcare (medical advisory board 2009–2012), Maquet, and Novalung (medical advisory board). Philip van der Zee, Han Meeder, and Henrik Endeman report no competing interests.

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