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RESEARCH NEWS

Lung recruitment and titrated PEEP in moderate to severe ARDS

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Article

Effect of lung recruitment and titrated PEEP vs. low PEEP on mortality in patients with ARDS. Published in JAMA, in October 2017.[1]

Why was this research done?

ARDS causes collapse, flooding and consolidations in large parts of the lung. This increases the risk of ventilator-induced lung injury due to over-distention of aerated lung and cyclic opening and closing of collapsed alveoli (atelectrauma).

To reduce ventilator-induced lung injury, the open lung concept has been advocated and is accepted practice in many ICUs. Recruiting collapsed lung regions using recruitment manoeuvers (RM) and applying PEEP to keep these regions open reduces atelectrauma and more evenly distributes the tidal volume, thus limiting over-distention of the aerated lung. The level of PEEP needed and how to determine this for the individual patient is, however, unknown.

Three large RCTs applying high PEEP and RM in patients with ARDS (P/F ratio <300) did not show an effect on mortality.[2-4] However, a meta-analysis of these trials suggested a reduction in mortality in patients with a P/F ratio <200.[5]

This RCT was conducted to study the effect of RM and titrated PEEP on mortality in moderate to severe ARDS (P/F ratio < 200).

What was the research question?

Does a strategy of lung recruitment and titrated PEEP vs. no recruitment and low PEEP reduce 28-day mortality in patients with moderate to severe ARDS?

How was this investigated?

The authors performed a multicentre randomised controlled trial in 120 ICUs from 9 countries. Patients were included over a 6-year period.

A total of 1013 patients with moderate to severe ARDS were randomised after exclusion of 1064 patients. The main reasons for exclusion were P/F ratio >200 after standard ventilation (296 patients), increasing dose of vasoconstrictor or mean arterial pressure <65 (273 patients), pneumothorax or pneumomediastinum (139 patients) and contraindications to hypercapnia (129 patients). The remaining patients were randomised to receive lung recruitment and PEEP titrated according to the best lung compliance (501 patients) or low PEEP without recruitment (512 patients).

In the RM and titrated PEEP group patients received neuromuscular blocking agents and fluid loading in preparation for the RM. RM consisted of incremental PEEP up to 45 cm H2O followed by decremental PEEP titration to best lung compliance. PEEP was set at this level + 2 cm H_2O. In the low-PEEP group PEEP was set according to the ARDSnet table. In both groups, patients were ventilated with 6 ml/kg (or less) tidal volumes and plateau pressures were kept under 30 cm H_2O.

The primary endpoint was 28-day all-cause mortality. Secondary endpoints were length of ICU and hospital stay, ventilator-free days, pneumothorax requiring drainage or barotrauma within 7 days, and ICU, in hospital and 6-month mortality.

Main findings

Compared with the control group, RM and titrated PEEP increased 28-day all-cause mortality (55.3% vs 49.3%; hazard ratio [HR] 1.20; 95% CI 1.01 to 1.42; p=0.041). In addition, 6-month mortality was increased (65.3% vs 59.9%; HR 1.18; 95% CI 1.01 to 1.38; p=0.04) and ventilator-free days were decreased (5.3 vs 6.4; 95% CI -2.1 to -0.3; p=0.03). The RM and titrated PEEP group showed an increased risk of pneumothorax (3.2% vs 1.2%; 95% CI 0.0% to 4.0%; p=0.03) and barotrauma (5.6% vs 1.6%; 95% CI 1.1% to 6.5%; p=0.01).

PEEP in the intervention group was 3-4 cm H_2O higher over the first 7 days. The mean P/F ratios were higher in the RM and titrated PEEP group; however, the decrease in driving pressure in this group was less than 2cm H_2O compared with the control group.

Discussion, conclusion and consequences for daily practice

This large multicentre RCT studied two interventions (RM and high PEEP) to 'open up the lung and keep it open' and compared this with a strategy of low PEEP, set according to the ARDSnet table. It shows that RM and titrated PEEP increases mortality in patients with moderate to severe ARDS. It has previously been shown that high PEEP does not influence mortality in a study group consisting of mild, moderate and severe ARDS;[2-4] however, no or milder recruitment manoeuvers were used in those studies. In this study, there was a relatively small difference in the PEEP levels between the experimental and control group (3-4 cm H_2O); in addition, the driving pressure was only 2 cm H_2O lower in the experimental group. This suggests only minimal recruitment after the RM. It is conceivable that individual patients with recruitable lungs might have benefited from an RM; however, this analysis was not performed. In addition, a major variable between the two groups was the fluid loading in preparation for an RM. Excessive administration of fluids could have increased detrimental outcome in the experimental group; however, the exact amount of fluids or fluid balances was not reported.

In conclusion, this study emphasises the risk of RM and questions the routine use of titrated PEEP in patients with moderate to severe ARDS.

Disclosures

The author declares no conflict of interest. No funding or financial support was received.

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