

Lung recruitment manoeuvre and PEEP decreases shunting and improves oxygenation, lung compliance and end expiratory lung volume in mechanically ventilated children with normal lungs.

Scohy Thierry, Bickers Ido, Hofland Jan, Jong de Peter, Bogers Ad, Gommers Diederik. ErasmusMC, Thorax Anesthesia, Rotterdam, The Netherlands.

t.scohy@erasmusmc.nl

Objective

Optimizing alveolar recruitment by lung recruitment manoeuvres (RCM) and maintaining lung volume with adequate positive end-expiratory pressure (PEEP) allows preventing ventilator induced lung injury (VILI) [1]. Knowing that PEEP has its most beneficial effects when lung compliance is maximized[2], we hypothesize that the use of 8 cm H₂O PEEP with RCM [3] results in an increase of lung compliance and end expiratory lung volume (EELV) compared to 8 cm H₂O PEEP without RCM and to zero PEEP in mechanically ventilated paediatric patients with normal lungs.

Methods

After approval by the local Ethics Committee and obtaining parental informed consent, 20 consecutive children (table 1) scheduled for cardiac surgery for congenital heart disease were studied post-operatively. 3 different ventilation strategies were applied to each patient in the following order: 0 cm H₂O PEEP, 8 cm H₂O PEEP without a RCM and 8 cm H₂O PEEP with a standardized RCM. At the end of each ventilation strategy, dynamic lung compliance, EELV and arterial blood gases were measured.

Results

EELV, dynamic compliance (figure 1) and PaO₂ / FiO₂ ratio changed significantly ($p < 0.001$) with application of 8 cm H₂O +RCM. Mean PaCO₂-EtCO₂ difference between 0 PEEP and 8 cm H₂O PEEP + RCM was also significant ($p < 0.05$).

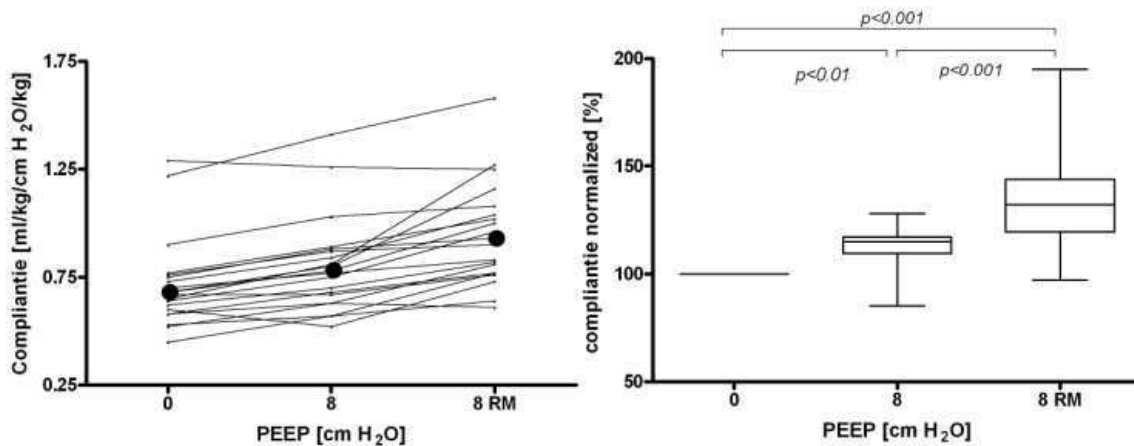
Conclusion

Our study provides strong evidence to conclude that RCM + PEEP of 8 cm H₂O significantly decreases shunting and improves dynamic lung compliance, oxygenation and EELV, hereby decreasing alveolar stress and preventing VILI in children with normal lungs under general anesthesia.

Table 1: Patient demographics

N	20
Gender, female/male	6/14
Age, months (median +range)	34 (3 - 132)
Weight (kg)	10.1 (7.4)
Length (m)	0.85 (0.34)

Figure 1: lung compliance versus PEEP



References

1. Pinhu L, Whitehead T, Evans T, Griffiths M: Ventilator-associated lung injury. Lancet 2003, 361: 332-340.
2. Ward NS, Lin DY, Nelson DL, Houtchens J, Schwartz WA, Klinger JR et al.: Successful determination of lower inflection point and maximal compliance in a population of patients with acute respiratory distress syndrome. Crit Care Med 2002, 30: 963-968.
3. Rimensberger PC, Cox PN, Frndova H, Bryan AC: The open lung during small tidal volume ventilation: concepts of recruitment and "optimal" positive end-expiratory pressure. Crit Care Med 1999, 27: 1946-1952