Volume-targeted versus pressure-limited ventilation in the neonate

23 September 2013

RHL summary

In some preterm babies, ventilator-assisted breathing can be lifesaving, but such an intervention can also damage the baby’s immature lungs. New ‘volume targeted’ modes of ventilation have aim to reduce lung injury by controlling the amount of air entering the lungs with each breath. This review compares outcome in infants treated with volume-targeted ventilation with those ventilated using traditional ‘pressure limited’ modes. Infants on volume-targeted ventilation were more likely to survive and remain free from lung damage. Moreover, ventilator assistance was applied for a shorter duration and fewer infants developed pneumothorax. The review calls for further research to understand whether volume targeted modes also lead to improvements in the development of movement and intellect.

Cochrane review


Abstract

Damage caused by lung overdistension (volutrauma) has been implicated in the development bronchopulmonary dysplasia (BPD). Modern neonatal ventilation modes can target a set tidal volume as an alternative to traditional pressure-limited ventilation using a fixed inflation pressure. Volume targeting aims to produce a more stable tidal volume in order to reduce lung damage and stabilise pCO2.

To determine whether volume-targeted ventilation (VTV) compared with pressure-limited ventilation (PLV) leads to reduced rates of death and BPD in newborn infants. Secondary objectives were to determine whether use of VTV affected outcomes including air leak, cranial ultrasound findings and neurodevelopment.

The search strategy comprised searches of the Cochrane Central Register of Controlled Trials, MEDLINE PubMed 1966 to January 2010, and hand searches of reference lists of relevant articles and conference proceedings.

All randomised and quasi-randomised trials comparing the use of volume-targeted versus pressure-limited ventilation in infants of less than 28 days corrected age.

Two review authors assessed the methodological quality of eligible trials and extracted data independently.
When appropriate, meta-analysis was conducted to provide a pooled estimate of effect. For categorical data the relative risk (RR) and risk difference (RD) were calculated with 95% confidence intervals. Number needed to treat was calculated when RD was statistically significant. Continuous data were analysed using weighted mean difference.

Twelve randomised trials met our inclusion criteria; nine parallel trials (629 infants) and three crossover trials (64 infants).

The use of VTV modes resulted in a reduction in the combined outcome of death or bronchopulmonary dysplasia [typical RR 0.73 (95% CI 0.57 to 0.93), NNT8 (95% CI 5 to 33)]. VTV modes also resulted in reductions in pneumothorax [typical RR 0.46 (95% CI 0.25 to 0.84), NNT 17 (95% CI 10 to 100)], days of ventilation [MD -2.36 (95% CI -3.9 to -0.8)], hypocarbia [typical RR 0.56 (95% CI 0.33 to 0.96), NNT 4 (95% CI 2 to 25)] and the combined outcome of periventricular leukomalacia or grade 3-4 intraventricular haemorrhage [typical RR 0.48 (95% CI 0.28 to 0.84), NNT 11 (95% CI 7 to 50)].

Infants ventilated using VTV modes had reduced death and chronic lung disease compared with infants ventilated using PLV modes. Further studies are needed to identify whether VTV modes improve neurodevelopmental outcomes and to compare and refine VTV strategies.

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