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[Intervention Review]

Elective high frequency oscillatory ventilation versus conventional ventilation for acute pulmonary dysfunction in preterm infants

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ABSTRACT

Background

Respiratory failure due to lung immaturity is a major cause of mortality in preterm infants. Although intermittent positive pressure ventilation (IPPV) saves lives, lung distortion during its use is associated with lung injury and chronic lung disease (CLD). Conventional IPPV is provided at 30-80 breaths per minute while a newer form of ventilation called high frequency oscillatory ventilation (HFOV) provides 'breaths' at 10-15 cycles per second. This has been shown to result in less lung injury in experimental studies.

Objectives

The objective of this review is to determine whether the elective use of high frequency oscillatory ventilation as compared to conventional ventilation (CV) in preterm infants who are mechanically ventilated for the respiratory distress syndrome decreases the incidence of chronic lung disease, without adverse effects.

Search methods

Searches were made of the Oxford Database of Perinatal Trials, MEDLINE, EMBASE, previous reviews including cross references, abstracts, conferences and symposia proceedings, expert informants, journal hand searching by the Cochrane Collaboration, mainly in the English language. The search was updated in May 2003.

Selection criteria

Randomized controlled trials comparing HFOV and CV in preterm or low birth weight infants with pulmonary dysfunction, mainly due to RDS, who are to be given IPPV. Randomization and commencement of treatment should have been as soon as possible after the start of IPPV and usually in the first 12 hours of life.

Data collection and analysis

The methodological quality of each trial was independently reviewed by the various authors. Each author extracted data separately; they were compared and differences were resolved. Treatment effects were expressed using relative risk (RR) and risk difference (RD). From 1/RD the number needed to treat (NNT) to produce one outcome were calculated. Ninety five percent confidence intervals were used for all measures of effect.

Main results

Eleven eligible studies on 3,275 infants were included. Meta-analysis comparing HFOV with CV revealed no evidence of effect on mortality at 28-30 days of age or at approximately term equivalent age. These results were consistent across studies. The effect of HFOV on CLD in survivors at term equivalent GA was inconsistent across studies and not significant overall. Pre-specified subgroup analyses according to use of a high volume strategy, or use of surfactant, did not identify subgroups in which there was evidence of effect on death, or in which the size of effect on CLD was substantially increased, or in which heterogeneity of treatment effect on CLD was removed.

Short term neurological morbidity caused by HFOV was found in some studies, but this effect was not statistically significant overall. The subgroup of two trials not using a high volume strategy with HFOV found increased rates of Grade 3 or 4 IVH and of periventricular leukomalacia. An adverse effect of HFOV on longer term neurodevelopment was found in one large trial but not in two other small trials which reported this outcome.

Authors' conclusions

There is no clear evidence from this systematic review that elective HFOV, as compared with CV, offers important advantages when used as the initial ventilation strategy to treat preterm babies with acute pulmonary dysfunction. There is no evidence of a reduction in death rate. There may be a small reduction in the rate of CLD with HFOV use but the evidence is weakened by the inconsistency of this effect across trials and is not significant overall. Adverse effects on short term neurological outcomes have been observed in some studies but these effects are not significant overall. Information about effects on long term outcome is not adequate overall.

Any future trials on elective HFOV should target those infants who are at most risk of CLD (extremely preterm), compare different strategies for generating HFOV and CV, and report important long term pulmonary and neurodevelopmental outcomes. Economic analysis should also be incorporated.

PLAIN LANGUAGE SUMMARY

Insufficient evidence to support the routine use of high frequency oscillatory ventilation instead of conventional ventilation for preterm infants with lung disease who are given positive pressure ventilation.

High frequency oscillatory ventilation is a newer way of providing artificial ventilation of the lungs. Theoretically this may produce less injury to the lungs and therefore lower the rate of chronic lung disease. This review of the evidence from eleven randomised controlled trials showed variable results between studies and no overall clear benefit or harms resulting from high frequency oscillatory ventilation.