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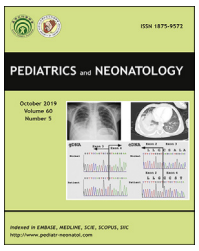

Images

Partial liquid ventilation for bronchopulmonary dysplasia: Visualizing ventilation patterns on chest radiographs

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Despite the advances in neonatal intensive care, bronchopulmonary dysplasia (BPD) still remains a major cause of mortality and morbidity in many preterm infants. A definitive treatment still does not exist, and BPD has serious consequences, including poor cardiopulmonary function and development. Hence, to address this need, a randomized clinical trial (NCT03041740) is currently underway to assess the safety and feasibility of partial liquid ventilation (PLV) in preterm infants with severe BPD.

PLV, which was first reported in neonates in 1989, involves endotracheal administration of an inert volatile perfluorochemical liquid (perfluorooctyl bromide, PFOB) with gas ventilation administered through the liquid.[1] PLV facilitates gas exchange due to the large oxygen- and carbon dioxide-carrying capacity of PFOB.[1] It has been suggested that PLV enhances oxygenation, reduces surface tension, decreases inflammation, recruits more alveoli, improves lung compliance, and clears secretions.[1] Nevertheless, despite early favorable trials in neonates, the development of PLV stopped abruptly due to negative results in adult acute respiratory distress syndrome.[1–3]

As a part of this recent study revisiting PLV, we present its use for treating severe BPD in an ex-preterm (26 weeks gestational age) 4-month-old male infant. A pre-PLV chest radiograph revealed chronic lung disease of prematurity as well as atelectasis of the right upper lobe (Fig. 1A). This patient was enrolled in the trial and received a total of approximately 180 mL of PFOB instilled via the endotracheal tube administered as three separate doses over 1 day with a maximum dose of 20 mL/kg (weight 4.5 kg). Due to the presence of bromine atom in PFOB, PLV can be evaluated radiographically — a unique feature that can illustrate ventilation patterns and guide dosing of liquid ventilation. A chest radiograph of PLV (Fig. 1B) taken immediately after the maximal dosing showed PFOB entering and re-expanding the atelectatic right upper lobe. After initially tolerating PLV, the patient had transient respiratory decompensation at maximal fill, but then showed subsequent improvement and tolerated the remainder of PLV with improvement in mechanical ventilation parameters. Subsequent patients benefitted from lower initial doses of PFOB. These findings suggest that chest radiographs are helpful in these patients to ascertain the distribution of the liquid to infer ventilation patterns.

Study of this new application of PLV in patients with severe BPD is being continued with careful assessment of

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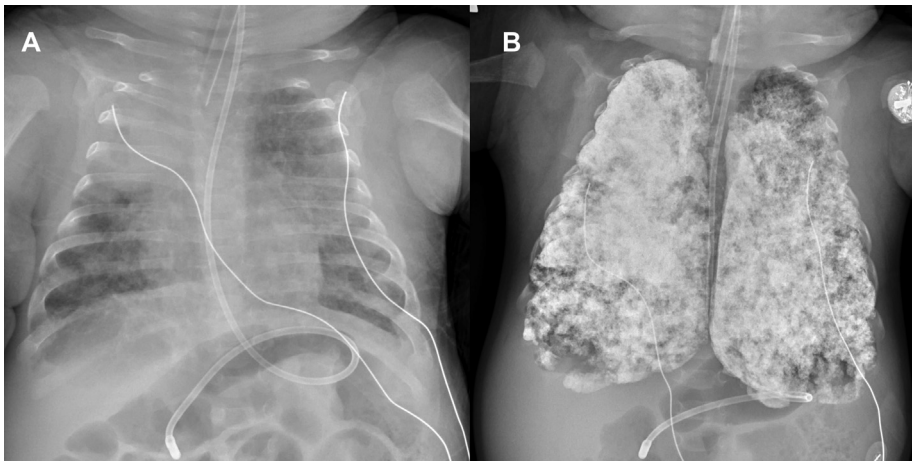

Figure 1 Recruitment of atelectatic lung with partial liquid ventilation in bronchopulmonary dysplasia. Initial chest X-ray (A) shows chronic lung disease and right upper lobe atelectasis. Following PLV (B), radiopaque PFOB is observed throughout the lungs with recruitment of the re-expanded right upper lobe.

safety in this population, along with the use of lower doses of PFOB. In the future, it is expected that PLV could potentially hold promise to mitigate the progression of abnormal lung development in preterm infants; however, larger trials are needed to assess the effectiveness of PLV in this novel application.

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Conflict of interest statement

The authors have no conflicts of interest to declare. Funders had no role in: (1) study design; (2) the collection, analysis, and interpretation of data; (3) the writing of the report; and (4) the decision to submit the paper for publication.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pedneo.2018.10.004.