Unconventional management approach to a life-threatening neonatal respiratory condition

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A steroid-exposed 1100g infant of 27+3 weeks’ gestation was born by emergency caesarean section for maternal COVID-19 pneumonitis. He required ventilation and surfactant administration at birth but continued needing ventilatory support despite a further dose of surfactant and an unsuccessful trial on continuous positive airway pressure (CPAP). It became increasingly difficult to oxygenate and ventilate him adequately, and with progressively worsening chest X-ray changes (figure 1), he warranted transfer to the nearest neonatal intensive care unit (NICU) as per national guidelines.1 2

**QUESTIONS**

1. What are the most striking features on this X-ray?
   A. Hyperinflation of the right lung, honeycomb appearance of the lung field, mediastinal shift to the left.
   B. Right-sided tension pneumothorax with mediastinal shift to the left.
   C. Bilateral ground-glass changes, worse on the right, with mediastinal shift to the left.
   D. Collapse of the left lung causing mediastinal shift to the left.

2. What is the most likely diagnosis?
   A. Congenital diaphragmatic hernia.
   B. Chronic lung disease (CLD).
   C. Asymmetrical pulmonary interstitial emphysema (PIE) secondary to respiratory distress syndrome (RDS).
   D. Atelectasis of the left lung.

3. Which two factors are most likely to have contributed to the aforementioned asymmetrical lung disease?
   A. Infection.
   B. Unilateral surfactant administration.
   C. Malposition of the endotracheal tube (ETT).
   D. Congenital abnormality of the lungs.
   E. Pulmonary/air embolism.

4. What management options are available when treating such significant asymmetrical disease?
   A. Steroids.
   B. Antibiotics.
   C. Unilateral lung ventilation.
   D. High-frequency oscillation ventilation.
   E. Minimal-pressure conventional ventilation.
   F. Chest drain insertion.
   G. Surfactant administration.
   H. Diuretics.

*Answers can be found on page 260.*

![Figure 1](Chest X-ray taken on day 10 of life.)
ANSWERS TO THE QUESTIONS ON PAGE 259

1. A – Hyperinflation of the right lung, honeycomb appearance of the lung field, mediastinal shift to the left.

2. C – Asymmetrical PIE secondary to RDS.
   - PIE is air leak into the pulmonary interstitium from overdistention of distal airways, particularly in infants with RDS on positive pressure ventilation. Air trapping causes hyperexpansion of the affected lung and atelectasis of the healthy lung, impairing gas exchange. Thus, higher pressure ventilation is required, compounding the problem. Interstitial air can radiate further, causing pneumothoraces or pneumomediastinum. Asymmetrical PIE can cause life-threatening respiratory distress.

3. B+C – Unilateral surfactant administration and malposition of the ETT.
   - While all these factors can cause asymmetrical lung disease, B and C are most likely. Surfactant delivered through a long ETT preferentially goes into the right lung due to the vertical orientation of the right main bronchus, leading to a mismatch in lung compliance. The ‘stiffer’ lung requires higher pressure for effective ventilation, worsening barotrauma and volutrauma to the more compliant lung, and subsequent potential for asymmetrical disease.

4. A+C+D+E.
   - Oxygenation and ventilation became increasingly difficult despite conservative management strategies: lateral decubitus positioning to decompress the overdistended lung, inhaled nitric oxide, dexamethasone and low mean airway pressure (MAP) ventilation.
   - There is no well-established approach to the management of such severe disease, other than anecdotal experience of single-lung ventilation. However, this has the potentially life-threatening risk of creating air leak in the ‘good’ lung. Despite this, we cautiously proceeded and, following successful selective intubation (figure 2), ventilated the left lung for 48 hours until radiological evidence of full expansion of the left lung and total collapse of the right lung. Unfortunately, the right lung significantly re-expanded within 24 hours of pulling the ETT back into the trachea. We repeated the procedure and ventilated the left lung with low MAP high-frequency oscillation for 9 days before successfully pulling the ETT back into the trachea for bilateral ventilation, extubating 3 days later to high-flow nasal oxygen therapy. The baby was discharged home breathing unaided in air at 3 months of age.

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Acknowledgements We thank Dr Hattingh (consultant radiologist, Bradford Royal Infirmary) for providing the high-quality X-ray images for this publication.
Contributors All authors were involved in patient care. All authors were involved in manuscript design and serial drafts, and all approved the final copy.
Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.
Competing interests None declared.
Patient consent for publication Consent obtained from parent(s)/guardian(s).
Ethics approval Not applicable.
Provenance and peer review Not commissioned; internally peer reviewed.
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Received 1 September 2022
Accepted 10 February 2023
Published Online First 2 March 2023

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Figure 2 Chest X-ray showing left main bronchus intubation, re-expansion of the left lung and subsequent collapse of the right lung.


