PATIENT CASE REPORT. CATEGORY: PEDIATRIC
SEVERE PNEUMOCOCCAL PNEUMONIA, ARDS AND MULTIPLE ORGAN FAILURE SUCCESSFULLY TREATED WITH NAVA.

Clinical background and situation:
A 3-year-old female was admitted into PICU for respiratory distress secondary to lobar pneumonia (figure 1). Four days prior to admission, she developed fever and respiratory difficulties. On admission she had a high fever and respiratory distress and showed poor saturation during treatment with 100% oxygen on facemask first and later on non-invasive ventilation. She subsequently required endotracheal intubation and mechanical ventilation secondary to respiratory failure.

Interventions and course of ventilation therapy:
The patient required high ventilatory settings with a fractional concentration of inspired oxygen (FiO₂) of 1.0, tidal volume (VT) up to 15 ml/kg, positive end expiratory pressure (PEEP) of 12 cm H₂O, and ventilator rate of 25 breaths per minute. There was no improvement of her PaO₂ as nitric oxide was initiated and titrated up to a concentration of 40 ppm. An arterial blood gas revealed a pH of 7.14, PaCO₂ of 107 mmHg, PaO₂ of 86 mmHg, and base excess (BE) of 3. To improve the oxygenation and to reduce hypercapnia, the patient was put on high frequency ventilation with VDR IV with a peak inspiratory pressure (PIP) of 51 cm H₂O. The mean airway pressure (MAP) was 26 cm H₂O and PEEP of 16 cm H₂O and high frequency oscillating between 600 and 900 cycles/minute. Her chest X-ray revealed bilateral streaky interstitial infiltrates, which progressed to bilateral, diffuse alveolar and interstitial infiltrates. On day 6 after admission she developed a bilateral pneumothorax which was properly evacuated by thorax drains (figure 2).

During the following week, she gradually worsened and developed a sepsis and multiorgan failure which required different antibiotics as well as circulatory support.

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support by using inotropes and vasopressors. She also remained NO and mechanical ventilation dependent and we were unable to reduce her ventilatory conditions, and had a lung injury score of 3 at that time indicating a severe lung injury. On day 14, she developed another pneumothorax which was promptly drained.

The CT scan of the thorax performed on day 15 showed bilateral bullar emphysema, plurifocal parenchymal condensation and necrosis as well as the presence of pneumothorax left (figure 3).

We were unable to reduce the FiO$_2$ as well as the PIP because of the persistent hypoxemia; moreover we were unable to sedate the patient despite the use of different drugs such as cisatracurium, rocuronium, catapressan, haloperidol, fentanyl, sufentanil, midazolam, propofol, remifentanil.

On day 17, the patient remained hypoxemic and agitated despite the use of several sedative drugs and high level pressure control ventilator parameters (FiO$_2$ of 0.95; PIP: 44 and PEEP: oscillating between 9 and 12 cm H$_2$O). Desperate as we were at that time, and unable to improve the oxygenation despite high pressure ventilator conditions and association with different drugs; the NAVA Edi catheter was placed and adequately positioned and confirmed by means of ECG.

When switching to NAVA, the conditions initially were high NAVA level (5.3) and high FiO$_2$ of 90%. Gradually we were able to reduce the FiO$_2$ to 60% and to reduce the NAVA level down to 2.1. Surprisingly, the TV substantially dropped, but the respiratory rate increased up to 50 breaths /min (figure 4).
Weaning process and results:
During the subsequent 2 days, she was ventilated alternatively on NAVA, Pressure Support and Pressure Control mode. Thereafter, she was solely on NAVA for another 5 days, which allowed reduction of the NAVA level, the FiO₂ and the sedation, with a substantial improvement of the oxygenation and the saturation.

We decide to extubate the patient, which was successfully done. The patient remain on passive oxygen flow and developed withdrawal signs such as tremor, anxiety, transpiration, fever, hypertonicity, high pitched cry and sneezing, and had a high Finnegan score. A substitution therapy was started with methadone and lorazepam with varying doses according to the Finnegan score. The patient was transferred to a regular ward on day 32 after admission to the PICU.

She remained on passive oxygen flow for another 8 days and was discharged later on without oxygen supply but with only pulmonary rehabilitation. The child recovered her speech and movement without any obvious sequelae.

The X-ray of the chest prior to discharge showed left pericardial bulbous emphysema (figure 5). In order to detect any sign of anoxic encephalopathy secondary to hypoxemia, A BERRA and EEG were performed and were normal. An MRI of the brain showed a small periventricular leukomalacia.

Case Summary:
A 3 year old girl with a severe pneumococcal pneumonia, ARDS and multiple organ failure, was successfully treated with NAVA. In spite of her severe lung disorder with extreme ventilatory setting and sedation problems, she manages to generate appropriate ventilation by means of NAVA.

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