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Use of neural trigger during neurally adjusted ventilatory assist in a patient with a large broncho-pleural fistula and air leakage

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Dear Editor,

Spontaneous breathing under mechanical ventilation in patients with a large broncho-pleural fistula and air leakage can be difficult because of autotriggering under pressure support ventilation (PSV). A neural trigger, with neurally adjusted ventilatory assist (NAVA), could improve patient–ventilator interaction compared to a pneumatic trigger; this case illustrates this situation.

A 30-year-old woman with Guillain–Barré syndrome developed multiple pulmonary abscesses with acute respiratory distress syndrome (ARDS). Two right chest drains were inserted for pneumothorax with serious air leakage under mechanical volume-controlled ventilation (VAC). Veno-venous extracorporeal membrane oxygenation (ECMO) was initiated because of refractory hypoxaemia, which significantly improved gas exchange while allowing reduction of ventilation.

After 3 days under ECMO, she had a large broncho–pleural fistula, an inspired tidal volume (V_{TI}) of 220 ml, and an expired tidal volume (V_{TE}) of approximatively 50 ml. Depression in the chest drain was limited to -15 cmH_2O. A nasogastric tube allowed diaphragm electrical activity (EA_{di}) to be monitored using a Servo-I ventilator (Maquet Critical Care, Slona, Sweden). Sedation was decreased to initiate spontaneous breathing (EA_{di} waves) and to reduce pleural leakage, while gas exchanges were conducted with ECMO.

She had no obvious stress, with a Ramsay score of 3. PSV level was fixed at 18 cmH_2O with positive expiratory pressure (PEP) 4 and an expiratory trigger of 30%. Because of chest-drain depression, autotriggering under PSV with standard inspiratory triggering (-1 cmH_2O) was vital as ventilation was impossible (Fig. 1, $PSV_{trig\text{-}1}$). Autotriggering was reduced when inspiratory triggering was -7 cmH_2O and completely disappeared when equal to chest-drain depression (-15 cmH_2O), but much inspiratory effort became ineffective or had important inspiratory trigger delay (Fig. 1, $PSV_{trig\text{-}15}$).

NAVA was initiated to use neural triggering instead of pneumatic triggering. Initially, the autotrigger persisted because of the default pneumatic inspiratory trigger of -1 cmH_2O under NAVA (Fig. 1, $NAVA_{trig\text{-}1}$). Once pressure triggering was set at -15 cmH_2O, only the neural trigger was effective, and assisted spontaneous breathing became possible with better synchronisation (Fig. 1, $NAVA_{trig\text{-}15}$). Under spontaneous breathing, V_{TI} was 200 ml and V_{TE} increased to around 120 ml; the leak became significantly reduced. The patient was progressively able to maintain long-term spontaneous breathing without fatigue, thus intermittent controlled ventilation was stopped after 4 days. She spent 24 days under ECMO and was finally discharged from intensive care after 2 months without oxygen supply.

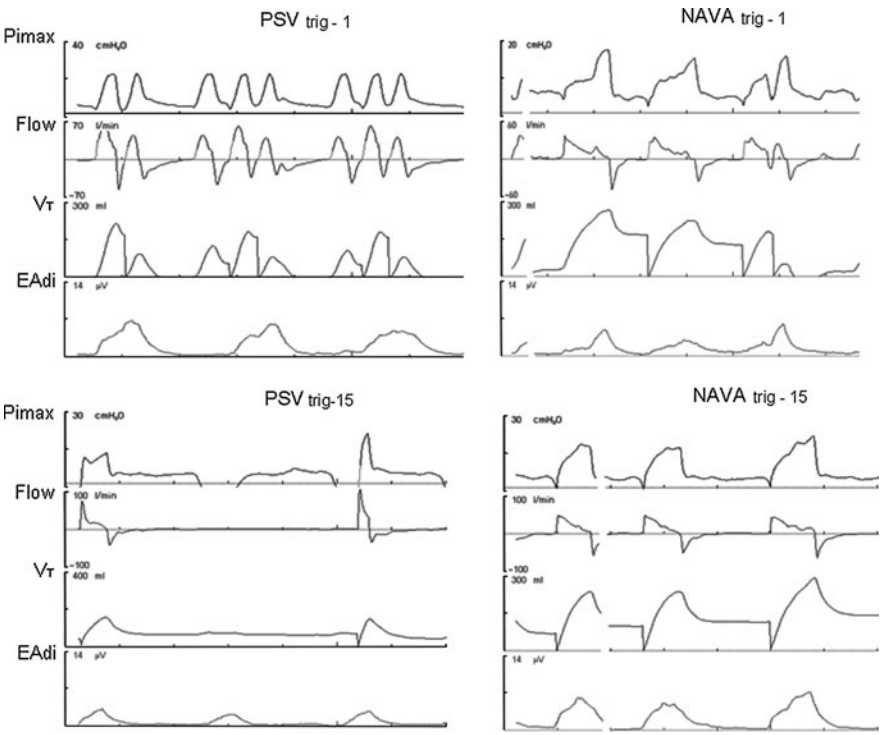

Fig. 1 Comparison between PSV and NAVA with a pneumatic inspiratory trigger of -1 or -15 cmH_2O. Flow (l/min), $P_{i\ max}$ maximal inspiratory pressure (cmH_2O), V_{TE} expired tidal volume (ml), EA_{di} electrical diaphragm activity (μV)

The goal, with large bronchopleural fistulas in ventilated patients, is to use spontaneous respiration with low airway pressure as soon as possible to reduce fistula flow and allow the leak to heal. As ECMO can support gas exchange independently of mechanical ventilation, it is possible to use very low V_T and plateau pressure, but also to switch from controlled to assisted mechanical ventilation [1]. Indeed, spontaneous breathing in ARDS patients may have some beneficial effects [2]. The association of ARDS, ECMO, and severe barotraumas may lead to spontaneous breathing, which is sometimes difficult to obtain with PSV [3].

This case demonstrates the usefulness of neural triggering under NAVA for patients with serious air leakage during mechanical ventilation. Indeed, it is possible to choose between neural or pneumatic triggering by setting different levels of electrical activity or pressure/flow triggers [4]. Use of PSV was difficult as we had to choose between permanent autotriggering, with low inspiratory pressure trigger, or ineffective effort and increased inspiratory trigger delay, with a higher trigger. Neural triggering allowed spontaneous breathing with better synchronisation, which reduced air leakage from 80% under VAC to 40%.

NAVA has been used successfully to maintain assisted ventilation after failure of PSV in a patient with cystic fibrosis awaiting lung transplantation [5], and in a patient with extremely low respiratory system compliance undergoing ECMO [5]. NAVA, compared to standard PSV, improves patient–ventilator synchrony in intubated spontaneously breathing patients [6]. Nevertheless, further studies are required to determine the clinical impact of NAVA, though NAVA seems helpful in specific difficult situations.

Conflicts of interest None.

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