Use of inhaled nitric oxide to manage hypoxia during one-lung ventilation: A case study

Dear Editor,

Thoracotomy for the evacuation of empyema requires lung isolation to facilitate surgical exposure. Hypoxia is a common complication during one-lung ventilation (OLV). We report management of such a case where the conventional methods of managing hypoxia were ineffective; we resorted to using inhaled nitric oxide (iNO) intraoperatively, and surgery could be completed successfully.

A 38-year-old woman was admitted to a teaching hospital's trauma intensive care unit (ICU) with multiple injuries following a motor vehicle accident. During her stay in the ICU, she developed ventilator-associated pneumonia and pneumothorax following prolonged mechanical ventilation. Multiple chest tubes were required, and she was tracheostomised. The patient developed a subacute pulmonary embolus, resulting in a right lower lobe pulmonary infarct and, subsequently, empyema. The ratio of arterial oxygen partial pressure to fractional inspired oxygen (PaO_2:FiO_2) was 150. She required an urgent thoracotomy for drainage of empyema in the right hemithorax. The patient was brought to the operating room. Lung isolation was achieved with an EZ Blocker® (AnaesthetIQ, Rotterdam, The Netherlands). The EZ blocker was advanced under fibre-optic (Ambu® aScope™ 4 Broncho) guidance into the tracheostomy tube until the carina was visualised. The cuffs were alternatively inflated to confirm both lungs' selective and sequential optimal ventilation. The patient was positioned in the left lateral decubitus position. We waited about 5 minutes to ensure she could tolerate the lateral position concerning ventilatory parameters and haemodynamic status. Flexible bronchoscopy confirmed the correct position of the blocker.[1] The surgery commenced, and OLV in the left lung was started with 100% oxygen at a tidal volume of 6 ml/kg and a respiratory rate of 16/min. Twenty minutes into the case, her oxygen saturation decreased, reaching a nadir of 79%. We ascertained the correct position of the tracheostomy tube and the EZ blocker with a bronchoscope. Milrinone (5 mg) was instilled down the endotracheal tube to a good but short-lived effect.[2] An incremental positive end-expiratory pressure starting at 5 cm of water to a maximum of 15 cm of water to the ventilated lung was applied, and we performed a recruitment manoeuvre bilaterally, followed by a continuous positive airway pressure of 5 cm of water to the nondependent lung. Her saturation improved transiently before dropping to 80–85%. We started iNO initially at 20 ppm and gradually increased to 40 ppm using the INOmax DSIR Delivery System (Mallinckrodt; Hazelwood, Missouri, USA). The saturation gradually improved and reached 94%. The iNO was decreased and stopped before instituting both lung ventilation. A large haemothorax and a lung abscess were drained. Her haemodynamic parameters remained stable throughout. The surgery could be completed satisfactorily. The EZ blocker was removed at the end of the surgery, and the patient was transferred to the ICU in a ventilated and sedated condition for monitoring and further management.

The incidence of hypoxaemia is cited in 5–10% of patients during OLV.[3,4] Various techniques have been described to manage hypoxia during OLV. In our case, the common strategies provided minimal benefit. The role of iNO in modulating hypoxic pulmonary vasoconstriction has been described in the literature.[3] Nitric oxide has been demonstrated to improve oxygenation and pulmonary hypertension in ICU patients by selective vasodilatation of the ventilated lung regions.[4] However, its use in the operating room needs to be better established, with conflicting reports. We decided to use iNO as a last measure before requesting the surgeons to stop the surgery. Such a short duration of use is unlikely to cause the potential adverse effects associated with nitric oxide use, namely methemoglobinaemia, inhibition of platelet aggregation, systemic vasodilation and renal toxicity.[5]

To conclude, iNO is an effective tool for improving oxygenation during OLV, and early consideration should be given to its use during OLV.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient consented to her images and other clinical information to be reported in the journal. The patient understands that her name and initials will not be published and due efforts will be made to conceal her identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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