

Inhaled sevoflurane via an anaesthetic conserving device for refractory bronchospasm in mechanically ventilated adults: A single-centre case series

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Dear Editor,

Refractory bronchospasm in mechanically ventilated patients with severe asthma or chronic obstructive pulmonary disease (COPD) can result in progressive air trapping, intrinsic positive end-expiratory pressure (iPEEP), respiratory acidosis, and haemodynamic compromise despite conventional therapy. Rescue options include neuromuscular blockade, ketamine, heliox, and, in selected patients, extracorporeal membrane oxygenation (ECMO). Volatile anaesthetics such as sevoflurane provide potent bronchodilation, but their use in intensive care is limited by the need for specialised anaesthesia equipment and scavenging systems. The authors describe their experience using an anaesthetic conserving device (AnaConDa; Sedana Medical, Danderyd, Sweden) to deliver sevoflurane through a conventional intensive care unit (ICU) ventilator.

The authors retrospectively reviewed consecutive mechanically ventilated adults who received inhaled sevoflurane for life-threatening refractory bronchospasm between February 2023 and December 2024. Sevoflurane was considered when respiratory acidosis or iPEEP persisted or worsened despite optimisation of mechanical ventilation and conventional pharmacological therapy, including continuous inhaled bronchodilators, corticosteroids, neuromuscular blockade, and ketamine.

AnaConDa was positioned between the endo-tracheal tube and the ventilator Y-piece, with a FlurAbsorb (Sedana Medical, Sweden) activated-

carbon filter connected to the ventilator exhaust. End-tidal sevoflurane (EtSevo) was continuously monitored. Sevoflurane was initially infused at 3–5 mL/h and titrated to an EtSevo concentration of approximately 1%, with a maximum target of 2%.

Fifteen patients received sevoflurane during the study period. Thirteen had asthma and 2 had COPD. The median age was 53 years (interquartile range [IQR] 47.5–56), and the median duration of sevoflurane therapy was 62 hours (IQR 33–87.5). All patients had failed conventional rescue therapy before sevoflurane initiation. One patient subsequently required venovenous ECMO.

Sevoflurane administration was associated with progressive improvement in respiratory physiology. Mean arterial pH increased from 7.17 ± 0.15 before treatment to 7.30 ± 0.09 at 24 hours and 7.35 ± 0.05 at 48 hours. Mean PaCO₂ decreased from 72.5 ± 24.1 mmHg to 57.8 ± 15.0 mmHg at 24 hours and 56.9 ± 11.6 mmHg at 48 hours. Mean iPEEP decreased from 9.5 ± 3.2 to 6.3 ± 3.4 cmH₂O at 24 hours (Table 1). Overall changes in pH, PaCO₂ and iPEEP were statistically significant ($P=0.001$, $P=0.033$ and $P=0.001$, respectively).

Haemodynamic effects were clinically relevant. Eight patients (53.4%) required initiation or significant escalation of vasopressor support within 6 hours of starting sevoflurane; the median norepinephrine-equivalent dose increased from 0.06 (IQR 0–0.10) to 0.23 (IQR 0.10–0.50) µg/kg/min. Nevertheless, no patient required abrupt discontinuation because

Table 1. Serial respiratory physiological parameters before and during sevoflurane therapy.

Parameter				
Arterial pH, mean ± SD	7.17 ± 0.15	7.19 ± 0.16	7.30 ± 0.09	7.35 ± 0.05
PaCO ₂ , mmHg, mean ± SD	72.5 ± 24.1	64.0 ± 17.2	57.8 ± 15.0	56.9 ± 11.6
iPEEP, cmH ₂ O, mean ± SD	9.5 ± 3.2	6.1 ± 3.3	6.3 ± 3.4	6.6 ± 3.8

h: hours; iPEEP: intrinsic positive end-expiratory pressure; PaCO₂: arterial partial pressure of carbon dioxide; SD: standard deviation
Repeated-measures analysis of variance was used for PaCO₂, and iPEEP, with $P<0.05$ considered statistically significant. Overall P values: pH 0.001; PaCO₂ 0.033; iPEEP 0.001.

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of refractory hypotension. One patient developed stage 2 acute kidney injury according to the Kidney Disease: Improving Global Outcomes criteria after 72 hours, although the mean serum creatinine level did not change significantly from baseline (84 ± 32 versus 87 ± 44 $\mu\text{mol/L}$). No patient developed malignant hyperthermia.

Clinical outcomes differed between asthma and COPD. Twelve of 13 patients with asthma (92.3%) were successfully extubated and discharged home. The remaining patient failed to respond and required ECMO. Neither of the 2 patients with COPD responded adequately; sevoflurane was discontinued after 24 and 124 hours, respectively, and both subsequently died of pneumonia.

The findings add to the limited literature supporting inhaled sevoflurane as rescue therapy for refractory bronchospasm in the ICU. A 2024 systematic review of adult cases reported improvements in arterial blood gases and pulmonary mechanics following sevoflurane administration. This cohort similarly showed improvements in pH, PaCO_2 , and iPEEP after treatment. Importantly, the use of an anaesthetic conserving device allowed administration through a conventional ICU ventilator, avoiding the need for an anaesthesia workstation. This may facilitate implementation where appropriate scavenging and monitoring systems are available.

The high proportion of patients requiring increased vasopressor support highlights the need for careful haemodynamic monitoring during treatment. The apparently favourable response among patients with severe asthma is encouraging, although neither of the 2 patients with COPD responded. Given the small sample size, particularly the limited COPD population, these findings should not be interpreted as evidence of differential efficacy between disease groups.

This single-centre retrospective case series cannot establish causality, and improvement in respiratory physiology may partly reflect concurrent treatment and the natural course of the disease. Nevertheless,

in patients with life-threatening bronchospasm refractory to conventional therapy, inhaled sevoflurane delivered through an anaesthetic conserving device appears feasible and may provide clinically meaningful bronchodilation. Prospective studies are warranted to define its efficacy, safety, optimal dosing, and patient selection.

Ethics statement

Ethics approval was granted by the National Healthcare Group Domain Specific Review Board (NHG DSRB reference number: 2025-1564).

Declaration

The authors declare that they have no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript.

Keywords: anaesthetics, anaesthetic conserving device, inhalation, mechanical ventilation, refractory bronchospasm, respiration, sevoflurane, status asthmaticus

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