Sevoflurane administration in status asthmaticus: A case report

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This case report describes the use of sevoflurane in a 26-year-old woman who presented to a rural critical access hospital emergency department in status asthmaticus and subsequently failed conventional therapy. Although the use of potent inhalation agents in the treatment of refractory status asthmaticus has been documented, there is little written about the use of sevoflurane in this situation. Sevoflurane was administered for approximately 2½ hours, stabilizing the patient’s condition enough to allow fixed-wing air transport to a tertiary facility.

Key words: Inhalation anesthetics, sevoflurane, status asthmaticus.

When severe asthma symptoms fail to respond to emergency treatment, status asthmaticus develops. Status asthmaticus is a condition where the airways become inflamed and constricted, causing air trapping and impaired gas exchange. Status asthmaticus is a life-threatening illness that demands immediate and aggressive treatment. Occasionally, conventional therapies for asthma and status asthmaticus fail. The end result can be severe morbidity or death. Inhalation anesthesia is often overlooked as a treatment option in refractory status asthmaticus. This is a report of the use of sevoflurane in the treatment of refractory status asthmaticus.

Case summary
A 26-year-old woman presented to the rural critical access hospital emergency department (ED) in status asthmaticus. On admission, the patient was unresponsive. Her initial vital signs were: heart rate, 165; blood pressure, 158/93; respiration, 2 (assisted up to 20 via bag-valve-mask ventilation); temperature, 98.2 axillary; and oxygen saturation (SpO2), 77% on 100% oxygen. She was intubated by the Certified Registered Nurse Anesthetist (CRNA). Three prior intubation attempts by ED personnel had occurred and failed while awaiting the arrival of the “on-call” anesthetist. Emesis was noted in the oropharynx and glottis. The endotracheal tube was lavaged and suctioned while conventional asthma treatment was instituted. Treatment included nebulized albuterol, subcutaneous epinephrine, and intravenous solumedrol. The patient’s SpO2 remained low, ranging from 49% to 87%. Contact was made to a tertiary facility that agreed to accept the patient after transport. The receiving physician assisted the ED staff with treatment protocols, and subsequently intravenous moxifloxacin and magnesium sulfate were added to her treatment regimen.

Because of the patient’s deteriorating arterial blood gases (and declining SpO2), it was decided to treat her with an inhalation anesthetic. An anesthesia machine was obtained from the operating room, and sevoflurane was administered to 8% using positive pressure ventilation. Within 13 minutes, the patient’s SpO2 had increased to 94% and her breath sounds, albeit still severely wheezy, had improved.

At that point it was determined to attempt to place the patient back on nebulized albuterol via positive pressure ventilation in order to administer beta-adrenergic agonists. Sevoflurane administration was thereby stopped, as there was no way to administer nebulized medications through the anesthesia machine at this facility. Within minutes, the SpO2 values had once again declined to a low of 36% with accompanying severe cyanosis. The patient was then removed from the bag-valve-mask ventilation and again placed on sevoflurane at 8% with 100% oxygen via the anesthesia machine using positive pressure ventilation. Again, the patient stabilized with SpO2 values over 90%, and her serial arterial blood gas values continued to improve. The patient remained on sevoflurane and was eventually weaned over the next 2 hours while preparations were made for transport to a tertiary facility.

Sevoflurane was discontinued and the patient was placed on the flight ventilator. Arterial blood gasses were repeated after 20 minutes on the flight ventilator. Arterial blood gas results showed continued hypercarbia, hypoxia, and respiratory acidosis, but with overall improvement. Twenty-two minutes after cessation of sevoflurane administration, the patient left the ED in critical but stable condition. Mental status at the time of discharge was difficult to ascertain since, following the general anesthesia, muscle relaxation and
sedation was maintained with the administration of rocuronium and midazolam for the flight to the tertiary facility. The total time she spent in the rural ED was 3 hours.

**Discussion**

Asthma affects 4% to 5% of the population. Asthma treatment consists of removing causative agents from the environment and drug treatment from 2 basic categories of medicine. The 2 categories are drugs that inhibit smooth muscle contraction (eg, beta-adrenergic agonists, methylxanthines, and anticholinergics) and agents that prevent and/or reverse inflammation (eg, glucocorticoids, leukotriene inhibitors, receptor antagonists, and mast cell stabilizers).

Asthma can cause a severe bronchoconstrictive condition, that, when it persists for days to weeks, results in a life-threatening respiratory debilitation called status asthmaticus. The patient becomes exhausted by the struggle to breathe against the high airway pressures (resistance) caused by the intense bronchoconstriction. This progressive exhaustion causes a respiratory acidosis that, in turn, leads to complete respiratory failure and death unless the patient's downward spiral is aborted by treatment. Treatment for status asthmaticus is aggressive beta-adrenergic antagonist therapy and other conventional asthma medications but may progress to the need for endotracheal intubation.

Several authors have described the use of potent inhalation agents for the treatment of status asthmaticus. The sole literature article that discusses the use of sevoflurane in the treatment of status asthmaticus is from Japan. Wheeler et al and Mutlu et al describe treating status asthmaticus with isoflurane and desflurane, but their reports were based on using those agents in tertiary level hospitals. Historically, ether was administered for status asthmaticus (L. A. Le Bel, written communication, October 15, 2003). Halothane, enflurane, and isoflurane also have been indicated in the treatment of status asthmaticus because of their ability to reduce airway resistance and their ability to lower central afferent parasympathetic nervous system activity. In the book, Anesthesia and Co-existing Disease, coauthors Stoelting and Dierdorf caution against the use of inhalation anesthetic agents for treating status asthmaticus, regarding it as a “hazardous approach” and warn that it should be “reserved for the desperately ill patient and can only be considered when potential benefits are judged to merit the risks.”

Sevoflurane was selected in this case because the only alternative potent inhalation agent available in this facility was isoflurane. Since sevoflurane is less pungent than isoflurane and is used for pediatric induction, sevoflurane was preferred given the circumstances, the limited option of agents, and the patient's critical condition.

**Conclusion**

Critical access hospitals lack the specialists in critical care medicine that tertiary centers have. With the critically ill or injured, it is the role of the healthcare providers in a critical access hospital to stabilize patients and expedite rapid transport to tertiary care. The use of sevoflurane for the stabilization of patients in severe status asthmatics is a viable option for critical access hospitals when standard treatment options fail and anesthesia support is available.

**Epilogue**

After leaving our facility, the patient was transported via fixed-wing air ambulance to the tertiary facility and was received there 1 hour and 10 minutes later. At the tertiary care facility she spent 5 days in intensive care, intubated and on the ventilator, then another 2 days recovering in the hospital. She returned to her home without any sequelae from the event and was grateful to the trauma team at her local community hospital.

**REFERENCES**


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