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CORRESPONDENCE

Efficacy of a simple scavenging system for long-term critical care sedation using volatile agent-based anesthesia

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To the Editor,

We are pleased to present new findings on the efficacy of a simple active scavenging system to minimize atmospheric pollution during long-term volatile anesthetic-based sedation in the intensive care unit (ICU). Even with historical data raising concerns over a link between high atmospheric levels of volatile agents and infertility, spontaneous abortions, and fatigue, gas-scavenging techniques are used routinely to ensure that occupational exposure remains below the current recommended limit of 2 parts per million (ppm).[1,2] Expired gases can be captured using passive charcoal adsorption or active suction-assisted techniques.[3]

Our group previously developed an active scavenging system that uses two connected canisters of Deltasorb® (Blue-Zone, Concord, ON, Canada) placed between the ICU ventilator's expiratory port and wall-outlet suction.[4] We have shown this system to be highly efficacious for short-term (< 12 hr) postoperative sedation, with only negligible atmospheric volatile levels present.[4] Recently, this system, as part of the Volatile Anesthetic Agents for Long-Term Critical Care Sedation (VALTS) pilot trial (clinical trials.gov: NCT01983800), was tested in 12 medical-surgical and cardiovascular ICU patients who required mechanical ventilation for > 48 hr. The trial protocol randomized patients to either inhaled isoflurane administered via an anesthesia-conserving device (AnaConDa®, Sedana Medical, Uppsala, Sweden) or intravenous propofol/midazolam. The level of sedation was titrated at the bedside using an explicit analgosedation protocol. Concentration levels of the volatile agent in air were measured daily using a sensitive multigas infrared vapour analyzer (InfraRan Specific Vapor Analyzer, Wilkins Enterprise Inc, Worcester, MA, USA) at four sampling sites: one in the ventilator expiratory port, one each in the tubing distal to each of the two Deltasorb® canisters, and one in the air surrounding the patient's head. The Deltasorb® canisters were changed every 7 days. There were nine and eight room air exchanges per hour in the cardiac and medical-surgical ICU rooms, respectively.

Patients were sedated for a mean [standard deviation (SD)] of 123.6 (70.2) hr, during which they received 232 (163) mL isoflurane. The mean (SD) isoflurane concentrations measured at the four sampling sites were 5.4 (3.3), 3.3 (1.6), 1.9 (1.4), and 0.5 (0.6) ppm, respectively. All ambient room levels remained below the recommended limit of 2 ppm regardless of the duration of isoflurane sedation (Table 1). There were no complications related to use of the scavenging system.

These data confirm excellent workplace safety using the Deltasorb® scavenging system during longer-term volatile anesthetic-based sedation. Although we are unable to ascertain the contribution of standard room air exchanges on atmospheric levels when not using our scavenging system, our data confirmed the presence of relatively

Registration: This work is part of a registered clinical trial (ClinicalTrials.gov, NCT01983800).

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Table 1 Individual patient daily atmospheric isoflurane levels (ppm)

		Study Number											
	Location	1	2	5	6	10	11	15	17	19	21	22	23
Day 1	1	3	1	1	1	*	0	4	7	8	9	22	1
	2	2	1	7	1	*	0	2	4	5	4	16	1
	3	1	2	7	0	*	0	1	1	4	3	12	1
	4	1	0	0	0	*	0	1	1	2	0	0	1
Day 2	1		0	5	1	3	3	7	6		0	16	8
	2		0	11	1	2	2	2	0		1	5	6
	3		0	0	0	1	0	0	2		1	2	5
	4		0	0	0	1	0	0	0		0	0	1
Day 3	1		3	0	2	0	8	8	12		10	1	
	2		5	0	3	0	1	4	5		7	0	
	3		3	0	2	1	0	1	0		6	0	
	4		0	0	1	0	0	0	0		0	0	
Day 4	1		3		5	1	6				12		
	2		5		0	2	2				7		
	3		3		0	1	0				2		
	4		0		0	0	0				1		
Day 5	1		6		2	*					0		
	2		3		2	*					1		
	3		2		0	*					1		
	4		0		0	*					0		
Day 6	1		1		8	1					7		
	2		1		4	2					5		
	3		0		3	1					0		
	4		0		1	1					0		
Day 7	1		3		5	1					7		
	2		2		0	1					6		
	3		1		0	3					1		
	4		0		0	1					0		
Day 8	1		3		8						13		
	2		5		7						5		
	3		4		0						1		
	4		0		0						0		
Day 9	1		8										
	2		2										
	3		1										
	4		0										
Day 10	1		1										
	2		2										
	3		6										
	4		1										
Day 11	1		2										
	2		4										
	3		2										
	4		0										

Location 1 = expiratory ventilator port; 2 = post 1st Deltasorb® canister; 3 = post 2nd Deltasorb® canister; 4 = ambient room air levels; ppm = parts per million. *Measurement not performed because of malfunction of the InfraRan gas analyzer

higher concentrations of the volatile agent at the ventilator expiratory port than at the other sites.

The Deltasorb® active system is simple to assemble and compatible with any ICU ventilator. Deltasorb® contains a silica zeolite matrix that adsorbs volatile agents and minimizes environmental gas emissions that might contribute to climate change. Furthermore, these agents can potentially be desorbed from the silica matrix and purified for later re-use.

The broader use of volatile agents for critical care sedation has become more appealing, with many studies demonstrating faster extubation times, earlier response to verbal commands, greater cardiovascular stability, and, potentially, the provision of analgesia, which cannot be achieved with intravenous agents.[5] These outcomes are attributable to the unique pharmacokinetic clearance of these agents (via pulmonary exhalation with minimal systemic accumulation) and bedside real-time end-tidal gas monitoring to aid dose titration. The role of volatile agents for ICU sedation requires further research, but this study confirmed that use of prolonged administration of these agents when using this active scavenging system can be done while maintaining workplace safety.

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Conflicts of interest None declared.

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