IN REPLY

In reply: Anesthesia scavenging in critical care areas: beware of possible hazards and questionable efficacy

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To the Editor,

We are most appreciative for the comments from Dr. Dain¹ regarding our recent publication describing a simple scavenging system used during volatile-based sedation in the intensive care unit (ICU) environment.² This project was part of a larger, ongoing study investigating the use of Volatile Anesthetics for Long-Term Sedation (VALTS study, NCT 01983800) that was designed to assess safety and feasibility concerns.³ The important points raised by Dr. Dain need to be addressed if volatile-based sedation is to become routine practice in Canadian ICUs. In our own center, and within the VALTS study protocol, we are still at an early stage of using this sedation modality for critically ill patients. We are, however, making every possible effort to maintain the safety of the patients and ICU staff as the highest priority.

Before we address each concern raised by Dr. Dain, a few general comments related to the rationale for volatile-based sedation in the broader context are warranted. There are numerous complications related to intravenous ICU sedation (e.g., delirium, propofol infusion syndrome, over-sedation), and the rate of their occurrence is quite high. Volatile anesthesia appears to offer several advantages over the current standards,⁴ and the overall goal of our study is to address several aspects of this potentially advantageous treatment modality. The current study

protocol - which includes the use of Deltasorb[®] canisters (Blue Zone; Concord, ON, Canada) as part of the scavenging system and specifically uses isoflurane for ICU sedation - was approved by Health Canada (control no. 164474).³ In addition, the device used in our study (AnaConDa[®]; Sedana Medical, Uppsala, Sweden) is also approved by Health Canada. The minimum alveolar concentration (MAC) of volatile anesthetics used for sedation is generally much lower (i.e., 0.1–0.3 MAC) than that used for general anesthesia. The study protocol and all devices (including the scavenging system) were reviewed, assessed, and approved by our medical engineering department, which is responsible for the use of any medical device based on Canadian and international standards.

Dr. Dain raised some very specific issues including the use of the medical vacuum pipelines for the scavenged gases. Although they may not have been specifically designed for dedicated anesthetic gas scavenging (AGS), they were inspected by our medical engineering department to ensure that they were compatible with oxygen-enriched gases. In general, the intended use of medical vacuum pipelines in the ICU includes the removal of oxygen-enriched gas (e.g., suctioning from endotracheal tubes). In a broader context, one must keep in mind that many patients who have undergone major surgery and who are now being ventilated in the ICU could still be exhaling volatile anesthetics when they first arrive in the ICU. Thus, vacuum systems are already frequently used in modern ICUs to handle high flows of medical gases that are not dedicated AGS systems. Therefore, Dr. Dain's concerns about increased fire risks have less relevance.

Regarding the question of the compatibility of ICU ventilators with AGS, we contacted all of the

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manufacturers of the ICU ventilators used in ICUs participating in the VALTS trial, and their replies did not raise any concerns. Dr. Dain further asked whether we performed a risk analysis prior to commencing our study. The answer is yes, we did, and although it remained a priority throughout the study, it was admittedly not up to the ISO 14971 standard that Dr. Dain cited. The AnaConDa[®] has now been used more than 35,000 times (according to information received from the manufacturer), with similar risk analyses performed by many investigators.

Concern was also raised about Health Canada registration of Blue-Zone technology producing Deltasorb[®] canisters. Indeed, Deltasorb[®] canisters are registered as class II medical devices and have been present in every operating room at our hospital for more than ten years.

Dr. Dain pointed out that some of the measured concentrations of isoflurane were higher distal to the Deltasorb[®] canister than at the ventilator expiratory port. In all of the mentioned cases, we adjusted gas flow during AGS to compensate. In most cases, the reservoir bag was overinflated, indicating the possibility of gas stagnation within the circuit. Additionally, the Deltasorb[®] canisters were changed every week and were also weighed to ensure that oversaturation was avoided. We also changed the canister in the operating room each week and have never experienced oversaturation despite the nearly 24-hr use of some of the operating rooms that have much higher concentrations of volatile anesthetics.

Dr. Dain also suggests using the scavenging system without Deltasorb[®] canisters. The hypothesis that using a direct scavenging system would work as effectively as a system containing Deltasorb[®] canisters requires a separate study to investigate this. In addition, if there is a high number of room-air exchanges, it has been suggested that an additional scavenging system is probably not even necessary.⁵

Lastly, with respect to the question of using other anesthetic gases, it is not our intention to use sevoflurane

for long-term sedation, and the AnaConDa[®] device is not certified for use with desflurane. Hence, repeating the Doyle *et al.* study⁶ with these gases, as suggested by Dr. Dain, is not necessary.

In summary, we agree with Dr. Dain's suggestion that use of volatile anesthetics for sedation in the ICU environment should always take into consideration the safety of the patients and ICU staff. Indeed, their use will likely require separate regulations and the development of standards after all the implications and research have been reviewed. We cannot agree, however, with the suggestion that we applied volatile-based sedation without taking into consideration all of the relevant safety aspects.

Conflicts of interest None declared.

Editorial responsibility This submission was handled by Dr. Hilary P. Grocott, Editor-in-Chief, *Canadian Journal of Anesthesia*.

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