

[NM-130] How safe is your anesthesia machine for patients at risk for MH?

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Background

Current evidence from data on animal studies suggests that to avoid triggering malignant hyperthermia in MH susceptible patients, the residual halogenated vapor concentration must be less than 5 ppm¹. With the evolution of newer anesthesia machines incorporating more plastic and rubber components into their internal breathing systems, the MHAUS suggests seeking directives from the manufacturers for the required flow and duration of flush needed to achieve safe levels of vapor concentrations³. As these components serve as a volatile anesthetic sink, recent studies show that the concentration of volatile anesthetic in anesthesia machines can remain well above the 5ppm threshold after a flush far longer than the previous 20 or 30-minute standard². We set out to test the two different makes of anesthesia machines in use at Stanford University Hospitals with a goal to come up with a local departmental guideline.

Study design

We first contaminated the Drager Apollo machine to deliver 7% Sevoflurane to a test lung for 90 minutes. During that time, we set the fresh gas flow to 3 LPM and ventilated at a tidal volume of 600 mL with a respiratory rate of 10 BPM. Then we turned-off the vaporizers, replaced the breathing circuit, rebreathing bag, test lung and CO₂ absorbent. At this point, we set the fresh gas flow to 10L min .We measured the concentrations of sevoflurane in the inspiratory limb between the breathing circuit and the test lung every 30 seconds until the values reached below 5 ppm, using the Miran SapphIRe XL Gas Analyzer (Thermo-Fisher Scientific, Waltham, MA)). At that time point, we reduced the gas flow to 3 LPM, and continued to record the readings, to examine the effect of reducing the flow on the residual vapor concentration, after a washout.

Then we repeated the entire experiment using a flush rate of 20 LPM.
We replicated the above process again for the Datex Aestiva machine.

Results

It is interesting to note from the attached graph that, with the modern anesthesia machines it takes considerably longer time of flush to achieve safer level of anesthetic vapor. With the absence of clear guidelines from the manufacturers, it is imperative for the anesthesia departments to make their own judgement before designing a local guideline on options for vapor free anesthesia delivery systems for MH susceptible patients.

References:

- 1.Maccani RM, Wedel DJ, Kor TM, Joyner MJ, Johnson ME, Hall BA: The effect of trace halothane exposure on triggering malignant hyperthermia in susceptible swine. *Anesth Analg* 1996;
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- 3.Shanahan H, O'Donoghue R, O'Kelly P, Synnott A, O'Rourke J. Preparation of the Drager Fabius CE and Drager Zeus anaesthetic machines for patients susceptible to malignant hyperthermia. *Eur J Anaesthesiol*. 2012 May;29(5):229-34

Sevoflurane washout

