

Exposure of Nurses in the PACU to Waste Anesthetic Gas - A Pilot Study

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Citation

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Abstract

Volatile anesthetics are a common method of providing surgical anesthesia, with the process of exhalation being critical to removal of the anesthetic from the patient. NIOSH recommends that workers should not be exposed to halogenated agents at concentrations of greater than 2 ppm over a sampling period not to exceed one hour. The authors utilized a MIRAN 1B SaphiRe Portable Ambient Analyzer to study waste anesthetic gas levels by simulating the practice activity of a nurse in the PACU. Exposure to waste anesthetic gases was found to be 50 % higher than published in national guidelines. PACU nurses may have exposure to waste anesthesia gases that supercede NIOSH guidelines. Further investigation is warranted.

INTRODUCTION:

Volatile anesthetics are a common method of providing surgical anesthesia, with the process of exhalation being critical to removal of the anesthetic from the patient. Health consequences from waste anesthetic gases in health care environments have been associated with multiple medical problems in unavenged situations. Operating rooms and dental facilities have developed techniques to decrease occupational exposure by scavenging the WAG's and thus minimize these potential health problems. In the post anesthesia care unit, some studies have demonstrated waste anesthesia gasses exceeding recommended levels in the patient's breathing zone though the ration of intubated patients upon arrive to the post-anesthetic care unit was higher than what may be seen in the common outpatient practice.(1)

The National Institute For Occupational Safety And Health (NIOSH) recommends that workers should not be exposed to halogenated agents at concentrations of greater than 2 ppm over a sampling period not to exceed one hour.(2) They also recommend that occupational exposure to nitrous oxide, when used as the sole anesthetic agent, should not exceed a time-weighted average of 25 ppm during the anesthetic administration.(3)

To the author's knowledge, there is not a recent study evaluating the common levels of exposure of WAG. We hypothesize that waste anesthesia gases in the caregiver breathing zone exceeds recommended levels of exposures in

the post-operative period.

METHODS:

Our study was specifically designed to measure waste anesthesia gas exposure by the PACU nurses. Waste anesthetic gases were measured using a MIRAN 1B SaphiRe Portable Ambient Analyzer. The machine uses infrared spectroscopy to accurately and continuously measure anesthetic gases emitted by the patient after general anesthesia. The device provides a continuous readout of the selected gas in parts per million (ppm).The analyzer has a vacuum hose with a wand attached that the end to collect the sample of air to measure the amount of anesthetic gas.

For the sake of recreating the environment and air that is breathed in by nurses and other PACU personnel, a hose was attached to the wand and wrapped around the data collector to obtain air from just in front of the data collector (See figures 1 and 2).

Figure 1

The hose is clipped onto the neck line of the data collector.



Figure 2

The hose is shown attached to the wand and clipped onto the data collector to hold up the sampling hose.



By clipping on the sampling hose and wrapping around to the collar of the data collector, it allows for the inlet of the sampling hose to be as close to the nose and mouth as possible to collect a sample of air being breathed in by the data collector.

As patients arrived to PACU, the data collector was directly at the bedside, connecting the monitors to the patient, and listening to report from the anesthesiologist mirroring the activity of the PACU nurse. This allowed the analyzer to obtain a sample to represent the amount of waste gas emitted as the patient was cared for in the PACU. The WAG value indicated on the analyzer was recorded upon arrival to the PACU, and then at 5, 10 and 15 minutes following arrival. The data collector performed duties as carried out by the PACU nurses assigned to the patient in question. These activities included removing the oxygen mask from the patient, examining the patient's incision sites, and administering medications with the nurses. While the data collector did not actually perform all of these functions, he was adjacent to the nurse in order to simulate the breathing zone of the PACU nurse performing her regular duties. The waste gas analyzer was constantly collecting data and not deactivated, but the only values recorded were at the time intervals described above.

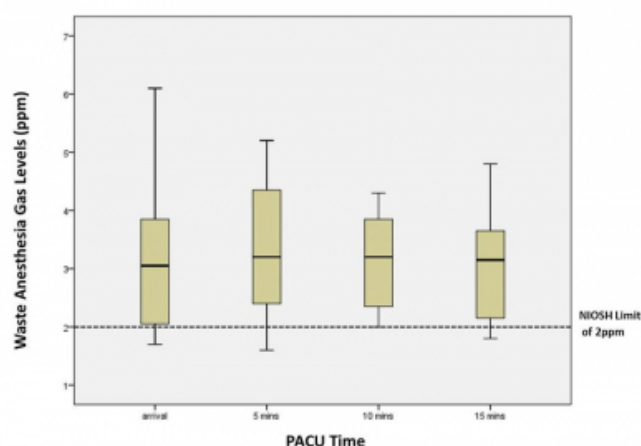
In this study, only patients administered as stated by the anesthesiologist during the case was used, as sevoflurane is most commonly utilized of all of the volatile anesthetics at our institution.

STATISTICS:

Descriptive statistics of relationship between waste anesthesia gases emitted at 5, 10 and 15 minutes following arrival of patient in PACU were utilized.

RESULTS:

Results



Results from this study indicate significantly elevated levels of waste anesthetic gas levels in the breathing zone of the nurses ranging as high as 6.1ppm. The overall mean waste

anesthetic gas level was 3ppm in the nurses environment at all times during the analysis. Mean WAG levels did not continually fall during the PACU admission.

DISCUSSION:

PACU staff concerns about exposure to WAG were the main initiating factors for performing this pilot study. As NIOSH guidelines stipulate that there should not be any WAG level greater than 2ppm, this trend is significant and warrants further investigation.(4) At no time interval was the WAG level averaging near or below the recommended levels by the NIOSH. The weakness of our study is that the subject was not blinded nurse, but a physician who replicated the activity of the nurse he was shadowing. Nonetheless, our findings are concerning, in that there is clearly no time frame in the first fifteen minutes of our patient's admission to the PACU that a nurses exposure to WAG can be expected to be at or below the levels recommended by NIOSH. Our study demonstrates that WAG exposure cannot be assumed to be within guidelines in the absence of an active scavenging system in patients receiving volatile anesthetics. As such,

further investigation is warranted regarding this phenomenon.

CONCLUSION:

In conclusion, this pilot study demonstrated a level of WAG in the PACU nurses practice environment which was above NIOSH recommended guidelines.(5) Further studies evaluating WAG levels should be pursued.

References

- 1)Sessler, DI, Badgwell, JM. Exposure of Postoperative Nurses to Exhaled Anesthetic Gases. *Anesth Analg* 1998;87:1083-8
- 2)Krenzischek, DA et al Phase I Collaborative Pilot Study: Waste Anesthetic Gas Levels in the PACU. *Journal of PeriAnesthesia Nursing*, Vol 17, No 4 (August), 2002: pp 227-239
- 3)<http://www.cdc.gov/niosh/pdfs/77-140d.pdf>, Page 11
- 4)OSHA Directorate of Technical Support and Emergency Management July 20, 1999 Revised May 18, 2000
- 5)National Institute for Occupational Safety and Health. 1977. Criteria for a recommended standard: Occupational Exposure to Waste Anesthetic Gases and Vapors. Cincinnati, OH: U.S.Department of Health, Education, and Welfare. Public Health Service. Center for Disease Control. National Institute for Occupational Safety and Health. DHEW (NIOSH) Publication No. 77-140.

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