K1 Gas Chromatography of Postmortem Blood Revealing Sevoflurane in a Patient Six Hours Post-Op

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Attendees will understand basic physiology and properties of sevoflu- rane, a general anesthetic used in same-day surgeries. Attendees will also learn that sevoflurane may interfere with an ethanol peak with a certain method of gas chromatography.

This poster will impact the forensic science community by alerting the community to the possibility of the presence of "ethanol" peaks on gas chromatography due to sevoflurane in post-operative patients.

A 54-year-old female patient underwent facelift surgery which lasted approximately six hours. During surgery, sevoflurane was used for induction and maintenance of anesthesia. There were no intraoperative complications. The patient was discharged home about one hour and forty-five minutes post-op at 1645 hours. Her only post-op complaint was of a migraine headache, which was treated with topiramate (Topamax®). Patient history as detailed by her family, stated that the patient consumed only ginger ale and yogurt prior to going to sleep after surgery. At 2100 hours, she was sleeping soundly. At 2115 hours, she was not breathing and unresponsive. Post- mortem examination revealed focal moderate calcific atherosclerotic narrowing of the proximal left anterior descending coronary artery, micro- scopic fibrosis of the superior interventricular septum of the heart near the atrioventricular node, and mild to moderate microvesicular steatosis of the liver. Postmortem toxicology revealed the presence of citalopram (Celexa®), lidocaine, morphine, and fentanyl. Gas chromatography (GC) of postmortem blood revealed a peak at 2.496 seconds retention time, consistent with ethanol (retention time 2.3 ± 0.1 sec). The concentration of ethanol was calculated to be 0.05 g/dL. Antemortem blood also revealed ethanol by GC at a concentration of 0.04 g/dL. However, the vitreous fluid was negative for ethanol.

Due to the family's insistence that the patient had not consumed ethanol, possible interferences were sought. Of the medications the patient received, sevoflurane was the best possible medication to cause interference. Sevoflu- rane [fluoromethyl 2,2,2,-trifluoro-1-(trifluoromethyl) ethyl ether] is a four carbon molecule that exists as a liquid and is used for induction and mainte- nance of anesthesia. A review of the literature revealed two manuscripts which reported ethanol and sevoflurane peaks to be within 0.1 and 0.15 seconds of each other (Biomed Chromatogr 2004; 18: 714-18 and Clin Chem 2001; 47: 281-91, respectively). Ethanol-negative blood was spiked with varying dilutions of sevoflurane, which co-eluted with ethanol. For example, the retention time of the 1:20,000 dilution was 2.483 seconds. Volatile analysis was performed with a head space procedure, using *n*-propanol as the internal standard. The column was a 6 foot Porapak-S at a temperature of 180°C. Instrumentation was Shimadzu GC-I 4A, Kyoto, Japan. Due to the high volatility of sevoflurane, a linear concentration curve could not be produced.

A study by Kharasch et al. of sevoflurane's metabolism and pharma- cokinetics shows that it can still be detected in a patient's blood several hours after an administration of three to five hours (Anesthesiology 1995; 82: 1369-78). The average half-life of sevoflurane in that study was 2.8 ± 1.0 hours. The above patient died approximately six hours after the end of anesthetic administration. The long detection time may be partially due to the high partition coefficient for adipose tissue. Adipose tissue dominates the pharmacokinetics past three hours post-administration (BMC Clin Pharma- col 2007; 7:1-21). The above patient had a body mass index of 28.6 kg/m^2, indicating a possible increase in body fat percentage over normal.

Therefore, although ethanol cannot be completely excluded, it is likely that the above patient did have sevoflurane in her blood, causing an inter- fering peak on gas chromatography. An interfering peak was obtained when ethanol-negative blood was spiked with sevoflurane. However, due to the high volatility of sevoflurane, consistent data points could not be obtained to determine the concentration of sevoflurane in the patient's blood.

Gas Chromatography, Sevoflurane, Ethanol

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