



Martin Pearson and Peter Best, South Tamworth Animal Hospital

Martin graduated in veterinary science from the University of Queensland in 1980. After a short period of mixed practice he traveled the UK where he undertook part-time postgraduate studies in veterinary anaesthesia at the University of Bristol. Between 1983 -1988 Martin was engaged in full time research and specialist training in veterinary anaesthesia at the University of Bristol which lead to the award of a PhD and the Diploma of Veterinary Anaesthesia of the Royal College of Veterinary Surgeons. He was appointed to a lectureship in veterinary anaesthesia at the University of Sydney in 1988 where he was head of the Section of Veterinary Anaesthesia and Intensive Care. In 1996 he headed for the country to join Peter Best as a partner in South Tamworth Animal Hospital.

Martin is a registered specialist in Veterinary Anaesthesiology, a diplomate of the European College of Veterinary Anaesthesiologists and is an adjunct Associate Professor of the School of Veterinary Science at the University of Queensland. He is a member of the Royal College of Anaesthetists and is honorary consultant veterinary anaesthetist at the Children's Hospital at Westmead.

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Waste Anaesthetic Gases: Are they Worth the Risk?

Inhalational anaesthetics make an important contribution to safe veterinary anaesthetic practice. They offer ease of administration, rapid control of anaesthetic depth and rapid, smooth recovery. With the addition of the necessary equipment, it is easy to measure end tidal anaesthetic levels and thereby estimate the partial pressure of the anaesthetic in the brain. For some years now there has been widespread awareness that there may be hazards associated with the use of these agents apart from the obvious risks to the patient from inappropriate dosing. Potential hazards arising from anaesthetic waste gases (WAG's) may be classified as (a) environmental (b) general health risks (c) risk to pregnancy

Halogenated anaesthetics and nitrous oxide contribute to the destruction of the ozone layer and to the greenhouse effect leading to global warming. Nitrous oxide is a particularly potent and long lasting greenhouse gas.

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These studies are quoted widely and uncritically in OH & S literature as evidence of the inhalation anaesthetics being hazardous substances. In studies using laboratory animals, there does appear to be good evidence for teratogenic or embryotoxic effects of halothane but not of enflurane, isoflurane, sevoflurane or desflurane. (Byhahn et al, 2001).

Early epidemiological studies that claimed to show evidence of hepatic, neurological, cardiovascular and renal damage from environmental exposure to WAG's have been extensively criticized in several review papers (Spence, 1987) and more recent studies have been reviewed by Sharples (2003) who stated that there are "no exposure data and no direct evidential link from anaesthetic waste gas pollution to significant adverse health effects". It should be remembered, however that the majority of these studies have been conducted in operating theatre environments where there is good ventilation and extensive scavenging of WAG from anaesthetic apparatus.

In veterinary practice, Johnson et al (1987) have shown that even though the odds ratio (OR) for spontaneous abortion after exposure to WAG among female veterinarians and female veterinary assistants was

greater than 1.0, when adjusted for use of diagnostic x-ray machines, it did not reach statistical significance. Schenker et al (1990) demonstrated that rates of spontaneous abortion and low birth weight infants were statistically similar among female veterinarians and lawyers.

SOURCES OF ENVIRONMENTAL CONTAMINATION

There are a number of sources of WAGs apart from the egress of surplus gas from the spill valves of breathing systems. These include filling and emptying of vaporizers, leaks from around endotracheal tubes, the use of face masks for anaesthetic induction or maintenance, anaesthetic induction chambers, leaks in anaesthetic equipment, unscavenged outlets of gas monitoring equipment such as capnographs, and anaesthetic agents exhaled by patients recovering from anaesthesia.

SO WHAT CAN WE DO ABOUT IT?

The most simple answer would be to stop using inhalational anaesthetics altogether. As mentioned in the beginning of this article, this would not be in the best interests of our patients. There are however, a number of measures that we can take that will minimize our exposure to WAGs.

- 1 Ensure that equipment used to deliver inhalational anaesthetics is well maintained and regularly serviced.
- 2 Check the anaesthetic machine and breathing system for leaks and correct function prior to each anaesthetic.
- 3 Ensure that there is good ventilation in all areas where anaesthetics are given.
- 4 Ensure that there is good ventilation in areas where patients are recovering from anaesthesia.
- 5 Use "key filling" systems to fill vaporizers
- 6 Fill vaporizers at the end of the day rather than at the beginning
- 7 Minimise fresh gas flow rates. Use circle absorber systems where appropriate. Anaesthetic agent monitors make running the circle as a closed system very simple. Humphrey ADE or parallel Lack systems require less than half the fresh gas flow rates of a T-Piece or Bain.
- 8 Where possible, avoid the use of anaesthetic induction chambers and "mask" inductions of anaesthesia.
- 9 Empty the reservoir bag and flush the breathing system with oxygen before disconnecting the patient from the breathing system.

- 10 Scavenge surplus gas from the spill valve of the anaesthetic breathing system.

a. Simple, passive scavenging systems are often appropriate (i.e. "tube through the wall" systems). When installing these systems it is important to ensure that they do not impose unacceptable resistance to exhalation.

b. Activated charcoal will absorb about 20% of its weight in volatile anaesthetics (but will not absorb nitrous oxide). Commercial activated charcoal canisters are available but they can be easily made from a plastic soft drink bottle. Numerous holes of 2-3 mm are drilled in the base of the bottle before filling it with activated charcoal from an aquarium supplies shop. Disposable 22 mm corrugated anaesthetic tubing is used to connect the bottle to the spill valve. On the bottle record its weight before and after the charcoal was added. The bottle should be weighed weekly and replaced when the weight of the contents has increased by about 20%.

c. Commercial "active" scavenging systems are available that use a fan or a venturi system. They must be appropriate to the particular situation and have adequate reservoirs.

In summary, if we take prudent measures to minimize our exposure to WAGs, any risks to our health are likely to be minimal. However, it might be remembered that this assessment comes from elderly veterinarians who have been exposed to many years of the as yet unreported brain rotting effects of these drugs!

References:

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