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Nitrous Oxide Abuse Presenting as Premature Exhaustion of Sodasorb

To the Editor:—Recently in my department we were having what was believed to be a problem with the quality of our Sodasorb Pre-Pak (Dewey and Almy Chemical Division): within 3 days, five of our six Sodasorb cannisters on three anesthesia machines needed to be changed. This was very unusual for the department. We considered the possibility that the Sodasorb was somehow faulty.

Three days after this problem was reported, the operating room team was called in for a late night case. A new hospital employee was found in the operating room breathing nitrous oxide with the mask strapped to his face. The Sodasorb cannister was completely blue, and water, not just mist, partially filled the breathing circuit. He obviously had been in the operating room for a long time, since he was found there 6 h after his shift had finished. He also had been in the operating room several nights earlier, and because of a logical reason for being there, the incident was not pursued.

Early exhaustion of the Sodasorb was our first indication that something was wrong in the operating room. The employee also had tampered with the isoflurane vaporizer, subsequent use of which could have injured a patient. When conditions in the operating room are not as they have been or not as they should be they should be investigated until a logical answer is found.

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Anesthesia for Microlaryngeal Laser Surgery

To the Editor:—The report by Sosis[1] of a fire in a "laser-proof" endotracheal tube reaffirms our belief that a "no-tube" technique is by far the safest for microlaryngeal laser surgery. Currently, we have performed approximately 1,000 laryngeal laser procedures using the proximal jet ventilation technique, and have reported our method and results.[2]

"Proximal" implies that the jet opening lies within the lumen of the laryngoscope and above (proximal to) the vocal folds. This particular method eliminates risk of barotrauma and prevents fire in the airway. Jet ventilation is effective even when there is significant laryngeal disease, and it has the additional advantage of allowing the surgeon an unobstructed view of the surgical field.

We believe that the reluctance of many anesthesiologists to use jet ventilation is unfounded. Jet ventilation is the most effective and safest technique currently in use.

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In reply:—I thank Koufman and Weeks for their comments on my report of an airway fire during laser surgery using a Xomed Laser Shield tracheal tube.[1]

Jet ventilation of the lungs can be carried out without the presence of combustible tracheal tubes; however, it has several potential pitfalls. It typically involves the administration of a high-pressure stream of gas (usually 100% O_2) intermittently along the axis of an operating laryngoscope. In patients whose glottis is patent (unobstructed by tumor and adequately abducted secondary to muscle relaxants) and whose pulmonary compliance is not seriously reduced, the jet ventilation technique can provide adequate pulmonary ventilation. The axis of the jet must be aligned with that of the trachea, and adequate egress of ventilating gases must be ensured. Misalignment of the jet can cause severe gastric dilatation and regurgitation.[2]

Barotrauma has been reported with the supraglottic jet technique advocated by Koufman and Weeks.[3] Furthermore, the jet technique usually requires the use of a totally intravenous anesthetic technique since exhaust gas scavenging is very difficult. Another disadvantage is that movement of the vocal cords due to the high gas velocities used may impede laryngologic surgery. Mucosal drying also may occur. Finally, the jet ventillation technique may be contraindicated for children with juvenile papillomatosis, due to the possibility of pulmonary implantation.

The jet ventilation technique has been used successfully, albeit with

occasional problems, for laser airway surgery in centers with experience with this technique. However, my report[1] outlines safe techniques for those practitioners who choose to perform laser airway surgery with the use of a protected endotracheal tube. Koufman *et al.*[4] do state that they sometimes use foil-wrapped tracheal tubes in preference to the jet ventilation technique.

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Safety of General Anesthesia in Patients Previously Tested Negative for Malignant Hyperthermia Susceptibility

To the Editor:—In the recent article by Allen *et al.* on the safety of anesthesia in malignant hyperthermia-negative (MH(−)) patients,[1] the authors concluded that triggering "anesthetic agents may be safely administered to patients who test MH(−) by *in vitro* contracture testing." The authors noted that there were no adverse incidents observed in 16 patients who received MH "triggering" anesthetic agents and who had previously been found to be MH(−) as defined by *in vitro* contracture testing. Although these patients represented a cohort more likely that the general population to have MH susceptibility (MHS) (*e.g.*, those with myopathy, masseter muscle rigidity, perioperative temperature elevation, *etc.*), it is critical to ascertain the prevalence of MHS within this select population before any conclusions may be drawn about the negative predictive value of contracture testing with halothane or caffeine.

According to Bayes' theorem,[2] the probability that a condition is absent given that a test result is negative can be determined by:

$$P(D-|T-) = \frac{P(T-|D-)\cdot P(D-)}{P(T-|D-)\cdot P(D) + P(T-|D+)\cdot P(D+)}$$

where P(D+) represents the prevalence of the disease condition in the population, and P(A|B) is a generic notation used to represent the probability that event A will occur given that event B has occurred. Therefore, the probability of MHS is actually absent, given that the contracture test result is negative, is intrinsically dependent on the prevalence of MH susceptibility in the population studied.

The prevalence of MHS in the general adult population has been estimated by Sessler to be approximately 1 in 40,000.[3] Allen *et al.* make no note of the likely prevalence of MHS in their select, high-risk population. Because the incidence of MHS is in fact so low,[4] it can be demonstrated mathematically that an arbitrary test could have yielded exactly the same results as the authors reported.

Consider a test that *always* is negative, regardless of whether or not a disease state is present. That is, the test has a P(T−|D−) and a P(T−|D+) both equal to 1, and therefore a P(T+|D+) or sensitivity equal to 0. The probability of having *no* MHS patients within a group of 16 individuals can range from 0.9996 (in a population in which the prevalence of MHS is 1 in 40,000) to 0.185 (in a population in which the prevalence of MHS is 1 in 10). Therefore, in the general population, there is a 99.96% chance that a group of 16 patients would contain no individuals with MHS. Consequently, there would be no incident associated with the use of anesthetic agents known to trigger MH in this group. However, one certainly could not conclude that these agents may be administered safely, on the basis of a negative test result preoperatively, since, by definition, the test is always negative!

Suppose that in a high-risk group (as investigated by the authors), as many as 10% of the patients would be expected to be MHS; *i.e.*, the prevalence of MHS in this group is 0.10. (In actuality, it is probably much lower than this.) There still is a $(1.00 - 0.10)^{16} = 18.5\%$ chance that no individual in this group actually has MHS. Therefore, there is an almost 20% chance that an arbitrary test that always is negative would accurately predict no adverse incident in the high-risk group.

In conclusion, it may have been premature to make conclusions about the negative predictive value of *in vitro* contracture testing with a small sample size, especially since the prevalence of MHS is not accurately known, and may in fact be quite low, even in select populations.

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