In Defense of Volatile Anesthetics for Short Outpatient Surgery

To the Editor:—In his recent article on intravenous anesthesia for outpatient surgery, we think that White illustrates that this technique is complicated and offers few advantages over more straightforward inhalational techniques.

He demonstrates that assessing the adequacy of anesthesia by the usual criteria of blood pressure, pulse, lacrimation, diaphoresis, and respiration for titration of intravenous anesthetics has drawbacks, since 20% of the patients in the fentanyl infusion group had purposeful movements interrupting surgery.

The author correctly suggests that monitoring \( P_{\text{ETCO}_{2}} \) or end-tidal \( \text{CO}_{2} \) might have prevented the signs of hypercarbia from being interpreted as “light anesthesia.”

A large fraction of patients receiving fentanyl exhibited hypoventilation requiring positive-pressure ventilation, risking inflation of the stomach. This may pose a significant risk, since outpatients have been shown to have larger gastric volumes than inpatients. Bradycardia, muscle rigidity, \( \text{remarcotization from sequestered drug} \), long-lasting respiratory depression, and awareness are other disadvantages ascribed to fentanyl.

The patients in the ketamine infusion group had excessively high incidences of diplopia (60%), visual distortion (36%), incoherent speech (56%), and dreaming (72%). In spite of assurances to the contrary, the risk of emergence delirium appears real. We suggest reserving this drug for more clearly indicated uses.

The well-recognized low risk of awareness, intrinsic muscle relaxation, and predictable potency make volatile inhalational agents very convenient. We have had good results with a technique of assisted respiration during administration of \( 1.3 \times \text{MAC} \) of inhalational agents by mask for maintenance of anesthesia for thousands of short gynecologic procedures.

Although much has been written on the subject, we know of no study directly comparing White’s technique with a volatile anesthetic technique, however, we concur with Blitt’s excellent review that the latter is advantageous.

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REFERENCES


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In reply:—In my recent article comparing continuous infusion versus intermittent bolus administration of fentanyl or ketamine, it was suggested that continuous administration of intravenous (iv) anesthetics would result in decreased dosage requirements, greater cardiorespiratory stability, and decreased recovery times, compared with the conventional intermittent bolus technique. Since this study did not attempt to compare iv and inhalational techniques, it is not clear to me why Dr. Sosis feels it is necessary to “defend the use of volatile anesthetics” for short outpatient procedures. Although volatile anesthetics are extremely useful in the outpatient setting, iv agents may offer advantages in certain situations (e.g., mid-trimester abortions). It is in situations where the anesthetist feels that iv anesthetics may offer an advantage over inhalational agents that this author would recommend the use of continuous infusion techniques. The side effects associated with fentanyl (e.g., intraoperative respiratory depression, postoperative nausea, and vomiting) and ketamine (e.g., postoperative emergence sequela) are problematic in the outpatient setting. However, other iv agents are available that may be associated with fewer...
side effects. Recently, we demonstrated that the new short-acting opioid analgesic, alfentanil, is associated with less respiratory depression and a more rapid recovery than fentanyl. The sedative–hypnotic compounds also can be administered by continuous infusion in combination with nitrous oxide. When outpatients were administered fentanyl 2 μg/kg, iv, and methohexitol, 1.5 mg/kg, iv (for induction of anesthesia), a maintenance infusion of methohexitol, 2–8 mg/min, proved to be an excellent adjuvant to nitrous oxide. Clearly controlled studies comparing infusion techniques (e.g., alfentanil, methohexitol) with commonly used volatile anesthetic techniques are needed.

Although the use of a continuous iv infusion of an anesthetic may sound complicated, it is not necessary to use expensive infusion pumps. For routine outpatient procedures, we simply add the drug to a drip chamber device and then piggy-back it into an existing iv line. If sterile technique is maintained, the same drip chamber can be used repeatedly. These infusion techniques are easy to learn and have been used by first-year residents.

Atracurium—Additional Information Needed

To the Editor:—In anticipation of the clinical introduction of atracurium, a new muscle relaxant, we reviewed the results from recent animal experiments and initial clinical trials. It has been postulated that atracurium is inactivated by spontaneous decomposition (i.e., Hofmann elimination) as well as by hydrolysis. Either of these reactions can occur as the first step in the inactivation process and be followed by the other. The Hofmann elimination (a cleavage of the bond between the quaternary nitrogen and the carbon atom on the aliphatic side chain) proceeds spontaneously at body pH and temperature. The resulting products include laudanosine and an ester of acrylic acid (i.e., an acrylate) (see abbreviated scheme below). The generation of an acrylate triggers our concern. Acrylates are highly reactive (and most likely relatively toxic) substances, yet the toxicologic aspects of acrylate formation following atracurium administration have not, to our knowledge, been reported.

The chemical reactivity of acrylates is ascribed to the presence of the α,β-unsaturated ester moiety. Many nucleophiles (i.e., substances that possess a sulfhydryl or an amine group) can be alkylated by acrylates. For example, the in vitro reaction of acrylates with simple thiols or proteins with nucleophilic groups has been documented. In vivo, acrylates alkylate glutathione with subsequent excretion of the corresponding mercapturic acid. Adverse reactions occur when acrylates come in contact with skin (e.g., dermatitis, blisters, hypersensitivity) or upon inhalation. Maximal limits for the occupational exposure to the volatile esters of acrylic acid are recommended to reduce potential hazards.

At least two factors would be expected to play a role in the overall toxicity of the acrylates generated from atracurium: first, the total amount of acrylate formed in vivo would depend upon the dose, the duration of exposure, and the rate of acrylate formation versus the rate of hydrolysis; and second, the in vivo site of acrylate formation. Since atracurium is a relatively nondiffusible bisquaternary ammonium salt, its distribution would be expected to be confined primarily to the extracellular fluid. Thus, the nucleophiles in, or in contact with, the extra-