In Reply—The letter by Dr. Moore criticizes the conclusion of our study, namely, that "to the extent that animal data can be extrapolated to humans, we believe that if significant hyperkalemia or hypernatremia are present (or are likely to occur), anesthetic techniques that might lead to high blood concentrations of bupivacaine, e.g., epidural or brachial plexus block, should be used with caution. Hypernatremia or hyperkalemia could add to or even potentiate bupivacaine-induced inhibition of intraventricular conduction and result in serious rhythm disorders."

Dr. Moore finds fault with our conclusions on two accounts. First, he states that animal data cannot be extrapolated to humans. Of course, one should not quantitatively extrapolate the results of an animal study to clinical practice. However, there is a history of cardiac arrest in patients following the use of bupivacaine, and previous animal studies have offered sound physiologic explanations for this phenomenon. We agree that the association of high plasma concentrations of bupivacaine (2.2–3.7 µg/ml) with severe hypernatremia (114 mM) or hyperkalemia (7.7 m) as occurred in our study, is rare. However, accidental intravascular injections during epidural anesthesia may occur relatively frequently (2–10%), particularly with multiorifice catheters. Furthermore, continuously increasing plasma bupivacaine concentrations up to 4 µg/ml have been observed after 2 days following epidural infusions for postoperative pain relief. Thus, to ignore results from an animal study that suggests conditions under which cardiac arrest may occur is not sensible. In fact, if regional anesthesia is indicated in a patient with significant hypernatremia or hyperkalemia, the clinician might consider selecting a technique that is not associated with high blood anesthetic concentrations (e.g., spinal rather than epidural anesthesia) or using an agent other than bupivacaine, or both. Another point regarding the use of animal studies to investigate clinical toxicity problems: What are the alternatives? Animal studies are used because patients cannot be put at risk while investigating the mechanisms, exacerbating factors, and treatments of drug toxicity; it then is reasonable to cautiously extrapolate the results of these studies to clinical practice.

Dr. Moore had a second criticism of our work that he emphasized by quoting from one of his own publications: "Believing in medicine is not enough, one must know." The danger with this type of reasoning is obvious. Who really knows the truth? And what is to be made of a statement that one person fervently holds to be true, and yet another person with equal conviction holds to be false? We reject this criticism because we cannot accept the dogmatic approach proffered by Dr. Moore.

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Termination of Hiccups Occurring under Anesthesia

To the Editor—Hiccups occurring during anesthesia can be problematic when the intermittent diaphragm spasm disturbs the surgical field. Hiccups can also interfere with diagnostic studies such as magnetic resonance imaging scanning and therapeutic interventions such as radiation therapy. The precise etiology of hiccups is unknown, but probably results from stimulation of one or more limbs of the hiccup reflex.1

Many empirical treatments have been described for terminating undesirable hiccups during anesthesia. Parenteral administration of drugs such as ketamine,2 methylphenidate,3 ephedrine, edrophonium, chlorpromazine, doxapram, anticonvulsants, and several muscle relaxants have been tried with variable effectiveness. The greatest success has been achieved with mechanical maneuvers that irritate or stimulate the soft palate and pharynx. This presumably interrupts the hiccup reflex by inhibiting vagal afferent impulses. The techniques described are nasopharyngeal instillations of ether4 or five ml ice cold saline5 and catheter stimulation of the nasopharynx.6

Although highly successful, these latter techniques can be used safely only in the awake patient or in the patient whose trachea is intubated because of the risk of airway compromise or aspiration or both. I describe here a simple, rapid-acting technique for terminating unwanted hiccups in the sedated or unconscious patient whose trachea is not intubated.

A 2-yr-old child with cerebellar neuroblastoma was undergoing one of many in a series of outpatient radiation treatments. The entire procedure takes less than 10 min and is not painful, but requires precise positioning and alignment of the radiation beam. It is essential that the patient not move during radiation administration. The patient was sedated with intravenous ketamine 2 mg/kg, midazolam 0.05 mg/kg, and glycopyrrolate 0.01 mg/kg. This combination produced rapid onset and short duration of sleep with spontaneous respirations and a patent airway. Normal respirations do not displace the head position. However, when this patient began to hiccup, the diaphragmatic spasms altered the precise position of his head. Rather than intubate the trachea for such a short procedure, I passed a broken ampule of ammonium chloride (“smelling salts”) under the patient’s nose. Within one respiratory cycle the hiccups abruptly ceased, and the radiation therapy proceeded without further interruption. I have since used this technique on several other patients, both awake and sedated, with 100% success and no adverse effects.

Since smelling salts usually are readily available in most hospital settings, they offer a rapid and convenient alternative method for terminating unwanted hiccups in the unintubated patient.

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Anesthesiology

Benzocaine and Methemoglobin: Recommended Actions

To the Editor—Benzocaine, absorbed from skin, mucous, or pulmonary membranes, commonly causes methemoglobinemia although this complication is not described in the drug package inserts, on the containers, or in the Physicians’ Desk Reference. This came to our attention following use of Hurricane® spray to facilitate placement of tracheostomy tubes in goats with tracheal stoma. In the initial instance that drew our attention, methemoglobin analyzed by a multiwavelength oximeter (OSM3, Radiometer) increased to 52% in a goat that was anemic (hemoglobin 6 g).

The following tests were done in three goats with tracheal stoma and arterial catheters. The goats were awake and were breathing air. After Hurricane® was sprayed for about 1 s into the stoma, meth-