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Femoral Block with Mepivacaine for Muscle Biopsy in Malignant Hyperthermia Patients

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The diagnosis of malignant hyperthermia (MH) susceptibility rests on either clinical signs or laboratory testing. Usual clinical signs include a rapidly developing temperature elevation, skeletal muscle rigidity, tachycardia, tachypnea, and metabolic acidosis during anesthesia. The laboratory diagnosis is based on the assessment of the contracture response of biopsied skeletal muscle to halothane and to caffeine.¹ Since the contracture test necessitates the removal of 500 mg to 1 g of muscle tissue, anesthesia other than local infiltration is often necessary for patient comfort. A safe anesthetic technique that does not trigger MH and that allows rapid patient mobility is desirable. Although some centers utilize general anesthesia with nontriggering agents, others have used regional techniques with some success. We report the use of femoral and lateral femoral cutaneous nerve block with the local anesthetic mepivacaine for muscle biopsy and subsequent contracture testing.

MATERIALS AND METHODS

Patients were admitted either on the day preceding or the day of biopsy. The indications for muscle biopsy included masseter muscle rigidity (30 patients); family history of MH (28 patients); concurrent myopathy (15 patients); unexplained tachycardia, acidosis, or temperature elevation in the perioperative period (24 patients); and other (six patients). Patients ranged in age from 4 to 76 years (table 1).

Routine evaluation in the absence of secondary disorders included hemoglobin or hematocrit, urinalysis, creatine phosphokinase, history, and physical examination. Premedication when utilized was at the discretion of the resident anesthesiologist and included diazepam and narcotics or barbiturate. Dantrolene was not administered preoperatively. Each patient had an iv infusion started upon arrival in the operating room, and all

patients were monitored with ECG, blood pressure cuff, and axillary temperature probe. A femoral nerve block was performed using the single injection technique as described by Khoo and Brown.² Paresthesias were not sought, but in some cases a nerve stimulator was used to confirm needle placement.

Approximately 0.3 ml/kg of 1 or 1.25% mepivacaine were used for this block. The lateral femoral cutaneous nerve was blocked using the technique described by Moore³ using approximately 0.15 ml/kg of the same solutions of mepivacaine. The total dose of mepivacaine did not exceed 8 mg/kg. When supplemental analgesia was necessary, local infiltration of the skin with 1% lidocaine was used. All blocks were supplemented with one or more iv drugs or nitrous oxide as shown in the table 2.

Following the muscle biopsy procedure, patients were admitted to the hospital overnight and were, in most cases, discharged the following day.

RESULTS

The age distribution and results of diagnostic biopsy are shown in table 1. There were no episodes of MH or deaths. Fourteen per cent of patients required local infiltration of the skin, otherwise analgesia was adequate. Two patients vomited during the surgical procedure, and one required atropine for the treatment of a sinus bradycardia. There were no signs of local anesthetic toxicity and no postoperative complications reported.

DISCUSSION

Providing safe and effective anesthesia for a MH-susceptible patient can be a challenging and worrisome experience. We have shown that the combination of

TABLE 1. Results of Muscle Biopsy Using Femoral Nerve Block and Lateral Femoral Cutaneous Nerve Block for Anesthesia

Patient Age	Number of Patients	No. MH Positive
4-6	13	4
7-9	14	6
10-12	8	5
13-20	16	9
21-25	10	6
>26	42	22
Total	103	52

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TABLE 2. Agents Used to Provide Intraoperative Sedation

Agent	Per Cent of Patients
Diazepam	67%
Fentanyl	81%
Droperidol	39%
Morphine	6%
Thiopental	3%
Nalbuphine	3%
Lorazepam	3%
N ₂ O	14%

femoral and lateral femoral cutaneous nerve block is a safe and efficacious technique for muscle biopsy in general and for the MH susceptible patient in particular. The block is simple to do and is well tolerated by patients, including children. The muscle tissue is not exposed to local anesthetic directly, so presumably the test results are not altered nor confusion generated by preoperative administration of dantrolene.

Much confusion and debate surrounds the use of local anesthesia in MH-susceptible patients. This confusion seems to arise from muscle studies with caffeine. At physiologic pH, amide local anesthetics will augment caffeine contractures, whereas ester local anesthetics either depress or do not influence caffeine contractures in either human or rat skeletal muscle.⁴ Skeletal muscle from MH-susceptible patients is more sensitive to caffeine-induced contractures than muscle from controls. Therefore, it is believed that local anesthetics that potentiate caffeine-induced contractures may be deleterious to MH-susceptible patients. This contention is not readily confirmed clinically, however. In one case where bupivacaine was used for epidural anesthesia, a patient developed a fever, acidosis, and cardiac arrest, presumed to be MH.⁵ However, no metabolic indices of MH such as arterial blood gases were assessed nor was creatine phosphokinase measured. There was no further testing of the affected family. There are no fully documented cases of MH reported in the literature that implicate local anesthetic agents. In contrast, Wingard *et al.*⁶ have

shown that iv lidocaine, when administered to MH-susceptible swine, failed to trigger an episode of MH. These same animals, however, were capable of being triggered on exposure to halothane. They concluded that amide local anesthetics do not trigger MH in susceptible pigs. Harrison and Morrell confirmed these findings with both lidocaine and bupivacaine.⁷ Finally, Katz⁸ described a clinical episode of MH that was attenuated by intravenous lidocaine.

Based on the present study and those in susceptible swine, we conclude that MH is not triggered by clinical doses of amide local anesthetics.

In summary, we have used femoral and lateral femoral cutaneous nerve blocks in 103 patients, ranging in age from 4 to 76 yr. The combination of lateral femoral and femoral nerve block obviates dantrolene pretreatment and provides safe and effective anesthesia of the upper portion of the lower extremity in MH-susceptible patients and others undergoing diagnostic muscle biopsy.

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