Effects of High-Dose Gentamicin Sulfate on Neuromuscular Blockade in Halothane-Anesthetized Horses

Brent A. Hague, DVM; Elizabeth A. Martinez, DVM; and Sandee M. Hartsfield, DVM, MS

A single high dose of gentamicin sulfate given perioperatively does not adversely affect neuromuscular function in horses anesthetized with halothane. Authors’ address: Depts. of Large Animal Medicine and Surgery (Hague) and Small Animal Medicine and Surgery (Martinez and Hartsfield), College of Veterinary Medicine, Texas A & M University, College Station, TX 77843-4474. © 1998 AAEP.

1. Introduction
Gentamicin sulfate, an aminoglycoside antibiotic, is frequently administered to horses undergoing orthopedic surgical procedures for the prevention and treatment of gram-negative bacterial infections. A potential adverse effect of aminoglycoside therapy is neuromuscular blockade, which could lead to muscle weakness during recovery from general anesthesia. A single daily injection of a high dose of gentamicin is gaining popularity because of the increased effectiveness of this treatment regimen and a decreased nephrotoxicity. The purpose of this study is to determine if a high dose of gentamicin will affect neuromuscular function in halothane-anesthetized horses.1

2. Materials and Methods
A. Animal Preparation
Six adult horses served as their own control and received both gentamicin (6.6 mg/kg of body weight) and saline placebo intravenously. Anesthesia was induced with xylazine (1.1 mg/kg IV) and ketamine (2.2 mg/kg IV) and was maintained with halothane. Ventilation was controlled to maintain an end-tidal CO₂ concentration at 35–45 Torr. An end-tidal halothane concentration necessary to maintain a light level of surgical anesthesia, defined as a weak palpebral reflex and no autonomic response to supramaximal peripheral nerve stimulation, was measured by infrared analysis.

B. Measurement of Neuromuscular Function
Horses were placed in left lateral recumbency, and the right hindlimb was immobilized in a reusable fiberglass cast fixed to a steel frame. The hoof was attached to a force transducer, and resting tension was 0.93 ± 0.16 kg. Supramaximal train-of-four stimulus at 2 Hz for a duration of 0.25 ms was applied to the superficial peroneal nerve every 20 s by a square-wave stimulator. The force of the evoked digital extensor tension was recorded by using a computerized data-acquisition program to determine the first muscle twitch tension compared with the baseline value (T₁%) and the last twitch to first twitch (T₄/T₁) ratio.
C. Experimental Protocol

Once the horses were instrumented and a stable twitch tension was observed for 30 min, baseline data were recorded. An isovolumetric saline placebo was administered intravenously and T1% and the T4/T1 ratio were recorded at 5, 10, 15, 30, and 60 min following drug administration. At 60 min, after a second stabilization period of 10–15 min, baseline data were again recorded. Gentamicin (6.6 mg/kg) was administered intravenously and T1% and T4/T1 were recorded at 5, 10, 15, 30, and 60 min following drug administration. Whole-blood ionized calcium was determined at baseline and 60 min following placebo and gentamicin administration.

D. Statistical Analysis

Data for the effect of gentamicin on T1% and the T4/T1 ratio were analyzed by an analysis of variance for repeated measures, followed by a Bonferroni multiple comparison test. Ionized calcium levels for each treatment group were analyzed by using a paired t test. Results were considered significant at p < 0.05.

3. Results

There was a significant treatment–time interaction on the effect of gentamicin compared with the placebo on T1% (p = 0.04), with the placebo decreasing from 100% to 92% during the 60-min study period. There was no decrease in T1% in the gentamicin group. There was no significant treatment or time effect on the T4/T1 ratio between gentamicin and placebo groups. There was no significant difference in ionized calcium levels between groups.

4. Discussion

Because there was no decrease in T1% or the T4/T1 ratio following gentamicin administration, we conclude that high-dose gentamicin has no effects on neuromuscular function in halothane-anesthetized horses. The decrease in T1% in the placebo group was likely a result of an increased skin impedance during the first hour of mechanomyography, and a longer stabilization period prior to baseline readings may have obviated this decrease. Based on the findings of this study, the administration of a high dose of gentamicin (6.6 mg/kg IV) should not have an adverse effect on neuromuscular function, resulting in muscle weakness during recovery, in horses anesthetized with halothane.

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References