

linked local anesthetics were studied in addition to fresh preparations of lidocaine, 2-chloroprocaine, and procaine. Numerous control solutions have also been tested, including: distilled water; bacteriostatic 0.9% saline; 0.2–10% sodium chloride; and 0.1–0.4% sodium bisulfite in 0.2% NaCl and water. Our conclusion is that local anesthetics and not their antioxidants or preservatives are neurotoxic in a dose-dependent manner.⁵

These additional studies do not support the hypothesis originally proposed by Gentilli *et al.*³ that ester-type local anesthetics are more neurotoxic than amide-type local anesthetics. In addition, it is clear in this model that the local anesthetics, including 2-chloroprocaine, and not the Nesacaine-CE[®] vehicle, are neurotoxic. We thank Dr. Cartwright for this opportunity to elaborate on our report.

ROBERT R. MYERS, PH.D.

Research Career Scientist, Veterans Administration, and Associate Professor of Anesthesiology and Neurosciences

MICHAEL W. KALICHMAN, PH.D.

Research Pharmacologist

LAURENCE S. REISNER, M.D.

Clinical Professor of Anesthesiology

HENRY C. POWELL, M.D., M.R.C.PATH.

Associate Professor of Pathology (Neuropathology)

*VA Medical Center and
University of California, San Diego
Anesthesiology Research, V-151
La Jolla, California 92093*

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On the Efficacy of the Priming Principle with Vecuronium

To the Editor:—We read with interest the recent report by Taboada *et al.*¹ on priming with vecuronium (VEC). The authors, in evaluating priming doses of 5, 10, 15, and 20 $\mu\text{g}/\text{kg}$ VEC administered to sedated patients prior to anesthesia, found a decrement in twitch tension in none of the ten patients receiving 5 $\mu\text{g}/\text{kg}$ and only one of the 11 patients receiving 10 $\mu\text{g}/\text{kg}$ VEC. This is surprising, since O'Hara *et al.*² found 6% twitch depression in young adults receiving 10 $\mu\text{g}/\text{kg}$, and Engbaek *et al.*³ report significant decrements in train-of-four ratios and numerous subjective signs and symptoms after both 5 and 10 $\mu\text{g}/\text{kg}$.

An additional consideration is the fact that the patients of Taboada *et al.* were heavily sedated. They received morphine sulfate 10 mg im, diazepam 10 mg po, fentanyl 50–100 μg iv, and/or diazepam 5–10 mg iv. A comparison of the side effects and symptoms listed by Taboada *et al.* with those of Engbaek *et al.* for 5, 10, and 15 $\mu\text{g}/\text{kg}$ VEC doses shows a much higher incidence in Engbaek's

unmedicated patients. We suggest that the heavy sedation may have resulted in underestimation of these problems.

We share the view of Taboada *et al.* that a priming dose causing the fewest side effects should be the one advocated. They selected the 10 $\mu\text{g}/\text{kg}$ VEC dose using this criterion. However, inspection of their table 2 clearly shows that the incidence of "blurred vision" was significantly lower in the 5 $\mu\text{g}/\text{kg}$ VEC group than in all other groups. The 5 $\mu\text{g}/\text{kg}$ group, therefore, had the fewest overall side effects.

Taboada *et al.* note that the 5 $\mu\text{g}/\text{kg}$ VEC priming dose provides no improvement in time to 80% or 100% reduction of twitch tension over their controls (0 $\mu\text{g}/\text{kg}$) when administered 4 min prior to an intubating dose of 0.1 mg/kg VEC. This, along with a previous report,⁴ puts the efficacy of priming with VEC in doubt.

MITCHEL SOSIS, M.D., PH.D.
*Clinical Assistant Professor of
Anesthesiology*

Jefferson Medical College
Thomas Jefferson University
Philadelphia, Pennsylvania 19107

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In reply:—We appreciate Dr. Sosis' concerns about the priming principle, but disagree with many of his interpretations of our data and the literature. First, our results (Taboada *et al.*¹) are consistent with those of O'Hara *et al.*² and Engbaek *et al.*³ We sequentially investigated various vecuronium (VEC) priming doses, priming intervals (time interval from priming dose to intubating dose), and intubating doses. The priming dose of VEC, 10 µg/kg iv, given to awake sedated patients, allowed a faster onset from the intubating dose than no priming dose, and had minimal symptoms and side effects during the priming interval. O'Hara *et al.*² established VEC dose-responses in patients during nitrous oxide-narcotic-thiopental anesthesia. It is not valid to equate the results from priming doses in awake patients with those of anesthetized patients. On the other hand, Engbaek *et al.*³ found decrements in train-of-four ratios from VEC, 10 µg/kg, in awake patients. This is not surprising, since train-of-four monitoring is a greater stress to the neuromuscular junction than single twitch and, thus, the former is more sensitive than the latter. The train-of-four ratio (used by Engbaek *et al.*³) can be decreased when single twitch tension (used by Taboada *et al.*¹) is not. Of note, however, is the fact that VEC, 10 µg/kg iv, only caused the train-of-four ratio to decrease to 0.86 (range 0.76-0.94), which is well within previously described guidelines for adequate respiratory function.⁴ In addition, Engbaek *et al.*³ found no significant change in respiratory frequency, vital capacity, and inspiratory force from VEC, 10 µg/kg iv. Peak expiratory flow was decreased from 475 to 460 l/min in these patients. These results suggest that adequate ventilation and airway protection should be present in patients who receive VEC, 10 µg/kg iv, as a priming dose.

Furthermore, Engbaek *et al.*³ did not find higher incidence of side effects and symptoms from the VEC, 10 µg/kg iv, priming dose than we did. Engbaek *et al.*³ measured a few different side effects, such as ptosis and headlift, than we did, but with those measurements our studies

have in common the results are virtually the same. For example, one of nine patients from Engbaek *et al.*³ had difficulty swallowing, while in our study one of 11 patients had difficult swallowing. We do not feel that the sedation in our study resulted in underestimation of side effects from the priming dose because all patients responded to our sequential evaluation of these side effects. The more important consideration to the reader is the effect of preinduction sedation with diazepam and narcotic on the rapidity of development of paralysis from the intubating dose of VEC. We do not know how important this sedation was on onset time from the intubating dose.

We do not consider blurred vision to be an important dangerous effect from priming. Blurred vision has been for years a well-tolerated side effect from the widely accepted practice of administering a "defasciculating" dose of nondepolarizing muscle relaxant prior to the administration of succinylcholine. The most important implication from Dr. Sosis' letter is the concept that there may be patients who have an exaggerated response to the administration of a priming dose of nondepolarizing muscle relaxant. We agree with this concept. However, we feel that appropriate precautions and vigilance for this consequence are the appropriate response rather than abandonment of the technique entirely. After all, we have been using the same required vigilance with the "defasciculating" dose of nondepolarizing muscle relaxant before succinylcholine for years. So, why should the priming dose of VEC be of greater concern?

In addition to the existence of patients who are very sensitive to a priming dose, there are patients who will be resistant. For example, in our study two patients had onset time from the administration of the intubating dose of VEC to 100% depression of twitch tension equal to 140 s, when the priming dose was VEC 10 µg/kg (priming interval = 4 min; intubating dose = VEC 0.1 mg/kg iv). This possibility should be anticipated, and appropriate management can be aided by information gained from a