

The author also cites studies by Katz<sup>6</sup> and Epstein and Epstein<sup>7</sup> that concluded that the nondepolarizing blockade of *d*-tubocurarine depressed MMG to a greater extent than EMG. Caution should be exercised in comparing the studies, however, because the two earlier studies based their EMG values on amplitude of the primary peak of the evoked EMG potential. The Datex<sup>®</sup> NMT 221, on the other hand, rectifies and electronically integrates the EMG potential. The numerical value is a measure of area rather than peak amplitude.

In summary, there is much to be learned with regard to clinical application of EMG monitoring. There are many variables affecting the EMG response that need to be elucidated before sound clinical recommendations can be made. In the meantime, more clinical studies such as Dr. Kopman's should be conducted comparing mechanical twitch—the gold standard of neuromuscular monitoring—to the relatively newer and less well-known EMG.

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*In reply:*—Drs. Lee and Chen correctly point out that motion artifacts can occur in electromyogram (EMG) as well as mechanomyogram (MMG) recordings. We are well aware of this phenomenon, and we took pains to secure the arm, hand, and fingers securely during our study. No patients with neurologic disease were included, and blood pressures were taken from the contralateral arm.

It is true that Katz<sup>1</sup> and Epstein and Epstein<sup>2</sup> measured peak-to-peak amplitude of the EMG. However, there is now ample evidence that there is an excellent correlation between this technique and the integrated EMG.<sup>3,4,\*</sup> The fact that coughing can occur during laryngoscopy in a lightly anesthetized patient despite a T1/Tc ratio of 0.15 is not really surprising. It is well-known that, during nondepolarizing neuromuscular blockade, doses that totally suppress the adductor pollicis leave the diaphragm far from completely paralyzed. Donati *et al.*<sup>5</sup> recently demonstrated that the ED<sub>90</sub> for the diaphragm is 2.24 times that of the adductor pollicis.

The observation of Lee and Chen that they were able

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to attain sustained head lift despite an EMG T4/T1 ratio of 0.10 in one patient is interesting but not convincing. There is no published data to suggest that the evoked MMG response after nondepolarizing blockers recovers before the EMG. Our experience in over 200 patients is quite the opposite.

Finally, we believe our recommendations regarding EMG T1/Tc levels and surgical relaxation are basically sound. In our experience, values in the range of 0.20 to 0.35 provide conditions that are very acceptable to our surgeons. However, this presupposes that the muscles monitored belong to the hypothenar group, that respiratory acidosis has been avoided, and that the patient is adequately anesthetized. As Donati's work clearly shows, significant diaphragmatic activity is possible, despite paralysis of the hand muscles, if sufficient drive to respiration is present. The answer to inadequate relaxation is not always more relaxant.

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Delivering Bronchodilators into the Anesthesia Circuit

To the Editor:—Having been a firm believer in intra-operative bronchodilator aerosols, I was intrigued by the beautiful simplicity of the method used by Duckett and Zebrowlku<sup>1</sup> until I tried to use it with salbutamol (Ventolin®: Allen and Hanbury). The required movement of the aerosol jet and the needle hub length in this case render it impossible to trigger the spray.

I would like, therefore, to share our method of using aerosols during anesthesia, which is somewhat less disposable but does allow our aerosols to function (fig. 1).

The hand-held mouthpiece supplied by the manufacturer is opened up, and the cylindrical stem that accepts the aerosol can spout is removed. This is inserted into a one-quarter inch hole drilled in a 15-mm connector\* and secured with epoxy glue top and bottom with the side orifice directed toward the patient. The 15-mm connector is then epoxied to a 22-mm connector† and, when required, the apparatus, as illustrated, is interposed between the right-angle connector and the anesthetic tubing.

As in the original description, the aerosol can is squeezed during inspiration and, despite having to negotiate a right angle, sufficient spray is delivered to the patient for pharmacologic effect.

Although this is not disposable, the described apparatus will last for years and withstand autoclaving—without the aerosol can in place!

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\* Bird Catalog Number 22490140.

† Bird Catalog Number 22490150.



FIG. 1. View of the nebulizer-connector assembly.