have time to wait for the proper laryngoscope. We have modified the technique of laryngoscopy in such situations so we can use the conventional laryngoscope. Our technique is to detach the blade from the laryngoscope and insert it in the mouth, with the help of the tongue blade if necessary. After the blade is in place in the mouth, the handle is attached to the blade (fig. 2). Blade and handle attach easier when they are at an angle of about 80° than when they are perpendicular to each other. This maneuver can be used for either a curved or a straight blade.

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Caution in Making Clinical Recommendations Based on Electromyographic Measurements

To the Editor:—We read with great interest Dr. Kopman's recent clinical report, "The Relationship of Evoked Electromyographic and Mechanical Responses following Atracurium in Humans".1 Properly documented clinical observations and appropriate clinical recommendations will become invaluable as this type of monitoring achieves greater use in the operating room. Regarding the author's recommendations in the above-mentioned paper, we believe there are certain very important issues that must be clarified. Our own impressions based on clinical use of the Datex® NMT 221 Neuromuscular Transmission Monitor differ from those of Dr. Kopman, who compared the integrated electromyogram (EMG) potential and mechanical twitch (mechanomyogram [MMG]). Both EMG and MMG values are represented as ratios with respect to control values, or EMG T1/Tc and MMG T1/Tc. The author observes that, during atracurium blockade, EMG is less sensitive to depression than MMG, the data showing that EMG values exceed corresponding MMG values by 15%. Hence, Kopman concludes that in order to obtain adequate surgical relaxation under nitrous oxide-narcotic anesthesia requiring 90% twitch depression,2 i.e., MMG T1/Tc = 0.10, an EMG T1/Tc of only 0.25 need be attained; and in the presence of potent volatile anesthetics, surgical relaxation that would require 75% twitch depression,2 i.e., MMG T1/Tc = 0.25, an EMG T1/Tc of only 0.40 to 0.45 is needed.

Our own experience with the Datex® NMT 221 persuades us to seek higher degrees of EMG depression during clinical dosing of muscle relaxants. For example, we note that coughing can often occur during laryngoscopy at EMG T1/Tc values of 0.15 and, on rare occasions, as low as 0.10. Recovery from muscle blockade seems to correlate even less consistently with EMG T1/Tc values. One of our patients, after a 6-hour surgical procedure, demonstrated a sustained head-lift of 5 s despite an EMG T1/Tc of only 0.51 and an EMG T4/T1 ratio of 0.10. It should be emphasized that differences in EMG recordings may result from differences in technique of application. One major variable is the initial calibration of the monitor in order to obtain a baseline, or 100% value. There is evidence that the baseline drifts downward significantly during the first several min after anesthetic induction and before the administration of muscle relaxants.3 In Dr. Kopman's clinical report, it is hinted that this baseline was obtained after it had become "stable" for at least 5 min. As a result, T1/Tc ratios based on this "stable" baseline would be higher than if the baseline had been obtained earlier in the anesthetic. There are a number of other variables that may affect EMG response. For example, immobilization of the hand and digits is recommended to eliminate motion artifact.4 We have seen changes in the EMG tracing as a result of alteration in the position of the digits, surgical positioning, and possibly even blood pressure cuff inflation. The effect of such variables as regional blood flow, sympathetic tone, CNS depression, and changes in skin impedance and electrode impedance need to be assessed. It is known that upper motor neuron lesions can produce EMG changes suggestive of lower motor neuron disease.5

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The author also cites studies by Katz and Epstein and Epstein 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 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 and Epstein and Epstein 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. 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. recently demonstrated that the ED₉₀ for the diaphragm is 2.24 times that of the adductor pollicis.

The observation of Lee and Chen that they were able 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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