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In reply:—Dr. Cullen has missed some salient points in our paper and hence is misquoting us. The main purpose of our study was to determine how effectively nondepolarizing neuromuscular blockade was reversed in routine practice in three anesthesia departments. As stated in the paper, none of the anesthetists involved knew that the study was in progress, and a nerve stimulator was never used peroperatively. The nature of the study entailed that we did not know the clinical criteria for adequate reversal applied by the individual anesthetists, but we were able to evaluate the result of their clinical judgment using both train-of-four (TOF) nerve stimulation and clinical assessment in the recovery room. We did not try to weigh the value of TOF nerve stimulation against clinical assessment.

We did not state, "that despite train-of-four ratios between 60 and 80 per cent many patients showed inadequate reversal of neuromuscular blockade on arrival in the recovery room." We stated that "irrespective of the chosen variable of recovery, a train-of-four ratio of 80, 70 or even 60 per cent, or head lift sustained for 5 sec, too many patients in the three hospitals had inadequate reversal of neuromuscular blockade on arrival at the recovery room." In other words, if we chose TOF ratios of 80, 70 or 60 per cent to reflect adequate recovery, then 50, 42 or 22 per cent of the patients, respectively, had neuromuscular blockades that were inadequately reversed. If we had evaluated only the ability to sustain a head lift for 5 sec (in the awake patients), then the figure would be 24 per cent. That is, 16 of 68 patients and not 37 of 38 patients as stated by Dr. Cullen.

Katz[1] and Miller *et al.*[2] showed that when using a nerve stimulator and a recorder, thus knowing the degree of twitch depression at any time, neostigmine, 2.5 mg, was sufficient to antagonize most nondepolarizing blocks in adult patients. We found (taking a TOF ratio of 70 per cent to reflect adequate clinical recovery) that about 40 per cent of all patients, managed peroperatively without the use of a nerve stimulator and given neostigmine, 2.5 mg, routinely for reversal, had insufficient reversal on arrival at the recovery room. One reason for this finding, as discussed in our paper and proposed by Dr. Cullen, might be a pronounced neuromuscular blockade at the time of attempted reversal. Therefore, we concluded that if neuromuscular transmission were monitored throughout anesthesia, the number of patients needing more than 2.5 mg neostigmine would probably be much smaller, partly because overdosage of relaxants could be avoided and partly because the effects of neostigmine could be more easily evaluated.

Last, we have not questioned the results of Brand *et al.*[3] indicating that complete clinical testing of neuromuscular blockade correlates with the TOF ratio (and we couldn't possibly do that—compare figure 1 in our paper). On the contrary, we used the results of the above-mentioned study in evaluating the degree of residual curarization in the recovery room. In this way we were able to show that residual curarization in the recovery room remains a problem.

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REFERENCES

1. Katz RL: Clinical neuromuscular pharmacology of pancuronium. ANESTHESIOLOGY 34:550–556, 1971
2. Miller RD, Larson CP Jr, Way WL: Comparative antagonism of *d*-tubocurarine-, gallamine-, and pancuronium-induced neuromuscular blockade by neostigmine. ANESTHESIOLOGY 37:503–509, 1972
3. Brand JB, Cullen DJ, Wilson NE, et al: Spontaneous recovery from nondepolarizing neuromuscular blockade: Correlation between clinical and evoked responses. Anesth Analg (Cleve) 56:55–58, 1977

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Ventilator Hazard Revealed

To the Editor:—A previously unreported hazard of the Ohio anesthesia fluidic ventilator relates to the ease with which the on–off control can be accidentally turned to the off position. The control knob can be placed in an intermediate position approximately halfway between on and off. The ventilator cycles

normally with the knob in this intermediate position though even a slight mechanical impact can cause it to snap to the off position. To verify that this hazard exists in other ventilators of the same design, we examined 12 units from two hospitals. In each case the on–off control knob was easily placed in this intermediate position (semi-on), and at this setting each ventilator functioned as in the on mode.

To determine the force necessary for the knob to be turned either off or on, we replaced the knob with a balanced lever upon which weights were hung. The torque (W1) applied to the knob was calculated by the formula, W1 = W2R2/R1, in which W2 and R2 are the weights and the distance from the axis, respectively, and R1 is the radius of the knob. Ten determinations were made in each of three positions: 1) from off to on, 2) from on to off, and 3) from semi-on to off. The results show that the mean value of the torque required from off to on was 2,061 g ± 342 (SD), while the mean value from the on to off position was only 845 ± 525 g, and that from semi-on to off, 98 ± 43 g. This means that it is approximately 2.4 times easier to turn the machine off than to turn it on. In the intermediate position the force needed to turn the machine off is 8.6 times less than the force required to turn the ventilator from on to off. Even more significantly, this force is 21 times less than the force required to turn the ventilator from off to on. The force required to turn the ventilator off from this intermediate position is so small that any inadvertent, minor impact by personnel or equipment may turn the ventilator off. The pressure-activated disconnect-alarm is not triggered by turning off this control, hence the accident may go unnoticed. Wear did not appear to be a factor, since six of the 12 ventilators tested had been in service only four months. The measurements indicated no correlation between the age of the ventilators and the values obtained.

The ease with which this ventilator may be accidentally turned off when the control is in the intermediate position appears to be a weakness in design. Care must be exercised not to leave the machine in this potentially dangerous position. To avoid human error it would seem safer to use a lever or toggle switch, whose position is obvious to the eye and finger. A warning to avoid leaving the on–off control in this hazardous position is suggested. A separate accidental-off alarm may be desirable.

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Faulty Temperature Probe

To the Editor:—A rapid increase in body temprature may signal a malignant hyperthermia reaction. However, we have noticed three recent instances of an acute increase in temperature reading caused by a faulty temperature probe. One case involved a 2-month-old patient whose temperature increased acutely from 37 C to 45 C during anesthesia. Other vital signs were unchanged and the skin temperature felt normal. The probe was shifted to another temperature box, which showed the same reading. A new temperature probe was placed; it read 37 C. Two other similar events have occurred in our operating rooms. One probe had a faulty connection in the temperature box jack and the other two had faulty sensor tips. It is common practice to monitor patients' temperatures during surgical procedures. One should also be alert to mechanical causes of increased temperature readings before starting vigorous treatment.

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