Double burst stimulation_{2,3} at submaximal current

We investigated whether double burst stimulation_{2,3} (DBS_{2,3})¹ at submaximal current was useful to diagnose level of recovery from neuromuscular block. At varying degrees of vecuronium neuromuscular block, fade or waxing (the feeling that the muscular contraction in response to the second burst was stronger than that to the first) in response to DBS_{2,3} delivered at 50, 30, or 20 mA was determined in 120 adult patients. Discomfort associated with the DBS_{2,3} applied at 50, 30, or 20 mA was examined using 10 cm-visual analog scale (VAS) in 15 awake volunteers.

When TOF ratios were 0.31–0.40, 0.41–0.50, 0.51–0.60, 0.61–0.70, 0.71–0.80, and 0.81–1.00, the probabilities of detection of fade were 91, 70, 50, 16, 10, and 0% at a stimulating current of 50 mA; 84, 61, 33, 13, 0, and 0% at 30 mA; 97, 71, 38, 9, 3, and 0% at 20 mA. When TOF ratios were 0.61–0.70, 0.71–0.80, 0.81–0.90, and 0.91–1.00, the probabilities of detection of waxing were 19, 51, 84, and 98% at 50 mA; 11, 54, 68, and 93% at 30 mA; 9, 59, 63, and 96% at 20 mA. The probabilities of detection of fade or waxing did not differ at 50, 30, and 20 mA. The VAS associated with the DBS_{2,3} delivered at 50, 30, and 20 mA were 8.7 ± 1.7 , 6.8 ± 3.6 , and 4.3 ± 2.2 (mean $\pm$ SD, $P < 0.001$ among 50, 30, and 20 mA). (See Figure below.)

FIGURE Stimulating pattern for double burst stimulation_{2,3}.

Using DBS_{2,3} at submaximal current the depth of residual neuromuscular block can be evaluated with less discomfort than at supramaximal current. Adequate neuromuscular recovery occurs when the waxing in response to submaximal DBS_{2,3} is felt.

Yuhji Saitoh MD, Koshi Makita MD,
Hiroyoshi Tanaka MD*

Department of Anesthesiology and
Critical Care Medicine

Tokyo Medical and Dental University, Tokyo, Japan

*Department of Anesthesiology, Toride Kyodo
General Hospital, Ibaraki, Japan.

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Neuromuscular monitoring in paediatric intensive care patients

It seems sensible to monitor neuromuscular blockade with an apparatus that can measure the train of four (TOF) response, if only to focus the minds of clinicians on the therapy being used. In practice, the TOF response is usually observed at the thumb, by stimulating the ulnar nerve. The problem is that the response of the adductor pollicis does not reflect the degree of paralysis of other muscles. The muscles of the diaphragm, the orbicularis oris and the larynx have a different response to muscle relaxants than does the adductor pollicis. Therefore, a child could be coughing or bucking the ventilator while the TOF response at the adductor pollicis still shows full paralysis.

We demonstrated that in 25% of paediatric patients, there was definite movement while the TOF still showed 0–1 twitches and the observation was repeated in a subsequent study.¹ In my opinion, clinical monitoring provides adequate and pertinent information. If possible, drugs should be administered as boluses rather than infusions to allow a 'drug holiday' and prevent infusions for going on unchecked for days.

If formal comparisons are made between the adductor pollicis and other untested muscles, it is conceivable that we will find that the thumb TOF, which is the gold standard of neuromuscular blockade monitoring, to be irrelevant!

Dr. Sanjiv Nichani

Children's Hospital, Leicester, UK

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REPLY

The message of our study was that with the same amount of vecuronium, neuromuscular relaxation was deeper when using simple neuromuscular monitoring – visual evaluation of thumb movements.¹

We agree with Dr. Nichani that a patient without any movement of the thumb can cough because the diaphragm and larynx muscles are more resistant to relaxants than are the muscles of the thenar eminence. Muscles fibre size could be the reason for this.² However, thumb movements do mean something. In an anesthetized patient, relaxation is inadequate for most situations if all four responses are present. If one or two responses are visible, relaxation should be adequate for abdominal surgery. In a paediatric ICU population, (unanesthetized patients), TOF stimulation of the thumb may be less relevant.

Rene Martin MD FRCP
Sherbrooke, Québec

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REPLY

Dr Nichani rightly draws attention to the problems of controlling the administration of muscle relaxants during ventilator therapy in children. Neither adjusting dosage using clinical endpoints (to produce immobility) nor train-of-four responses (aiming for virtual abolition) is ideal. The latter will always overestimate diaphragmatic paralysis and the former results in relative over-dosage and delayed weaning from the ventilator.

The real issue is the recent recognition of cases of prolonged paralysis on withdrawal of therapy.¹ Lack of information about responses which are “normal” in critically ill patients, prevents interpretation of those that are “abnormal.” Muscle relaxants have been exhaustively examined in the surgical patient, but need to be re-evaluated (in comparable ways) in the intensive care

unit. At present, that means by train-of-four responses. Correlations of measured degrees of relaxation with respiratory function, histological and electrophysiological studies in the critically ill patients are indicated. Such studies² could lead to new ways of assessing muscle relaxant dosage in critically ill patients.

Joan C Bevan MD
Vancouver, British Columbia

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Feeding: an alternative to sedation in children

For auditory nerve and brainstem evoked response examination performed in infants and children, we usually provide sedation with triclofos sodium. This sedative is given *po* since, in our opinion, there is no justification in placing an intravenous line. Titration of this drug may be difficult. We report a case in which the patient woke up during the examination and another strategy had to be used. A three month old healthy baby, weighing 5 kg, had to undergo this procedure for suspicion of deafness. He was given 5 ml of syrup triclofos sodium. He fell asleep within 30 min and the audiologist started the examination. But, in the middle of the procedure, the baby suddenly awoke and the examination had to be stopped. We were confronted with a dilemma: give another dose of triclofos, with the risk of having a baby not ready for discharge for several hours, or reschedule the examination. Another alternative was proposed by the anaesthetist: we knew that the baby was very hungry (he had not been fed for five hours). It was decided, after consultation with the mother, to try to feed him (with a bottle of formula) with the hope he would fall asleep afterwards. Indeed, during the feeding he fell asleep, and the audiologist could proceed with the examination uneventfully. The baby was discharged home 30 min after the end of the procedure. For ambulatory paediatric sedation, a “post-prandial” sleep is, in certain conditions, an alternative that should be kept in mind.

D Gozal MD
Y Gozal MD
Jerusalem, Israel