Monitoring of neuromuscular blockade by pulse oximetry tracing: A simple modification of mechanomyographic and acceleromyographic principles

Sir,

Monitoring the action of neuromuscular blocking drugs is essential to assess conditions for tracheal intubation, degree of blockade and timing of reversal agent administration. The intensity of neuromuscular blockade is often assessed by tactile or visual evaluation of the responses rather than automatic quantification of the train-of-four (TOF) ratio.[1] Unfortunately significant residual muscle weakness might not always be detected when visual and tactile assessment is used.[2-5] Even very experienced observers are unable to manually detect fade at TOF ratio of 0.40-0.60 or more or double burst stimulation (DBS).[4] Consequently, the only way to reliably assess neuromuscular blockade is by objective monitoring methods.

Evoked Responses can be recorded by five methods: Measurement of the evoked mechanical response of the muscle (Mechanomyography), evoked electrical response of the muscle (Electromyography), acceleration of the muscle response (Acceleromyography), evoked electrical response in a piezoelectric film sensor attached to the muscle (piezoelectric neuromuscular monitor), and phonomyography.[6] These monitoring instruments are not always available in the operation theatre and are cumbersome to use. Commonly used modalities of electrical nerve stimulation for evaluation of neuromuscular blockade are single-twitch, TOF, titanic count, post-tetanic count (PTC), and double burst stimulation (DBS).[6] Neuromuscular function is monitored by evaluating the muscular response to supramaximal stimulation of a peripheral motor nerve.

We have devised a simple modification which works well in the operation theatre and which has a special advantage in dark operation rooms as in laparoscopic surgery. Moreover it has an added advantage in robot assisted surgeries in which the accessibility to the patient is limited and intense muscle relaxation is required throughout. It works to some extent on the principle of Mechanomyography (MMG), which is a standard method for monitoring neuromuscular blockade.[7] It measures the force displacement of a muscle contraction in response to electrical stimulation of a motor nerve with the help of a force transducer. We use the pulse oximetry probe as a force transducer which records the movement of the thumb on the monitor as abnormal waves in the pulse oximetry tracing.

Figure 1: Position of the ECG electrodes and pulse oximetry probe

Figure 2: The multiparameter monitor showing the pulse oximetry trace with the abnormal waveforms (shown under the white circle) corresponding to the TOF stimuli when the patient comes out of the effect of muscle relaxant

ECG silver chloride pads are applied over the ulnar nerve [Figure 1]. The pulse oximetry probe is placed on the thumb with special attention to keep the thumb and the cable loose. Stimulation of the ulnar nerve by the neuromuscular monitor causes contraction of the adductor pollicis muscle. With every contraction of the adductor pollicis muscle the thumb moves and the movement is transmitted by the pulse oximetry probe to the multiparameter monitor as 4-5 erratic waves [Figure 2]. Once we see the abnormal waveform in the pulse oximetry tracing, we know that it is time to give a top up of relaxant.

This technique makes it easier for the anesthesiologist to assess the state of neuromuscular blockade without a need to look for movement of the stimulated muscle all the time. Only thing to be done is attaching the neuromuscular monitor as mentioned, give the patient TOF stimuli when needed and keep an eye on the multiparameter monitor for visualisation of the depth of relaxation.

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Quick Response Code:	Website: www.joacp.org
	DOI: 10.4103/0970-9185.83709