A NEW NERVE STIMULATOR (MYOTEST)

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SUMMARY

The Myotest is a new nerve stimulator which can give train-of-four, single twitch (1 and 10 s) and tetanic stimuli. Power is supplied by standard batteries, which allow 200 h effective use. The impulse is unipolar constant current, and the amplitude can be adjusted between 0 and 40 mA. These factors, plus the electronic control of stimulus administration, make the nerve stimulator easy to use, and facilitate the interpretation of responses, especially to tetanic and post-tetanic stimulation.

Routine monitoring of neuromuscular function during and after anaesthesia using nerve stimulators is rare. However, our studies of the frequency of residual curarization in recovery wards (Viby-Mogensen, Jørgensen and Ørding, 1979) have convinced us that there are good reasons to pursue this technique. Probably, one reason why acceptance has been slow despite arguments for the routine use of nerve stimulators (Borden, Clarke and Katz, 1974; Lee, 1975, 1976; Savarese et al., 1975; Ali and Savarese, 1976; Geha, Blitt and Moon, 1976) is that there have been difficulties in the interpretation of the responses to conventional methods of stimulation. The introduction of train-of-four nerve stimulation (Ali, Utting and Gray, 1970, 1971a, b), however, eliminated many of these difficulties.

This report presents a new nerve stimulator (Myotest, figs 2 and 3) which in addition to the traditional stimulation forms—twitch and tetanus—offers train-of-four stimulation. Certain time constants which facilitate interpretation of responses, particularly to tetanic and post-tetanic stimuli, are built in.

Description

The nerve stimulator (figs 1 and 2) measures 90 x 45 x 165 mm and weighs about 400 g. Practical considerations and patient security dictated that the stimulator should be battery driven (4 x 1.5-V standard alkaline batteries, size AA); each set of batteries has a life of about 200 h. The stimulator gives a unipolar constant current impulse, with an adjustable amplitude from 0 to 40 mA, and with a constant impulse duration of 0.2 ms. Maximum allowable resistance between electrodes is 4000 Ω.

Stimulation forms

TOF (train-of-four) (Ali, Utting and Gray, 1970, 1971a, b) comprising four stimuli given at 0.5-s intervals. The train is repeated each 10 s.

1 s (single twitch), frequency 1.0 Hz.

10 s (single twitch), frequency 0.1 Hz.

TETANY. When this button is pressed, tetanic stimulation (50 Hz, duration 5 s) begins at the time when the next impulse (dependent on the chosen form of stimulation) is due.

Stimulation frequency

CONT (continuous). The machine stimulates continuously with one of the described forms of stimulation. At this setting the stimulator continues automatically with the pre-selected impulses 3 s after termination of a tetanic stimulus.

STB (standby). No stimuli are given, but previous settings (including LEVEL) are preserved. This ensures maintenance of supramaximal stimulation capacity. STB also functions as the basal setting for use of:

INTM (manual). This setting allows administration of a single stimulus of the selected stimulation form.

BATT. Stimulation control light. The light blinks with each impulse, and this gives visual control of the type of stimulation. When the light ceases to function, batteries should be changed. At this point there is still current for approximately 20 h of stimulation, so that the individual study need not be interrupted.

LEVEL. Continuous regulation of impulse amplitude. The control functions also as the “on-off” switch.

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The connections for the stimulating electrodes are located low on the front plate of the stimulator.

DISCUSSION
The Myotest differs most significantly from other nerve stimulators (Christie and Churchill-Davidson, 1958; Churchill-Davidson, 1965; Katz, 1965; Zeh and Katz, 1978) by giving a unipolar constant current impulse. This means that, irrespective of changes in impedance between the electrodes, the current to the stimulated nerve will be unchanged. This considerably increases the reproducibility of results.

Another advantage is the inbuilt, electronically controlled, time-constant system which facilitates the interpretation of responses especially to tetanic and post-tetanic stimulation. The response to tetanic stimulation, and the degree of post-tetanic potentiation, is dependent on the frequency of the tetanic stimulus, the duration of that stimulus, and the time lapse between the conclusion of the tetanic stimulus and the first post-tetanic single stimulus. It is therefore of paramount importance that these three variables are held constant, if valid comparison between neuromuscular response to tetanic stimulation at different times during anaesthesia is to be made. When the "tetany" button is pressed, tetanic stimulation follows automatically at the time when the
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REFERENCES


NOUVEAU STIMULATEUR DE NERFS (MYOTEST)

RESUME

Le Myotest est un nouvel appareil pour la stimulation des nerfs qui peut donner des chaînes de quatre stimulations, des crispations uniques (1 et 10 s) ainsi que des stimulations tétaniques. Le courant est fourni par des piles ordinaires qui permettent 200 h d'utilisation effective. L'impulsion est un courant unipolaire constant et l'amplitude peut être réglée entre 0 et 40 mA. Ces facteurs ajoutés au contrôle électronique de l'administration des stimulations font que

FIG. 4. Twitch, tetanus fade, and post-tetanic potentiation in the presence of a non-depolarizing block. Panel A: thumb twitches at a stimulus rate of 0.1 Hz. Panel B: thumb twitches at a stimulus rate of 1.0 Hz. Arrows indicate tetanic stimulation (50 Hz in 5 s). See text for further explanation.

next stimulus, irrespective of form, would otherwise have been given. (Thus, if the nerve stimulator is programmed to give a single stimulus every 10 s (0.1 Hz), the tetanic stimulus is given 10 s after the previous single twitch response (fig. 4).) The duration of the tetanic stimulus is 5 s and the first post-tetanic twitch stimulation follows 3 s later (fig. 4). This 3-s interval was chosen because the post-tetanic potentiation (decurarization) is maximal at about this time (Wylie and Churchill-Davidson, 1972; authors' unpublished observations).

The choice of a twitch frequency of 0.1 Hz was motivated by the consideration that two successive single stimuli must be separated by about 10 s, if the neuromuscular end-plate is to recover a steady state between stimuli. If this time lapse is not allowed, the response to a given stimulus is decreased initially and constant thereafter, but at a lower amplitude (Ali and Savarese, 1977). A stimulation frequency of 0.1 Hz thus allows the largest possible response to a single stimulus. Despite this, we chose the 1.0-Hz frequency, because we found it useful in our day-to-day use of the stimulator. The 1.0-Hz frequency gives a greater opportunity to elicit the supramaximal intensity at a shorter time and may be used in the initial evaluation of a depolarizing block.

We have used the Myotest nerve stimulator for more than 1 year both in our routine clinical practice and in research projects. It has proved robust, reliable and easy to use.
le stimulateur de nerfs est d'un usage simple et qu'il facilite l'interprétation des réactions, particulièrement aux stimulations tétaniques et post-tétaniques.

EIN NEUER NERVENSTIMULATOR (MYOTEST)

ZUSAMMENFASSUNG
Der Myotest ist ein neuer Nervenstimulator, der eine Viererreihe von Einzelzuckungs- und tetanischen Stimuli vermitteln kann. Der Antrieb erfolgt durch Standardbatterien, die 200 Stunden lang arbeiten. Der Impuls ist ein einpoliger, konstanter Strom, und die Amplitude kann zwischen 0 und 40 mA adjustiert werden. Diese Faktoren zusammen mit der elektronischen Regelung der Stimulus-Versendung, sorgen für eine einfache Anwendung des Stimulators und für eine Erleichterung der Interpretation von Reaktionen, besonders auf tetanische und posttetanische Stimulierung.

NUEVO ESTIMULADOR DE NERVIOS (MIOENSAYO)

SUMARIO
El Mioensayo (Myotest) es un nuevo estimulador de nervios que puede procurar una serie de cuatro estímulos, un solo crispamiento (1 y 10 s) y una punzada tétánica. Deriva su energía de baterías normales que permiten un uso durante 200 h. El impulso proviene de una corriente constante unipolar y se puede ajustar la amplitud entre 0 y 40 mA. Estos factores, así como el control electrónico de la administración de los estímulos, hacen del estimulador de nervios un aparato de fácil uso, y facilitan la interpretación de las respuestas, en particular en lo que se refiere a la estimulación tétánica y posttétánica.