TITLE: THE EFFECT OF TETANUS ON SUBSEQUENT TETANIC FADE

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Introduction. Anesthesiologists commonly employ tetanus as a means of assessing neuromuscular recovery. The extent of post-tetanic potentiation on single twitch height can range from less than 2 minutes at twitch heights above 25% of baseline to greater than 10 minutes at more marked depression of twitch height.[1,2] To date, the effect of a tetanus on a subsequent tetanus has not been evaluated in the clinical setting. The present study sought to determine the effect of a 5-sec tetanus on the response to subsequent tetanic stimulation five minutes later.

Methods. After institutional IRB approval, 13 subjects undergoing general anesthesia were enlisted and underwent induction with thiopental 5 mg/kg. Surface electrodes for a Digistim III nerve stimulator (NeuroTechnology, Houston, TX) were applied over the ulnar nerve. The ipsilateral thumb was placed into a calibrated adductor pollicis force transducer (Myotrace APM-L, Professional Instruments, Houston, TX) interfaced to a stripchart recorder. Intubation was facilitated with succinylcholine 1.0 mg/kg. After return of neuromuscular function, a vecuronium infusion was initiated. Response to train of four stimulation was assessed at 10 second intervals. After a steady T_4/T_1 (i.e., the ratio of the fourth to the first train of four neuromuscular responses) in the range of 0.1-0.9 was obtained, a 5-second, 50-Hz tetanic stimulus was delivered and its height quantified. The T_4/T_1 ratio, which always returned to baseline within 90 seconds after tetanus, was then monitored at 20 second intervals for the next 5 minutes to assure a stable degree of blockade. The tetanic stimulus was then repeated. The first and second sets of responses were compared with respect to baseline T_1 and T_4, maximum height of tetanus achieved within the first second, rate of decay of the tetanic response (mm/sec) and minimum height to which it faded (RateDEC). Comparisons were made using signed rank test and t-test for paired data; $p<0.05$ was considered statistically significant.

Results. As noted in the table, overall there was no significant difference between the first and second tetanic stimuli. Both sets of tetanic stimuli achieved the same maximum height (23.4 and 21.3 mm) and declined at virtually the same rate (2.7 and 2.5 mm/sec); p=ns.

Discussion. Our data suggest that if response to tetanic stimulation were used in determining the adequacy of neuromuscular function return, then an elapsed period of 5 minutes between sequential stimuli would be sufficient to ensure accurate assessment of tetanic amplitude or fade.

	FIRST TETANUS Mean±SD	FIRST TETANUS Median(Rnge)	SECOND TETANUS Mean±SD	SECOND TETANUS Median(Rnge)
BASELINE				
*T_1 (mm)	11.0±6	9.0 (4-25)	11.1±6	9.0(4-25)
*T_4 (mm)	4.2±3	3.0 (1-12)	4.0±3	2.0(1-10)
TETANUS				
*Max(mm)	23.4±10	24 (16-30)	21.3±11	16(12-30)
*Min(mm)	8.4±9	2.0 (2-14)	7.8±9	3.0(1-10)
*RateDEC	2.7±1	2.4 (.5-5)	2.5±2	2.1(.7-7)

*p=ns for first tetanus vs. second tetanus

References
1. J Appl Physiol 11:51-57, 1957
2. Anesth Analg 70:S38, 1990

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TITLE: SINGLE TWITCH ACCELOGRAPHIC RESPONSES AT SUBMAXIMAL AND SUPRAMAXIMAL CURRENTS

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Introduction. This study was designed to elucidate the relationship between current intensity and amplitude of evoked response over the range of detectable neuromuscular responses with an Accelograph (Biometer, Denmark).[1] This new neuromuscular transmission monitor obviates the need for using a force transducer, thus eliminating both the need for frequent thumb repositioning and adjusting preload.

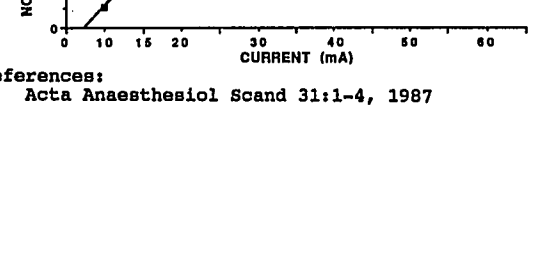
Methods. Following institutional IRB approval, 20 patients undergoing general anesthesia were monitored. The Accelograph was applied to the arm opposite the blood pressure cuff. Induction was accomplished with IV thiopental 4 mg/kg; then a baseline twitch height was obtained. Intubation was facilitated with IV succinylcholine 1 mg/kg. Following return of the neuromuscular response to baseline, a vecuronium infusion was started to establish a stable degree of blockade with a TOF ratio (T_4/T_1) ranging from 0.1 to 0.9. Once the accelographic T_4/T_1 remained constant for at least 5 minutes when tested with supramaximal current at 15 second intervals, the current was randomly varied between 10, 15, 20, 30, 40, 50 and 60 mA, and the twitch height was recorded on the interfaced stripchart recorder. The degree of blockade was then changed to achieve a different and stable T_4/T_1, and the study was repeated. A maximum of 5 studies were performed on each patient, such that a total of 71 data sets were obtained. In addition, nine patients underwent comparable testing prior to onset of nondepolarizing blockade. Data were expressed as mean ± SD, median and range.

Results. Of the 71 data sets during nondepolarizing blockade, 9 had responses at each of the 6 currents tested; 62 did not evidence a response to 10 mA stimulation. When twitch heights in each of the 71 subjects were normalized to the value obtained at 60 mA, a progressive increase in height at each current was observed (Table). The figure illustrates the logarithmic relationship ($r^2=0.99$) in the 9 subjects with responses at 10-60 mA.

Discussion. The data indicate that increasing stimulating current from the first detectable twitch height to supramaximal is associated with a logarithmic increase in twitch height. The Accelograph clearly documents this relationship.

NORMALIZED HEIGHTS

	DURING BLOCKADE (n=71) Mean	Median	Range	NO BLOCKADE (n=11) Mean	Median	Range
mA						
20	25.7±22	17.8	2-118	37.6±19	29.8	19- 69
30	49.3±28	43.6	6-135	69.4±20	67.0	44-107
40	67.9±27	68.9	11-147	79.1±21	82.8	53-111
50	86.4±17	86.8	54-138	95.8±11	95.8	80-120
60	100.0± 0	100.0	100	100.0± 0	100.0	100



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1. Acta Anaesthesiol Scand 31:1-4, 1987