

Title: PROBLEMS OF RECOVERY AND RESIDUAL NEUROMUSCULAR BLOCKADE: PANCURONIUM VS. VECURONIUM

Authors: S. J. Brull, M.D., D. G. Silverman, M.D., J. Ehrenwerth, M.D.

Affiliation: Department of Anesthesiology, Yale University School of Medicine/Yale New Haven Hospital, New Haven, CT 06510

**Introduction.** Over 30 years ago, Christie and Churchill-Davidson proposed the use of peripheral nerve stimulators for evaluating the degree of neuromuscular blockade during anesthesia. Despite apparently adequate reversal as judged in the operating room by responses to nerve stimulation, a significant number of patients who receive long-acting relaxants still evidence incomplete neuromuscular recovery when tested in the Post Anesthesia Recovery Room (PAR).<sup>1,2</sup> It remains to be determined whether such compromised function is present when using neuromuscular blockers of intermediate duration. The present prospective controlled investigation compares the incidence of residual neuromuscular blockade following administration and reversal of pancuronium and vecuronium.

**Methods.** Following approval of the Institutional Human Investigation Committee, train of four (TOF) neuromuscular responses<sup>3</sup> to 50 mA stimuli (Digistim III, Neuro Technology Inc., Houston, TX) were assessed in 100 consecutive patients within 15 minutes of their PAR arrival. The investigator was blinded to intraoperative technique, and the anesthesia care provider was not informed that the patient would be evaluated postoperatively. The patients assessed had received one of four intraoperative regimens: I) regional anesthesia or general anesthesia without nondepolarizing agents; II) vecuronium as the sole nondepolarizing agent; III) pancuronium as the sole nondepolarizing agent; and IV) a combination of nondepolarizing muscle relaxants. Group I served as control. Sixty-four of the 100 patients were in groups I, II or III. The 36 patients in group IV did not meet the study criteria and were subsequently excluded from analysis.

TOF responses were quantified with a Medar adductor pollicis monitor (Medar Corp., Scarsdale, NY) interfaced to a strip chart recorder. Data for each group are presented as mean + SEM. Inter- and intra-group differences were analyzed by ANOVA;  $p < 0.05$  was considered statistically significant.

**Results.** The mean TOF ratio ( $T_4/T_1$ ) in the control group was  $0.98 \pm 0.01$ . This was not statistically different from the vecuronium group, in which the mean TOF was  $0.93 \pm 0.02$ . In contrast, patients who had received pancuronium had a mean TOF of  $0.75 \pm 0.03$ . This was statistically different from both the control and vecuronium groups ( $p < 0.05$ ) (Table). Forty-eight percent of patients (14/29) in the pancuronium group evidenced a TOF ratio below 0.70. In contrast, only 8% of patients (2/24) receiving vecuronium evidenced a TOF ratio of less than 0.70. There were no significant intra- or inter-group differences with respect to age, sex, ASA physical status, antibiotic therapy, duration of anesthesia, dose of reversal agents, or duration from reversal to time of TOF testing.

**Discussion.** A TOF ratio of greater than 0.70 is

considered to reflect adequate clinical recovery from neuromuscular blockade.<sup>4</sup> The present study demonstrates that patients who received vecuronium evidenced no statistically significant residual neuromuscular blockade when compared to the control group. In retrospect, the two patients who had received high-dose vecuronium (0.25 mg/kg) for rapid intubation were the only ones to evidence a TOF below 0.70 (0.60-0.70 range) in this group. In contrast to the vecuronium and control groups, 48% of patients who received pancuronium exhibited inadequate neuromuscular function upon PAR testing, consistent with prior investigations.

In addition to documenting a significant difference between vecuronium and pancuronium with regard to residual neuromuscular blockade, the present study also emphasizes the difference between neuromuscular testing in the PAR as compared to that noted immediately postoperatively. At the end of surgery, all patients in this study were considered by the anesthesia care provider to be adequately reversed by assessing TOF and/or sustained tetanus. Yet, in the PAR nearly half of the patients (14/29) in the pancuronium group and two in the vecuronium group demonstrated inadequate TOF response.

In conclusion, the present study emphasizes the potential for residual neuromuscular blockade. Clinical assessment and/or neuromuscular blockade monitoring in the post-anesthetic period may be critical, particularly in patients who receive longer acting relaxants. In contrast, patients administered vecuronium appear to have a greater margin of safety postoperatively.

#### References.

1. Beemer GH, Rozental P: Postoperative neuromuscular function. *Anaesth Intens Care* 14:41-45, 1986
2. Viby-Mogensen J, Jorgensen BC, Ording H: Residual curarization in the Recovery Room. *Anesthesiology* 50:539-541, 1979
3. Ali HH, Utting JE, Gray TC: Quantitative assessment of residual antidepolarizing block. *Br J Anaesth* 43:473-485, 1971
4. Brand JB, Cullen DJ, Wilson NE, et al: Spontaneous recovery from nondepolarizing neuromuscular blockade: Correlation between clinical and evoked responses. *Anesth Analg* 56:55-58, 1977

T4/T1	% OF PATIENTS IN EACH GROUP		
	CONTROL	VECURONIUM	PANCURONIUM
0.0-0.3	0	0	0
0.3-0.4	0	0	6.9
0.4-0.5	0	0	6.9
0.5-0.6	0	0	6.9
0.6-0.7	0	8.0	27.6
0.7-0.8	0	0	10.3
0.8-0.9	0	4.0	13.8
0.9-1.0	100.0	88.0	27.6
	n=10	n=25	n=29