Title: NEUROMUSCULAR AND HEMODYNAMIC EFFECTS OF ATRACURIUM DURING ENFLURANE ANESTHESIA

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Introduction. Atracurium (BW33A) is a new non-depolarizing neuromuscular blocking agent having an intermediate duration of action.[1] Previous studies during balanced anesthesia have shown it to be non-cumulative and void of significant hemodynamic side effects at doses up to 3 times the ED_{95}.[2,3] This study was performed to evaluate the neuromuscular and hemodynamic effects of atracurium during enflurane anesthesia.

Methods. Sixty-five patients 18 to 60 years old classified ASA status I or II were studied. Written informed consent was obtained in all cases after approval by the institution's Human Research Practices Committee. Twenty-five patients received atracurium during balanced anesthesia (thiopental, fentanyl, N_2O/O_2) and forty patients received atracurium during enflurane, N_2O/O_2 anesthesia (MAC end tidal = 1.16 ± SE.03).[2] Monitoring included blood pressure by cuff, continuous EKG, heart rate by tachograph and temperature by esophageal thermistor. All patients were intubated prior to administration of atracurium and ventilation was controlled mechanically to maintain normocarbia, verified by arterial blood gas analysis. Evoked twitch response of the adductor pollicis muscle to supramaximal stimulation of the ulnar nerve at 0.1 Hz was monitored on a Grass polygraph. After establishing baseline control twitch response and stable blood pressure and heart rate, atracurium was administered to 5 subgroups of patients anesthetized with balanced anesthesia (B) and to 4 subgroups of patients anesthetized with enflurane to induce neuromuscular block (NMB). Blood pressure, heart rate and temperature were recorded every minute for 10 minutes following bolus injection of atracurium. No additional relaxants were administered until spontaneous recovery to 95% control had occurred. Recovery index (RI) was measured as the time required for recovery from 25% to 75% of control twitch height. When necessary, residual block was antagonized with neostigmine and atropine.

Results. Neuromuscular data are presented in Table 1. Hemodynamic data in Table 2 display mean arterial pressure (MAP) and heart rate (HR) as a percent of control.

Discussion. During balanced anesthesia recovery index was independent of dose as others have found.[2,3] Enflurane potentiates the neuromuscular blocking potency of atracurium and may prolong the recovery index compared to balanced anesthesia. The recovery index during enflurane anesthesia following 180 µg/kg of atracurium was significantly prolonged compared to the recovery index following a similar degree of block during balanced anesthesia. At a higher initial dose of atracurium (360 µg/kg) however, the recovery index was not significantly prolonged. This may have been due to a lower end tidal concentration of enflurane during the recovery phase following the higher dose. This is only speculative, as end tidal concentrations were not measured during this period. No significant hemodynamic side effects were encountered in either anesthetic group even at twice the ED_{95}. Atracurium is a safe and effective non-depolarizing neuromuscular blocking agent of intermediate duration. Although speed of onset is not significantly greater than that of longer acting agents, it can be facilitated by increasing the dose. At twice the ED_{95} no significant hemodynamic side effects were seen and prolongation of block was only increased by 10 to 15 minutes. Atracurium should be very useful for surgical procedures lasting 30 to 60 minutes requiring profound muscle relaxation.

Table 1:

Grp	N	Dose (µg/kg)	NMB (%)	Onset (Min)	Recovery 95%	Recovery R.I.
B	5	60	7.7	7.6	25.9	NA
	5	150	45.8	7.1	23.0	NA
	5	250	89.4	7.5	38.0	10.6
	5	375	>99.9	3.6*	50.5	11.0
	5	500	>99.9	2.8*	54.7	10.2
E	11	80	35.2	8.6	27.1	NA
	10	100	42.6	7.9	31.6	NA
	10	180	93.1	7.4	54.0	17.3*
	9	360	>99.9	2.9*	61.9	12.4

* $P < 0.05$

Table 2:

Group	N	Dose (µg/kg)	HR (%)	MAP (%)
B	5	60	96.6	98.4
	5	150	91.6	103.0
	5	250	96.8	103.4
	5	375	105.0	100.6
	5	500	111.2	107.6
E	11	80	104.5	105.2
	10	100	103.8	99.7
	10	180	103.4	100.2
	9	360	103.1	106.6

References

1. Payne JP, Hugh R. Brit J Anes (1981) 53,45.
2. Basta SJ, et al. Anes and Anal (1982) 61, 169. (Abstract)
3. Lee C, et al. Anes and Anal (1982) 61, 199. (Abstract)