

Title: Rapid Tracheal Intubation with Vecuronium: The Timing Principle
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Introduction. Succinylcholine provides predictable, excellent intubating conditions in 60 seconds or less. Depolarizing drugs, however, produce unacceptable side effects in certain clinical settings. Recently, vecuronium and atracurium (nondepolarizing muscle relaxants) have been administered using innovating strategies in an attempt to provide rapid, reliable paralysis during intubation. Perhaps the best studied, most commonly used technique is "the priming principle".¹ While some investigators have found this approach an improvement, with a reported incidence of bucking as high as 40%, problems remain.²

The present study was designed to evaluate intubating conditions when a single bolus of an intermediate duration nondepolarizing muscle relaxant (vecuronium) is given before the induction agent (sodium pentothal). The administration of the anesthetic agent is timed to the onset of clinical weakness: the "timing principle."

Methods. The protocol was approved by the institutional human use and clinical investigation committees. Informed consent was obtained from each participant. Patients at increased risk (for aspiration, difficult intubation, surgical emergencies, etc.) were excluded.

Patients were randomly assigned to one of three groups. Groups differed only in the vecuronium dose administered during induction with group A receiving .1 mg/kg, group B .15 mg/kg, and group C .2 mg/kg.

All patients received reglan and ranitidine preoperatively. Routine monitoring included pulse oximetry and mass spectrometry. The degree of neuromuscular blockade was visually estimated via train of four using a Digi Stim II nerve stimulator after the patient lost consciousness.

After pre-oxygenation all patients were given 0.040 mg/kg of midazolam IV. One minute later level of consciousness was assessed and the appropriate bolus of vecuronium was given. At the onset of clinical weakness, as judged by weakening hand grip or decreased ventilatory effort, patients were asked to cough and then received 4 mg/kg of sodium pentothal.

Sixty seconds later patients were intubated, by blinded experienced staff personnel. Clinical conditions during intubation were graded according to Table I. Clinical train of four measurements were also made at this time. Results were analyzed using student's t-test and analysis of variance.

Results. All groups were similar in terms of age, weight, and sex. Intubation scores were uniformly excellent. Table 2. There was also no significant difference between groups for onset time of clinical weakness. There was, however, a significant difference between groups for the time required for the return of twitch. Additionally, this was found to correlate with increasing age.

Commonly patients exhibited a hemodynamic response to intubations with elevations of both heart rate and blood pressure.

Discussion. The search for a suitable nondepolarizing neuromuscular agent for rapid sequence inductions has led to numerous investigations of the priming principle. This approach has proven unpredictable. Small initial doses may produce significant weakness, patients may cough or buck, or very large doses require longer times before reversal is possible.

In the present study, timing the administration of a single moderate sized bolus of vecuronium to the onset of clinical weakness provided consistently excellent intubating conditions at 60 seconds. From a pharmacodynamic standpoint this method of administration seems logical. The "timing principle" may provide the optimal method of administration of current nondepolarizing muscle relaxants for rapid sequence intubations.

Table 1. Grading of Intubating Conditions

Grade	Definition
3	Excellent (jaw relaxed, cords abducted, no movement)
2	Good (jaw relaxed, slight cough)
1	Poor (jaw poorly relaxed, cords moving or "bucking")
0	Unable to intubate

Table 2. Visual Estimate of Train of Four (TOF) and Clinical Scores During Intubation

Group (vecuronium dose)	Intubation Score		TOF at Intubation	
	Score	# Pts	TOF	# Pts
A (.10)	3	12	4/4	11
	2	0	3/4	0
	1	0	2/4	0
	0	0	1/4	0
B (.15)	3	12	4/4	10
	2	0	3/4	0
	1	0	2/4	0
	0	0	1/4	1
C (.20)	3	9	4/4	1
	2	0	3/4	0
	1	0	2/4	0
	0	0	1/4	1
	0	0	0/4	7

References:

1. Földes FF: Rapid tracheal intubation with nondepolarizing neuromuscular blocking drugs: The priming principle. *Br J Anaesth* 56:663, 1984
2. Baumgarten RK, Carter CE, Reynolds WJ, Brown JL, Devera HV: Priming with nondepolarizing relaxants for rapid tracheal intubation: A double blind evaluation. *Can J Anaesth* 55:5-11, 1988