

Title: THE DEVELOPMENT OF TACHYPHYLAXIS AND PHASE II BLOCK DURING THE INFUSION OF SUCCINYLCHOLINE IN INFANTS

Authors: N.G. Goudsouzian, L.M.P. Liu

Affiliation: Department of Anesthesia, Harvard Medical School at the Massachusetts General Hospital, Boston, MA 02114

It has been demonstrated that during halothane anesthesia children over 1 year of age develop tachyphylaxis to the neuromuscular effect of succinylcholine (SCh) after receiving 3.5 ± 0.3 mg/kg (mean \pm S.E.) of the drug and that Phase II block develops after 4.1 ± 0.6 mg/kg¹. The dose at which infants less than a year develop phase II block or tachyphylaxis following continuous infusion of SCh is not defined².

Methods. This study was approved by the Subcommittee on Human Studies, Committee on Research of our institution. Ten infants, 2 weeks to 11 months, were studied. They were anesthetized with N₂O/O₂ and halothane, and maintained at 1-1.5% inspired halothane concentration. Atropine (0.1 mg) was given IV prior to the administration of SCh. 5-10 min after tracheal intubation, IV SCh (0.2 mg%) was infused via an I Med (Model 922) volumetric infusion pump at a rate of 7.5 mg/kg/h. The rate was increased to 10, 12.5, 15, 20, and 25 and 30 mg/kg/h according to clinical requirements and the twitch response.

The force of contraction of the adductor of the thumb was recorded on a Grass Polygraph via a Grass FT-03 force displacement transducer. Square wave impulses of supra-maximal voltage were delivered from a Grass S88 stimulator to the ulnar nerve via surface electrodes at a frequency of 0.1 Hz. Intermittently train-of-four stimuli (2 Hz for 2 sec) were also recorded.

Tachyphylaxis was defined to occur when the twitch height increased to more than 10% of the height achieved during the constant SCh IV infusion. Phase II block was considered to occur when the fourth twitch (T₄) in a train-of-four response was 50% or less of the first twitch of the same train (T₄/T₁=50%)

Results. Infants less than 3 months showed marked resistance to the neuromuscular effects of SCh, when compared to older infants.

	Infants 2wks-3mos 5	Infants 6mos-11mos 5
# of patients	5	5
Mean (\pm SE) infusion rate that produced 90-95% depression of the twitch (mg/kg/h)	28.0 \pm 3.4*	8.5 \pm 1.3*
Total dose of SCh to onset of tachyphylaxis (mg/kg)	3.9 \pm 0.3	3.1 \pm 0.9
Duration of SCh infusion to onset of tachyphylaxis (min)	13.4 \pm 2.4	18.0 \pm 4.3
Total dose of SCh to onset of Phase II block (mg/kg)	5.9 \pm 0.6	4.4 \pm 0.8
Duration of SCh infusion to onset of Phase II block (min)	17.4 \pm 3.5	30.3 \pm 6.3
Recovery time of train-of-four:		
To 25%	1.5 \pm 0.5	1.3 \pm 0.3
" 50%	4.5 \pm 0.9	2.6 \pm 0.4
" 75%	16.8 \pm 4.5**	4.6 \pm 0.9**
*p<0.001		** p<0.025

Discussion. The requirement and the neuromuscular response of infants older than 6 mos was similar to children between 1-15 years. In contrast, infants less than 3 mos showed a significantly higher resistance to the effects of SCh and recovered much faster from its effects.

From single dose studies², it has been suggested that this higher requirement is due to the larger extracellular fluid volume of the infant. However, this marked resistance (3 times) can only be partially explained by the differences in extracellular volume. Other factors which could account for this difference are a change in receptor sensitivity and an alteration in cholinesterase activity.

References

1. DeCook, TH, Goudsouzian, NG: Tachyphylaxis and Phase II block during infusion of succinylcholine in children. *Anesth Analg* 59:639-643, 1980.
2. Cook, DR: Muscle relaxants in infants and children. *Anesth Analg* 60:335-343, 1981.