

Vecuronium and Prolonged Neuromuscular Blockade in Postpartum Patients

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The intermediate duration of action of vecuronium (*i.e.*, longer than succinylcholine, shorter than pancuronium) suggests that it should be useful in short obstetrical procedures, such as postpartum tubal ligation. However, studies of vecuronium in pregnant patients are few, and there are no reported studies in the postpartum patient. The characteristics of three doses of vecuronium in postpartum patients were compared to a nonpregnant control group in this study.

MATERIALS AND METHODS

The study was undertaken with Institutional Review Board approval. Thirty ASA physical status I and II patients undergoing elective postpartum tubal ligation and ten ASA physical status I and II patients undergoing elective gynecologic procedures were studied. Postpartum patients received cimetidine 300 mg orally at 0600 the morning of surgery, and metoclopramide 10 mg iv plus Bicitra 30 cc PO 30 min prior to induction of anesthesia. All patients were monitored in the operating room with a peripheral nerve stimulator (Neuro Stim II) delivering a "train-of-four" stimulation over the ulnar nerve at the wrist. Neuromuscular response was observed visually. Following fentanyl 2 µg/kg iv and thiopental 3 mg/kg iv, a baseline train-of-four was obtained. Vecuronium was then given to postpartum patients in a dose of 0.05 mg/kg (group I), 0.07 mg/kg (group II), or 0.1 mg/kg (group III). The non-pregnant controls (group IV) received 0.1 mg/kg vecuronium. The train-of-four twitch response was monitored every 10 s throughout the case in all groups. Onset of complete motor blockade was taken as the time from the end of injection of vecuronium to the disappearance of all twitches in a train-of-four sequence. The duration of

clinical relaxation was taken as the time from end of injection of vecuronium to the appearance of the fourth twitch in the train-of-four sequence. This corresponds to 25% recovery of twitch height.¹ After maximal twitch suppression, the trachea was intubated. Intubating conditions were evaluated and based on relaxation of the jaw and vocal cords and coughing.

Anesthesia was maintained using 70% nitrous oxide in oxygen with supplemental 50 µg doses of fentanyl given iv for hypertension or tachycardia during the procedure. After return of the fourth twitch in the train-of-four response, neuromuscular blockade was antagonized with atropine 0.02 mg/kg and neostigmine 0.04 mg/kg. Adequacy of recovery was assessed by return of train-of-four response to baseline and ability to sustain head lift for 5 s.

The duration of the three doses of vecuronium used in postpartum patients were compared by linear regression. Other data in the postpartum groups were compared by analysis of variance. The postpartum group receiving 0.1 mg/kg vecuronium was compared to the nonpregnant control group using Student's *t* test. A *P* value of less than .05 was considered significant.

RESULTS

The demography of the postpartum groups I-III is shown in table 1. There was no significant difference in demographics or onset times between the three groups. All three doses of vecuronium provided complete twitch suppression with good (cords relaxed, slight diaphragmatic movement) to excellent (cords widely abducted, no movement) intubating conditions. Three patients in the 0.05 mg/kg dosage did not completely depress twitch tension.

Time from administration of vecuronium to return of fourth twitch (clinical duration) ranged from a mean time of 31.4 min in the 0.05 mg/kg group I to a mean time of 63.0 min in the 0.1 mg/kg group III. A linear response between dose and duration was found (fig. 1) ($r = .48$, $P < 0.01$). In the nonpregnant control group, however, clinical duration was 35 min at a 0.1 mg/kg dose. When compared to the postpartum patients in group III who also received 0.1 mg/kg vecuronium (table I), this difference in clinical duration between non-pregnant and postpartum patients was highly significant ($P < .001$). All patients were easily reversed

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TABLE 1. Characteristics of Vecuronium Neuromuscular Blockade

	Postpartum			Nonpregnant
	Group I	Group II	Group III	Group IV
n	10	10	10	10
Dose (mg/kg)	.05	.07	0.1	0.1
Parity	4.0	3.7	3.5	—
Height (cm)	157 ± 4.6	158 ± 2.3	158 ± 4.6	163 ± 7
Weight (kg)	65.8 ± 3.3	64.6 ± 3.7	62.6 ± 3.6	65 ± 7.9
Neuromuscular blockade				
Onset (min)	3.2 ± 0.4	3.5 ± 2.1	2.4 ± 0.2	2.9 ± 0.6
Clinical Duration (min)	31.4 ± 1.5	42.5 ± 4.9	63.0 ± 5.9	35.3 ± 3.1*

Values are mean ± SE.

* Significantly different from postpartum group III ($P < 0.001$).

after return of fourth twitch in the train-of-four response.

DISCUSSION

The onset times for vecuronium in our postpartum patients were similar to those reported previously.²⁻⁴ Increasing the dose of vecuronium did not decrease the onset time, but good intubating conditions were obtained in all patients. Agoston *et al.*⁵ found excellent intubating conditions with a blockade of the peripheral twitch response of only 40–60% when using vecuronium.

In this study, the clinical duration of vecuronium in postpartum patients was considerably longer than expected. Previous studies in non-obstetric patients have reported clinical durations of 30–40 min after an intubating dose of 0.1 mg/kg.^{6,7} We found similar results in our non-pregnant control group; however, in the postpartum patients, 0.1 mg/kg vecuronium provided approximately 1 h of clinical surgical relaxation. A dose of 0.05 mg/kg in postpartum patients provided a 31-min

period of relaxation, similar to the recommended intubating dose of 0.1 mg/kg in non-pregnant patients.

There are few studies of vecuronium in pregnant patients. Baraka *et al.*⁸ administered vecuronium 0.05 mg/kg to patients undergoing cesarean section after recovery from succinylcholine. Under those conditions, the period of clinical relaxation was 19 min. Dailey *et al.*⁹ found that the elimination half-life in pregnant patients at cesarean section was significantly shorter as compared to non-pregnant patients. Since our patients were only 24–48 h postpartum, the finding of a significantly prolonged block after vecuronium was unexpected. However, a recent study in rabbits found the ED₅₀ of vecuronium to be decreased by more than half in pregnant rabbits when compared to non-pregnant animals. Furthermore, the recovery time in the pregnant animals was significantly longer.¹⁰

In the immediate postpartum period, the clinical duration of vecuronium neuromuscular blockade was almost twice that which was expected. The reasons for this are unclear, and require further study to determine the cause of these differences between postpartum and non-pregnant patients.

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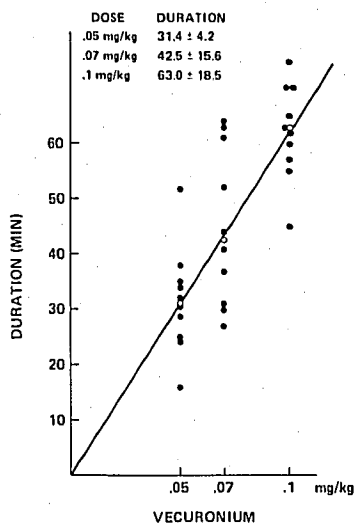


FIG. 1. Relationship of dose of vecuronium to its clinical duration. $r = .48$, $P < 0.01$.

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Burn, Erosion, and "Sun"tan With the Use of Pulse Oximetry in Infants

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The less-invasive nature of pulse oximetry has contributed greatly to monitoring in anesthesia and critical care medicine. We have been using various pulse oximeters for the past 8 yr in children, and have encountered three complications, as described below.

CASE REPORTS

Case 1. A 3-month-old infant was admitted for elective repair of a right inguinal hernia. A pulse oximeter (Nellcor® N-100 probe I-25, Nellcor) was placed on the left great toe to collect normal baseline data the night before surgery. A nurse removed the probe 6 h later because the infant had been unusually irritable. She found a localized skin burn underneath the photo-transmitter side of the probe. The skin lesion turned into a blister (fig. 1).

Upon investigation, the surface temperature of the photo-transmitter side of this particular probe showed over 70° C. The overheating was not solved by using another new probe. The device was returned to the manufacturer for repair. The skin burn healed without any sequelae.

Case 2. A 4-month-old infant was paralyzed and ventilation controlled following repair of congenital tracheal stenosis. The ear probe of a pulse oximeter (Biox III®, Ohmeda) was placed on the upper part of the left antihelix. Because of the stable readings, the probe was left

in place for over 48 h without reclipping or relocating. An area of mild skin erosion was noted underneath the ear probe, presumably because of clipping pressure. It healed without any sequelae.

Case 3. An 8-month-old infant's ventilation was controlled following a repair of total anomalous pulmonary venous return. The left foot was fixed on a splint and a pair of fiberoptic finger probes of a pulse oximeter (Mochida MET 147®, Minolta) was attached for 5 continuous days. Upon removal of the probe, a localized tanned area coinciding with the photo-transmitter probe was noted. No thermal injury or skin burn was noted, and the hyperpigmentation had faded 3 months later.

DISCUSSION

Recent articles on the use of pulse oximetry mainly stress its usefulness and the non-invasive nature.¹⁻³ Although the complications described by us were of a mild nature, they could become serious if unnoticed for an extended period of time. Until real electric safety is established by the manufacturer, routine evaluation of the probe site is mandatory.

Pressure erosion or necrosis can and should be prevented. Until a better ear probe is developed, ear probes should be reclipped or relocated frequently during use. Although we have not experienced pressure necrosis, the tight application of flexible finger probes with elastic adhesive tape could cause this. The use of double-sided self-adhesive tape may solve this, but would prevent routine evaluation of the probe site because of possible skin abrasion upon removal, especially in premature infants. Since pulse oximetry does not require probes to be in tight contact with skin, unlike transcutaneous oxygen electrodes, the construction of probes may need to be modified to avoid these problems in pediatric use.⁴

In summary, non-invasive pulse oximetry is not necessarily harmless. We have observed one skin burn from

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