

Pharmacokinetic Modeling of Ropivacaine Following Single Shot Erector Spinae Plane Block in Pediatric Patients: *a feasibility study*

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BACKGROUND

Wide variation exists in the dosing of local anesthetics for regional anesthesia in infants and children due to local anesthetic toxicity concerns. There are no evidence-based guidelines on the appropriate dosing of erector spinae plane (ESP) blocks in children.

PURPOSE

The **aim** of this **study** was to evaluate the pharmacokinetic profile of serum Ropivacaine concentrations following a single-shot ESP block in children.

METHODS

Study Design: Prospective, observational, pilot study; STROBE guidelines were maintained.

Participants: Four children aged 6 months to 18 years, who underwent video-assisted thoracoscopic surgery were included in the study (Table 1).

Unilateral ultrasound-guided ESP block was performed with Ropivacaine 1.5mg/kg/dose. Total and free serum Ropivacaine concentrations were collected at baseline and the following time points after block injection: 30, 60, and 90-minutes and 2, 4, and 6-hours (Figure 1). A baseline alpha-1 acid glycoprotein was also collected. Pharmacokinetic 1-compartment modeling with NONMEM v.7.4 analyzed the Ropivacaine population pharmacokinetics (Figure 2).

Age	Weight (kg)	Surgical Procedure	Initial Ropivacaine Bolus (mg)	ESP level	Intraoperative Opioid MME/kg	AAG (mg/dl)
15 yo	56.2	Thoracoscopy, left lower lobe wedge resection	84.3	T6-7	0.1	xx
8 yo	22.1	Thoracoscopy, excision of left chest mediastinal tumor	33.15	T7-8	0.2	65
11 mo	9.5	Thoracoscopy, right lobectomy	14.4	T6-7	0.16	47
15 yo	53.8	Esophagomyotomy	80.7	T8-9	0.15	71

Table 1: Demographic data and perioperative variables

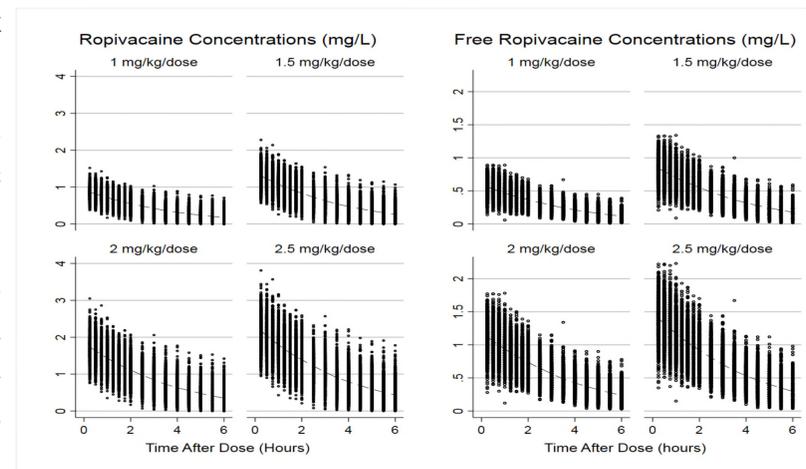
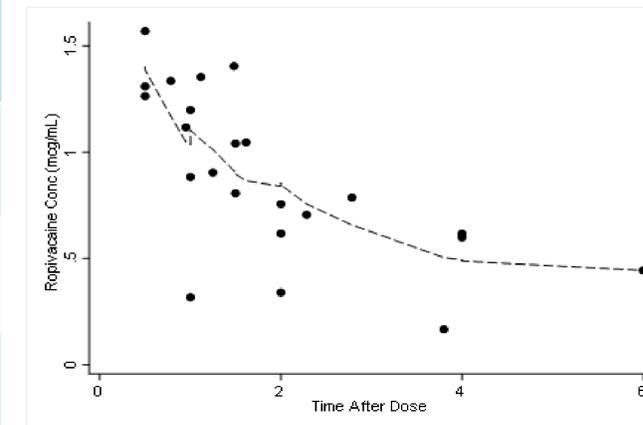


Figure 2: Total and free ropivacaine with pharmacokinetic modeling

Ropivacaine Concentration over Time After Dose



Free Ropivacaine vs Time after Dose

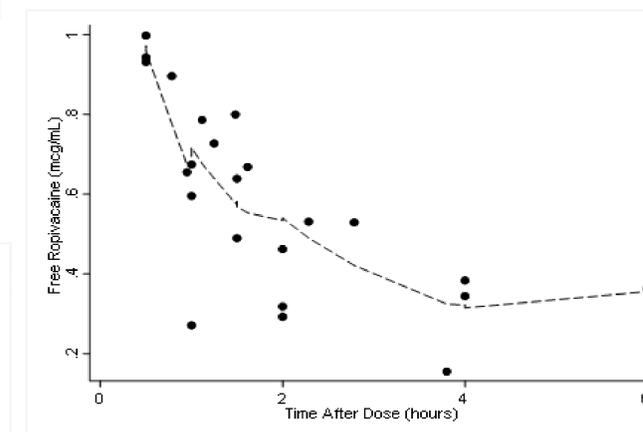


Figure 1: Total and free ropivacaine

RESULTS

- Serum Ropivacaine concentrations did not exceed the local anesthetic threshold for central nervous system toxicity (0.6mg/L) following a single-shot ESP block at 1.5mg/kg/dose
- When adjusted for age and weight, population pharmacokinetic modeling of Ropivacaine dosing for the block was safe up to 2.5mg/kg/dose

CONCLUSION

- Regional anesthesia in children entails uncertainty in assessing early neurotoxicity
- In our study, peak unbound Ropivacaine plasma concentrations did not exceed 2µg/ml following a single-shot ESP block
- Pharmacokinetic modeling suggests that even with higher Ropivacaine dosing of up to 2.5mg/kg/dose, neurotoxicity levels would not be achieved
- Our *N* was not high enough for generalizability
- This pilot study allows for the development of a randomized clinical trial assessing the minimum effective dose of single-shot ESP block in children

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