PHARMACOKINETIC MODELING OF ROPIVACAINE FOLLOWING SINGLE-SHOT ERECTOR SPINAE PLANE BLOCK IN CHILDREN: A PILOT STUDY

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Background: Wide variation exists in the dosing of local anesthetics for regional anesthesia in infants and children. Although the efficacy of the erector spinae plane (ESP) block has been described in children, the pharmacokinetic profile remains unknown. The aim of this study was to evaluate the pharmacokinetic profile of serum Ropivacaine concentrations following a single-shot unilateral ESP block in children. We hypothesize that free serum Ropivacaine levels will not result in a concentration associated with central nervous system toxicity.

Materials/Methods: This was a prospective, observational investigation approved by the Baylor College of Medicine IRB. Children aged 6 months to 18 years, who underwent minimally invasive video-assisted thoracoscopic surgery with the adjunct of a single-shot ESP block, were enrolled. Unilateral ultrasound-guided erector spinae plane 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. A baseline alpha-1 acid glycoprotein was also collected. Liquid chromatography/mass spectroscopy (LC-MSMS) was used to process the plasma for Ropivacaine metabolites. Pharmacokinetic 1-compartment modeling with NONMEM v.7.4 analyzed the Ropivacaine population pharmacokinetics.

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

Conclusions: Neurological manifestation is the first and most common feature of local anesthetic toxicity. However, regional anesthesia in children limits the ability to assess early local anesthetic toxicity since children are often under general anesthesia. In our study, peak unbound Ropivacaine plasma concentrations did not exceed 2μg/ml following a single-shot ESP block with a dose of 1.5mg/kg/dose. Furthermore, pharmacokinetic modeling extrapolation suggests that a neurotoxic concentration with higher Ropivacaine dosing up to 2.5mg/kg/dose would not be achieved. This pilot study allows for the safe development of a randomized clinical trial for unilateral and bilateral ESP block efficacy with expansion to other newer truncal fascial plane blocks in children.

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