Neuromuscular blocking agent Rocuronium correlates with increasing GMFCS score and gestational age in patients with cerebral palsy

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ABSTRACT

Background
Cerebral palsy (CP) is a group of conditions associated with static encephalopathy and disordered movement. Children with spastic-type CP are resistant to non-depolarizing neuromuscular blocking agents (NMBA) during surgery. NMBA resistance has been associated with chronic anticonvulsant therapy (CAT), but since NMBA like rocuronium (ROC) competitively inhibit nicotinic acetylcholine receptors (AChRs) at neuromuscular junctions (NMJs), variations in effective dosing can also indicate NMJ disruption. Previous studies indicate that patients with CP have disorganized neuromuscular junctions (NMJs), but the relationships between ROC dosing, the degree of disordered movement, the use of CAT, and NMJ organization have not been well studied.

Hypotheses
Rocuronium use in surgery is higher in patients with spastic CP. ROC resistance in CP is associated with NMJ disruption, increasing Gross Motor Function Classification System score, disease etiology, and CAT.

Approach
Study participants with spastic CP and controls were enrolled, ROC dosage was compared against degree of NMJ dysmorphism, disease etiology, and surrogate measures of liver function (pre-operative serum levels of ALT). NMJ disruption was evaluated by examining the microanatomy of select NMJ components with fluorescence microscopy and a co-localization algorithm.

RESULTS

Rocuronium dosing among comparison groups: Participants with CP required about 2.5 times the standard dose of 0.6 mg/kg of body weight (represented by horizontal dashed bar, p=5x10^-4, MWU). Those with CP who were on CAT required significantly more ROC than those who were not (p=7.1x10^-3, MWU). Participants who were full-term or had a higher birth weight, required more ROC than pre-term participants (p=0.04 and p=0.02 respectively, MWU). ROC dose was both significantly different across and correlated with, increasing GMFCS score (p=0.01, KW, and p=0.0001; Spearman’s rho).

CONCLUSIONS

- ROC dosing was higher in patients with spastic CP.
- Participants with CP on chronic anticonvulsant therapy (CAT) required more ROC than those with CP who were not on anticonvulsants; both groups required more ROC than controls.
- Participants on CAT had elevated serum ALT (an indicator of liver function) that correlated with ROC dosing.
- In participants with CP who were not on anticonvulsants, ROC dosing correlated with NMJ organization scores.
- ROC dosing correlated with:
  - GMFCS score
  - Birth weight (TD > LBW)
  - Gestational age at birth (full term > pre-term)

Further work is needed to understand the detailed mechanisms of ROC resistance in spastic CP.

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REFERENCES

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