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The Efficacy and Safety of Mivacurium in Children in Singapore

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ABSTRACT

Aim: The aim of this study was to evaluate the clinical use of mivacurium, a short-acting, non-depolarising muscle relaxant, in the paediatric population in Singapore.

Methods: Twenty children between the ages of 2 and 12 years were given mivacurium to maintain neuromuscular blockade during nitrous oxide-halothane anaesthesia. Reversal from neuromuscular blockade was spontaneous. The onset, ease of intubation after different doses of mivacurium, and the ease of reversal were evaluated.

Results: Different intubating doses of mivacurium did not result in significantly different times of onset. The mean recovery index (25% to 75% recovery) was 4.1 minutes. There were no adverse reactions.

Conclusions: Mivacurium provided rapid and efficacious onset of neuromuscular blockade in the local paediatric population. Rapid spontaneous recovery obviated the need for reversal agents.

Keywords: anaesthesia; paediatric; neuromuscular relaxants; mivacurium

INTRODUCTION

Mivacurium is a short-acting non-depolarising neuromuscular blocking agent that has been shown to be safe and efficacious in both adults[1,2] and children[3]. The objective of this study was to evaluate its use in the paediatric Asian population in Singapore.

This study was approved by the Hospital Ethical Committee of the Singapore General Hospital. Written parental consent was obtained for all patients.

METHODS

Twenty-five ASA class I or II patients aged 2 to 12 years requiring tracheal intubation and neuromuscular blockade for elective surgery were studied. Patients receiving aminoglycoside antibiotics, antihistamines, quinidine or trimetaphan within 48 hours prior to the study were excluded. Also excluded were those receiving carbamazepine or phenytoin within a week prior to the study.

All patients were monitored with electrocardiogram, non-invasive blood pressure, pulse oximetry, end-tidal carbon dioxide and skin temperature. Neuromuscular monitoring was done with the TOF-Guard acceleromyograph (Organon Technika). Neuromuscular monitoring was commenced after induction but before administration of mivacurium. The degree of neuromuscular blockade was assessed as the percentage reduction, relative to control, of the first twitch (T1) of the train-of-four response.

Anaesthesia was induced with either intravenous thiopentone 5 mg/kg or by inhalation of halothane (up to 4%), nitrous oxide 50% and oxygen 50%. The patients were randomly allocated into two groups: Group A (n = 12) received a dose of mivacurium 0.2 mg/kg for tracheal intubation whilst Group B (n = 8) received mivacurium 0.25 mg/kg. Intubation was attempted when T1 was decreased to 25% or less. When the twitch height reached 5% recovery, an infusion of mivacurium was started at a rate of 10 μg/kg/min. 1 μg/kg/min adjustments of the infusion rate were made to maintain neuromuscular blockade at 95 ± 4%. Infusion rates were maintained for at least 3 minutes before making any changes. Spontaneous recovery was allowed to take place at the end of surgery. The intubating conditions were graded as follows:

Grade 1 Easy passage of tube without coughing.

Grade 2 Passage of tube with slight coughing and/or bucking. Vocal cords relaxed and adducted.

Grade 3 Passage of tube with moderate coughing and/or bucking. Vocal cords moderately adducted.

Grade 4 Passage of tube not possible. Vocal cords tightly adducted.

RESULTS

Twenty-five patients were studied. Five patients were omitted from analysis because of incomplete data collection.

There was no significant difference in age or weight between Group A (n = 12) receiving 0.2 mg/kg and Group B (n= 8) receiving 0.25 mg/kg mivacurium for intubation (see below).

	GROUP A	GROUP B
Age (mean ± SD) yr	5.4 ± 2.6	6.25 ± 3.7
Weight (mean ± SD) kg	20.2 ± 9.0	24.2 ± 12.5

The mean time taken to reach T1 = 25% was 1.8 ± 0.4 (1.0 – 2.5) minutes for Group A, and 1.6 ± 0.5 (1.0 – 2.7) minutes for Group B. There was no significant difference in the time of onset of neuromuscular blockade between the 2 groups.

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Intubating conditions were optimal (Grade 1) in all patients except for one patient in Group A who coughed on intubation (Grade 3).

The mean recovery index (time taken for T1 to recover from 25% to 75% of control), was 4.1 ± 1.6 (1.45 – 7.5) minutes.

None of the patients developed cutaneous flushing or urticaria after receiving the intubating dose or during infusion of mivacurium. There were no significant changes in blood pressure or heart rate. After extubation, none of the patients exhibited residual weakness or required reintubation.

DISCUSSION

Mivacurium has been shown to be effective and safe in children. The manufacturer's recommended intubating dose is 0.2 mg/kg. While the onset time is said to be dose dependent, our experience found no significant difference between using 0.2 mg/kg and 0.25 mg/kg for intubation. None of the patients developed cutaneous flushing, urticaria or significant changes in blood pressure and heart rate.

While the onset of mivacurium was rapid at 1 to 2.7 minutes, it is still not as rapid as suxamethonium which, at a dose of 0.5 to 1.0 mg/kg, has an onset time of 30 to 60 seconds. The time of onset of mivacurium may be further reduced by increasing the intubating dose, but this will increase the incidence of side-effects resulting from histamine release. However, mivacurium may prove to be an alternative to suxamethonium in rapid sequence induction, especially in conditions like malignant hyperthermia or open globe injury, where the latter drug is contraindicated.

Although most reports measure onset as the time taken to reach 95% twitch suppression, we found that at 75% twitch suppression intubating conditions were optimal in all patients except one. A larger number of patients will need to be studied to determine if this is clinically significant.

We found that spontaneous recovery from neuromuscular blockade after an infusion of mivacurium to be rapid. The mean recovery index (T25 – 75%) of 4.1 ± 1.6 minutes was comparable to those in other reports[4-6]. The present study did not analyse the recovery times after the two different intubating doses of mivacurium.

Mivacurium would be ideal in cases of neuromuscular disorders such as myasthenia gravis and muscle dystrophy syndromes where spontaneous recovery without residual neuromuscular blockade is a particularly desirable characteristic. It is also useful in day-surgery where suxamethonium-induced muscle pains may be avoided. Its rapid recovery after infusions of varying duration allows for fast turnover of cases and prompt discharge of patients.

CONCLUSION

In conclusion, mivacurium is a rapid-onset, short-acting non-depolarising muscle relaxant which has minimal side-effects when administered to children. Its rapid onset may make it an alternative to suxamethonium in rapid sequence induction. Reversal of neuromuscular blockade is not necessary as spontaneous recovery is rapid even after an infusion.

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