

Rocuronium Versus Suxamethonium: A Survey of First-line Muscle Relaxant Use in UK Prehospital Rapid Sequence Induction

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Abbreviations:

BASICS: British Association for Immediate Care Society
HEMS: Helicopter Emergency Medical Service
RSI: rapid sequence induction
UK: United Kingdom

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Abstract

Introduction: Prehospital anaesthesia in the United Kingdom (UK) is provided by Helicopter Emergency Medical Service (HEMS) and British Association for Immediate Care (BASICS), a road-based service. Muscle relaxation in rapid sequence induction (RSI) has been traditionally undertaken with the use of suxamethonium; however, rocuronium at higher doses has comparable intubating conditions with fewer side effects. **Hypothesis/Problem:** The aim of this survey was to establish how many prehospital services in the UK are now using rocuronium as first line in RSI.

Methods: An online survey was constructed identifying choice of first-line muscle relaxant for RSI and emailed to lead clinicians for BASICS and HEMS services across the UK. If rocuronium was used, further questions regarding optimal dose, sugammadex, contraindications, and difference in intubating conditions were asked.

Results: A total of 29 full responses (93.5%) were obtained from 31 services contacted. Suxamethonium was used first line by 17 prehospital services (58.6%) and rocuronium by 12 (41.4%). In 11 services (91.7%), a dose of 1 mg/kg of rocuronium was used, and in one service, 1.2 mg/kg (8.3%) was used. No services using rocuronium carried sugammadex. In five services, slower relaxation time was found using rocuronium (41.7%), and in seven services, no difference in intubation conditions were noted (58.3%). Contraindications to rocuronium use included high probability of difficult airway and anaphylaxis.

Conclusion: Use of rocuronium as first-line muscle relaxant in prehospital RSI is increasing. Continued auditing of practice will ascertain which services have adopted change and identify if complications of failed intubation increase as a result.

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Introduction

Prehospital care within the United Kingdom (UK) encompasses both Helicopter Emergency Medical Service (HEMS) and British Association for Immediate Care (BASICS), a predominantly road-based service. Both services provide physician-delivered care and are involved in prehospital rapid sequence induction (RSI) and anaesthesia.^{1,2}

Muscle relaxation in RSI has been traditionally undertaken with the use of suxamethonium, due to its rapid onset and short duration; however, it can be associated with potentially life-threatening side effects, including hyperkalaemia, bradycardia, and malignant hyperthermia.³ Rocuronium, a nondepolarizing neuromuscular blocker with a longer duration of action, at higher doses has comparable intubating conditions to suxamethonium without the associated side effects, and is therefore a useful alternative.⁴⁻⁹

The aim of this survey was to establish how many prehospital services in the UK are now using rocuronium as first line in RSI.

Methods

A database was constructed of all UK providers of prehospital care in 2013. All BASICS providers throughout the UK were identified through their web site, and air ambulance

1. Which service are you responding from (eg, BASICS/HEMS)
2. What is your standard first-line neuromuscular blocking agent for prehospital RSI?
☐ Suxamethonium
☐ Rocuronium
3. If rocuronium is used for induction, what dose is used?
☐ 0.6 mg/kg
☐ 1 mg/kg
☐ 1.2 mg/kg
☐ Other
4. If rocuronium is first line for RSI, in what circumstances would you not use it?
5. Do you routinely carry sugammadex?
6. If using rocuronium, have you found any difference in intubating conditions achieved?

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Table 1. Survey Questions Sent to All Prehospital Services
Abbreviations: BASICS, British Association for Immediate Care Society; HEMS, Helicopter Emergency Medical Services; RSI, rapid sequence induction.

services in the UK were identified through the UK HEMS web site.¹⁻² The lead clinician for each service was contacted via email to complete the survey on behalf of their service. The survey was constructed using online questionnaire SurveyMonkey (SurveyMonkey; Palo Alto, California USA).¹⁰ Questions related specifically to the choice of first-line neuromuscular blocker (rocuronium or suxamethonium) in prehospital RSI. If suxamethonium was answered, then the survey ended at that point; however, if rocuronium was answered, four further questions regarding dose, use of sugammadex, contraindications to use, and difference in intubating conditions were asked (Table 1).

Results

Nineteen regional air ambulance services were identified throughout the UK, of which, 15 delivered physician-based prehospital care. Thirty organized BASICS schemes were identified across the UK, of which, 16 services routinely delivered physician-based care able to provide prehospital anaesthesia. This gave a total of 31 services providing prehospital anaesthesia, and all were contacted. No reply was obtained from one service. A total of 30 responses were obtained (96.8%); however, one was incomplete resulting in 29 full responses (93.5%).

First Line Neuromuscular Blocker

Suxamethonium was used as first line by 17 prehospital services routinely (58.6%), and rocuronium was used first by 12 services (41.4%).

Dosage

In 11 services, a dose of 1 mg/kg of rocuronium was used at induction (91.7%).

In only one service, a dose of 1.2 mg/kg was used (8.3%). No service used any other dose.

Contraindications to First Line Use of Rocuronium

This question allowed a free-text answer and services could specify many reasons, if required (two services gave more than one reason). In nine services, if there was a very high probability of difficult airway being experienced, then careful consideration would be given to whether rocuronium should be used (75%). Previous anaphylaxis or allergy was a contraindication to use in three services (25%); however, it was recognized that in the prehospital setting, this information was unlikely to be available. In two services, no contraindications to first-line use of rocuronium were documented (16.7%).

Sugammadex Use

In all 12 services using rocuronium for induction, none routinely carried sugammadex (0%).

Difference in Intubating Conditions

In five services, slower relaxation time was found with use of rocuronium (41.7%), and in seven services, no difference in intubation conditions were noted (58.3%).

Discussion

Recent studies have shown high-dose rocuronium (1-1.2 mg/kg) is comparable to suxamethonium in RSI.⁴⁻⁹ Previous surveys of UK prehospital anaesthesia found that 32% of prehospital services carry rocuronium.¹¹ Use of rocuronium as a first-line muscle relaxant is on the increase, and almost half the services contacted in this survey have converted from suxamethonium. In theory, rocuronium should not be used in a difficult airway due to the increased risk of failed intubation; however, the nature of all prehospital RSIs necessitate all intubations to be difficult and waking the patient up is usually not an option. In a study of 402 prehospital intubations by London HEMS, three cricothyroidotomies were performed, two as primary and one as a rescue procedure.¹² In this study, 98.8% were intubated on first or second attempt, which illustrates the benefits and importance of adequate training and a clear failed-intubation drill.¹² The longer duration of action of rocuronium can be an advantage when a failed intubation has occurred and a rescue technique is required. The patient will remain paralyzed without a second dose of suxamethonium needing to be administered, which can be associated with life-threatening bradycardia.³ This is particularly the case with children. If physicians have concerns regarding rocuronium and they anticipate a very difficult airway, consideration should be given to the prehospital use of sugammadex. However, this may not be feasible with the high cost and short shelf life (after first opening and dilution, it requires to be stored at 2°C to 8°C and used within 24 hours).¹³ Intubation conditions obtained by high-dose rocuronium and suxamethonium are similar.⁴⁻⁹ There is a tendency towards quicker relaxation time with suxamethonium, but this appears clinically insignificant.^{4,5,9} The mixed views within this survey have echoed these results.

Conclusion

Use of rocuronium as a first-line muscle relaxant in prehospital RSI is increasing. Continued auditing of practice will be important to ascertain which services have adopted this change and identify if complications of failed intubation increase as a result.

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