

Study of Efficacy of Sevoflurane with Rocuronium during Induction in Neurosurgical Patients

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Abstract

Background: Rocuronium provides good intubating conditions but large doses causes prolongation of its duration of action, making it unsuitable for short surgical procedures. **Aims:** We assessed the efficacy of sevoflurane with rocuronium during induction in terms of reducing the onset time for intubation, evaluating intubating conditions and haemodynamic responses during intubation. **Subjects and Methods:** This prospective, randomised, double-blind study was conducted in 40 adult patients undergoing lumbar disc operations under general anaesthesia were randomly allocated into two equal groups namely Group R (received 0.8 mg/kg of rocuronium) and Group RS (received 0.8 mg/kg of rocuronium and 2% sevoflurane during induction). **Results:** The two groups were comparable with respect to age, sex, weight and ASA grade. The time for loss of thumb adduction was 101.4 ± 11.2 s in Group R compared with 61.04 ± 5.4 s in Group RS [$P < 0.001$]. The onset time of intubation was significant [$P < 0.001$]. Significant differences in heart rate and mean arterial pressure were seen immediately after intubation, at 1 and 3 min after intubation ($P < 0.05$) between the two groups. The mean intubation score was comparable in both the groups is insignificant [$P = 0.11$]. **Conclusion:** Rocuronium 0.8 mg/kg along with 2% sevoflurane provides rapid sequence intubation during anaesthesia in neurosurgical patients.

Keywords: Sevoflurane, Rocuronium, Haemodynamic responses.

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Introduction

Endotracheal intubation using succinylcholine is an established technique for rapid sequence intubation in patients at risk of gastric aspiration. Succinylcholine has a number of undesirable side effects like hyperkalaemia, bradyarrhythmias, increased intraocular tension, increased intracranial tension,^[1] malignant hyperthermia and masseter spasm. Hence, it is not suitable in conditions like neuromuscular disorders, burns, acute head injury,^[2] open eye injury, intracranial haemorrhage spinal cord injury, cerebrovascular accidents and renal disease.^[3]

Rocuronium is an aminosteroid NDMR with rapid onset and intermediate duration of action. It has a faster neuromuscular blockade onset time compared to other NDMRs.^[4] It provides clinically acceptable intubating conditions within 60-90 s in dose range of 0.6-1.2 mg/kg,^[5] but large doses unduly prolong its duration of action, making it unsuitable for short surgical procedures. Hence, it may not be preferable for rapid sequence induction and endotracheal intubation.

Volatile anaesthetics are known to potentiate the effects of NDMRs.^[6] We used 2% sevoflurane with rocuronium bromide (at intubating dose of 0.8 mg/kg) during induction in patients undergoing elective lumbar disc surgeries under general anaesthesia.

Subjects and Methods

This prospective, randomised, double-blind study was conducted after Institute Ethics Committee approval from local review board with valid, written, informed consent from patients. Study carried out at Department of Anesthesia in 40 adult patients undergoing lumbar disc operations under general anaesthesia were randomly allocated into two equal groups namely Group R (received 0.8 mg/kg of rocuronium) and Group RS (received 0.8 mg/kg of rocuronium and 2% sevoflurane during induction).

Inclusion criteria:

Patients belonging to American Society of Anesthesiologists (ASA) physical status Grades 1 and 2 aged between 30 and 65 years, of either gender.

Exclusion criteria:

Patients with neuromuscular diseases, anticipated difficult intubation, pregnancy and breastfeeding, hepatic, renal diseases, patients with neuromuscular disorders, patient on drugs that affect neuromuscular block and pregnant and lactating mothers history of allergic reaction to rocuronium and psychiatric patients.

TOF was used for neuromuscular monitoring. The chosen hand was cleaned with spirit over the area around the ulnar nerve and the thumb. Two surface electrodes were applied over the ulnar nerve at the wrist and transducer was applied to ipsilateral thumb. In the operation theatre routine standard monitors were attached. 18 G intravenous line was secured and a drip of ringer lactate started. Patients were pre-oxygenated with 100 percent oxygen at a flow rate of 6 L/min for 3 min. After the loss of verbal response, a supramaximally set TOF stimulus was applied to the ulnar nerve at the wrist through surface electrodes (stimulation current set at 50 mA) and baseline TOF ratio percentage was noted. After giving an intubating dose of rocuronium 0.8 mg/kg, supramaximally set TOF stimulus was again applied and repeated every 15 s to evaluate visually for loss of adduction of thumb and disappearance of the first response (T1) of TOF stimuli. Onset time of intubation was taken as the time interval between the intubating dose and the loss of T1 of TOF stimuli. Intubating conditions were graded as excellent when intubating scores were between 8 and 9, good with 6-7, fair with 3-5 and poor with 0-2. Excellent and good intubating conditions were considered clinically acceptable as per Cooper et al.^[7]

Data noted included loss of thumb adduction, onset time of intubation, conditions at the time of intubation (using Cooper's scoring system), heart rate, mean arterial pressure, oxygen saturation (using pulse oximetry) at baseline, post-induction, at intubation, immediately after intubation, 1 min, 3 min and 5 min after intubation.

The observations were recorded in Microsoft excel spread sheet and analysis was done using the SPSS 21 software. A P value <0.05 was considered significant. Data noted includes loss of thumb adduction, onset time of intubation and conditions at the time of intubation (using Cooper's scoring system). Continuous measurements were presented as mean ± standard deviation (SD) used for comparing intubating conditions among the groups and demographic data.

Results

All 40 patients completed the study and following results were obtained.

Table 1: Demographic details in both groups of study

Demographic data	Group-R	Group-RS	P-Value
Age (in years)	50.6+10.1	49.4+9	>0.05
Gender(M:F)	10:10	11:9	>0.05
Weight	59.2+13.1	60.5+13.9	>0.05
ASA Grade I and II	15:5	16:4	>0.05
Duration of surgery (min)	45+7.8	47+8.1	>0.05
Duration of anesthesia (min)	50.4+8.9	51.4+9.1	>0.05

The two groups were comparable with respect to age, sex, weight and ASA grade with P value > 0.05.

The time for loss of thumb adduction was 101.4 ± 11.2 s in Group R compared with 61.04 ± 5.4 s in Group RS [P < 0.001]. The onset time of intubation was 102.65 ± 10.1 s in

Group R compared with 59.6 ± 4.1 s in Group RS [P < 0.001].

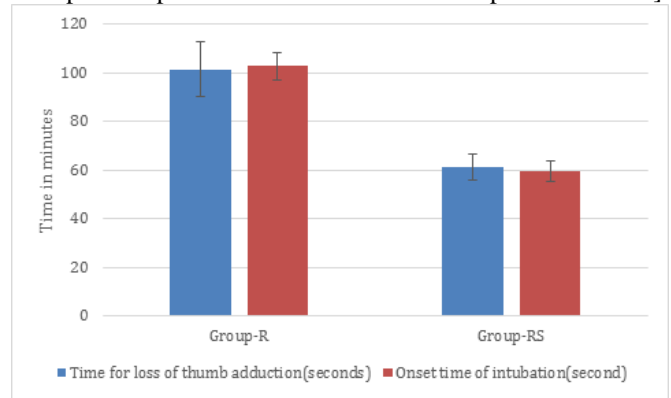


Figure 1: Neuromuscular monitoring data

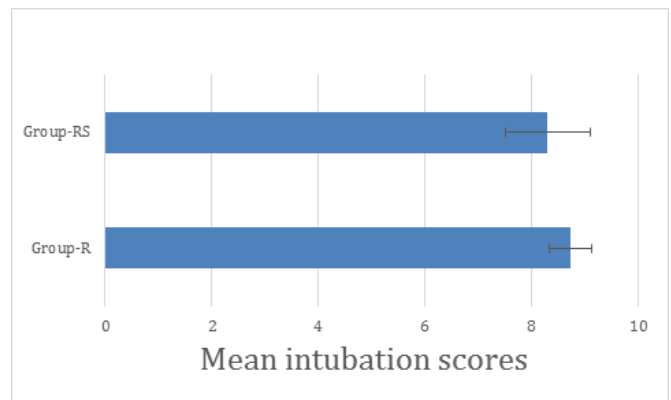


Figure 2: Mean intubation score (mean ± standard deviation)

Mean intubation score is insignificant when compared in both groups.

Table 2: Comparison of changes in Systolic blood pressure between the groups.

Time	Group-R	Group-RS	P-Value
Basal	96+8.1	94 +8.4	>0.05
Post induction	90 +7.1	83+ 7.2	>0.05
At intubation	90+7.2	83+7.1	
Immediately after intubation	99+6.1	91+6.8	
1 min after induction	98 +5.4	91+7.2	>0.05
3 min after induction	97+6.7	89+6.5	>0.05
5 min after induction	92+9.5	92+7.3	>0.05

Table 3: Comparison of changes in Heart rate between the groups.

Time	Group-R	Group-RS	P-Value
Basal	88+5.5	86 +5.4	>0.05
Post induction	87 +5.7	86+ 6.2	>0.05
At intubation	92+5.6	87+5.7	
Immediately after intubation	100+5.7	91+5.8	
1 min after induction	98 +5.4	91+5.2	<0.05
3 min after induction	97+5.7	91+5.5	<0.05
5 min after induction	96+5.7	90+5.1	<0.05

Mean arterial pressure was significantly reduced from

baseline values post-induction and at the time of intubation in Group RS as compared to Group R ($P = 0.001$). In Group R, mean arterial pressure increased immediately after intubation, at 1 and 3 min after intubation, though statistically not significant. [Table 2]

Significant differences in heart rate and mean arterial pressure were seen immediately after intubation, at 1 and 3 min after intubation ($P < 0.05$) between the two groups. Heart rate increased significantly ($P < 0.05$) above baseline values immediately after intubation, at 1 min, 3 min and 5 min after intubation in Group R as compared to Group RS. [Table 3]

Discussion

Rocuronium is derivative of vecuronium, differing from it at three positions on steroid nucleus. Rocuronium has got a rapid onset of action intermediate duration of action and is devoid of any clinically significant cardiovascular side effects at effective neuromuscular blocking doses which makes it a better agent for endotracheal intubation among non-depolarizing neuromuscular blocking drugs. Potent inhalational anaesthetic like sevoflurane is known to potentiate the neuromuscular blocking effects of aminosteroid neuromuscular blocking agents. Our study was conducted to compare the intubating time and conditions of rocuronium with 2% sevoflurane. The two groups were comparable with respect to age, sex, weight and ASA grade. Some recent studies have concluded earlier acceptable intubating conditions with sevoflurane under similar anaesthetic conditions in adult.^[9] The dose used is more than 2 times ED₉₅. Cooper et al compared the intubating conditions with rocuronium (0.6 mg/kg) and succinylcholine (1 mg/kg) in 50 patients. In the study, 95% of patients generated clinically acceptable intubating conditions at 60 s and 100% patients at 90 s with rocuronium. Intubating conditions were excellent in all cases. They concluded that rocuronium can be used as a safe alternative to succinylcholine in RSI.

In present study time of onset of intubation was significant ($P < 0.001$). Similar conclusions regarding onset time and intubating conditions were obtained from other studies.^[8,9] Wright et al.^[10] concluded that the onset time of rocuronium, in doses more than 0.8 mg/kg was comparable to that of succinylcholine 1 mg/kg at the adductor pollicis but was significantly delayed at the laryngeal adductors. Studies have found that effect of rocuronium 0.6 mg/kg was enhanced by 1.5 MAC of sevoflurane in comparison with isoflurane or propofol anaesthesia.^[11]

In Present study Significant differences in heart rate and

mean arterial pressure were seen immediately after intubation, at 1 and 3 min after intubation ($P < 0.05$) between the two groups. Elderly patients being treated with rocuronium 0.9 mg/kg showed no clinically significant change in heart rate, arterial blood pressure or plasma catecholamine concentrations.^[12] Slight to moderate increase in heart rate after rocuronium injection may be attributed to either pain on injection or to its weak vagolytic effect. The heart rate increase may be controlled by the prior administration of fentanyl.

Conclusion

Rocuronium along with sevoflurane provides excellent intubating conditions in elective neurosurgeries in patients, this approach can be considered for rapid sequence intubation during anaesthesia in neurosurgical patients.

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