Comparison of Safety and Efficacy of Intubating Conditions between Rocuronium and Suxamethonium

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ABSTRACT

BACKGROUND

We wanted to compare the safety and efficacy of rocuronium and suxamethonium with regard to tracheal intubation.

METHODS

100 patients were divided at random into two categories of 50 subjects each. The first group was the suxamethonium (10 mg / Kg) group, and the second group was the rocuronium group (0 6 mg / Kg). Intubating conditions, time of intubation, duration of action, and complications if any, were assessed.

RESULTS

Clinically appropriate (excellent, good) intubating conditions were found in 100 % of patients in both categories. But, the time taken to intubate in group II (rocuronium) was significantly longer with a mean of 92.86 seconds than for group I (suxamethonium) with a mean of 63.04 seconds. The duration of action was longer for rocuronium with a mean of 24.30 minutes compared to suxamethonium with a mean of 72.60 minutes. No significant complications were observed in either group at the time intubation.

CONCLUSIONS

Rocuronium also creates clinically appropriate intubating conditions in 100 % of patients and rocuronium can be used as an alternative to suxamethonium where suxamethonium is contraindicated or is problematic.

KEYWORDS

Suxamethonium Rocuronium, Intubation

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BACKGROUND

An anesthesiologist's prime task is to procure and retain an airway. Apparent tracheal intubation is the safest ways to access a patient's airway. Right logical conditions reduce the risk of damage associated of intubation with the trachea. Intubating criteria (muscle tone, location of the vocal cords, laryngoscopic reaction, and orientation of the tube) depend on the anaesthetic depth and form of anaesthetics used. Muscle relaxants usually promote intubation with the trachea. The most widely used and regarded as "The Gold Standard" for intubation of trachea is suxamethonium, a depolarizing muscle relaxant. Due to its multiple side effects from a slight patient pin (because of postoperative myalgia) to lethal incidents like arrhythmias and malignant hyperthermia, the use of suxamethonium was questioned. One of the key reasons for suxamethonium's success is its ability to rapidly establish correct intubating conditions. This improves protection, as it enables a patent airway to be developed early, reducing the risk of aspiration. Anaesthesiologists have the benefit of other solutions with the introduction of modern, non-depolarizing muscle relaxants, where suxamethonium is contraindicated rocuronium bromide, a newer non-depolarizing steroidal muscle relaxant, is also a step forward in developing enhanced neuromuscular blocking agents. Another milestone is its introduction into clinical practice rocuronium bromide is the only agent in currently available non-depolarizing agents that has a fast start of its action, which is equivalent to suxamethonium. It has been shown that rocuronium bromide creates intubating conditions close to those created by suxamethonium. This study compares rocuronium versus suxamethonium for tracheal intubation.

METHODS

It is a randomized prospective, comparative study conducted among 100 patients of age group 18 - 60 years undergoing elective surgery under general anaesthesia in the Department Of Anaesthesiology, SVRRGGH, Tirupati.

Inclusion Criteria

ASA grade one and two, age between 18 - 60 years planned for planned surgeries.

Exclusion Criteria

Patients with cardiovascular, respiratory, and renal disease, history of drug sensitivity, patients on medication which interact with muscle relaxants and all patients with predicted airway problem (modified Mallampati grade 3 and 4). All patients with neuromuscular disease.

Rocuronium bromide 50 mg / 5 mL – 0 6 mg / Kg.

Suxamethonium hydrochloride 50 mg / mL – 10 mg / Kg. It acknowledges informed and written consent, it notes demographic data such as name, age, gender, occupation, economic status, literacy rate. The study included hundred subjects randomly divided into two categories of 50 subjects each, with suxamethonium category being the first group and the rocuronium category being the second. All patients joining the study undergo a thorough pre-anaesthetic examination and the existence of severe systemic disease and difficult airways is excluded. Informed consent is taken, and they are clarified regarding the study process. In the pre-anaesthetic room on the morning of surgery an intravenous line is secured with an appropriate size IV cannula.

Non-invasive blood pressure monitor, electrocardiogram, pulse oximeter and neuromuscular monitor-TOF Watch monitors are used. It was used to stimulate the ulnar nerve. After sufficient area preparedness, surface electrodes were applied over the volar aspect of the wrist. The negative electrode at the proximal wrist crease was positioned approximately 1 cm proximal. The other electrode had been positioned proximally 3 - 4 cm to the first for stimulation of supramaximum current of 60 mA was chosen.

Induction

Both patients are pre-oxygenated for 3 to 5 minutes with 100 percent oxygen. Heart rate and blood pressure is assessed against induction. Patient treated with 2 mg / Kg of Propofol-1 IV. The patients either got rocuronium 0 6 mg kg-1 or suxamethonium 1 mg Kg-1 IV at random. Patients receive 100 percent O2 ventilation. Based on the rating method introduced by Krieg et al updated by Cooper et al, the intubating requirements are evaluated. The criteria considered were relaxation of the mouth, movement of the vocal cord and the patient's gross reaction to the intubation.

Intubating Conditions Scoring System were added up and further grouped as 8 - 9 = Excellent 6 - 7 = Good 3 - 5 = Fair 0 - 2 = Poor.

After intubation the endotracheal tube cuff is inflated and the tube is attached to the ventilator, and nitrous oxide, oxygen, is used to start controlled ventilation. The neuromuscular block with glycopyrrolate 0 01 mg / Kg-1 IV and neostigmine 0 05 mg / Kg IV is removed at end of the surgery. After extensive suction, the patients become extubated.

RESULTS

26 males and 24 females participated in the study.

Group	Mean	SD
Age		
Suxamethonium	38 48	9 886
Rocuronium	37 16	10 647
Weight		
Suxamethonium	56 22	9 232
Rocuronium	56 50	8 054

Table 1. Demographic Distribution in the Study

The two groups were comparable to each other concerning age, weight, and gender. The intubating conditions observed for Group I (Suxamethonium) were excellent in 45 out of 50 patients (90 %), and good in the

remaining 5 patients (10 %). While the corresponding observation in Group II (Rocuronium) was excellent in 44 out of 50 patients (88 %) and good in 6 patients (12 %).

Group	Excellent	Good	Fair	Poor	Total
Suxamethonium	45 (90 %)	5 (10%)	0	0	50
Rocuronium	44 (88 %)	6 (12 %)	0	0	50

Table 2. Intubating Conditions

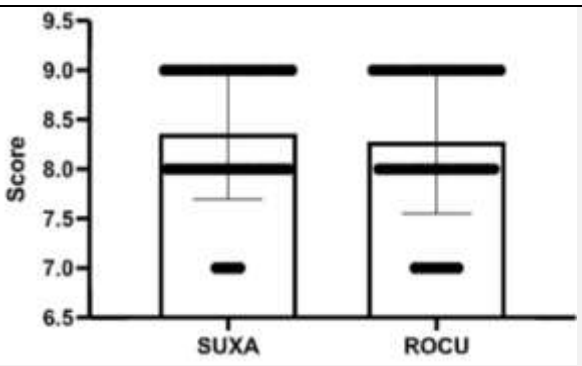

Figure 1. Intubation Score in the Present Study

The intubation score is not significant when compared in both groups.

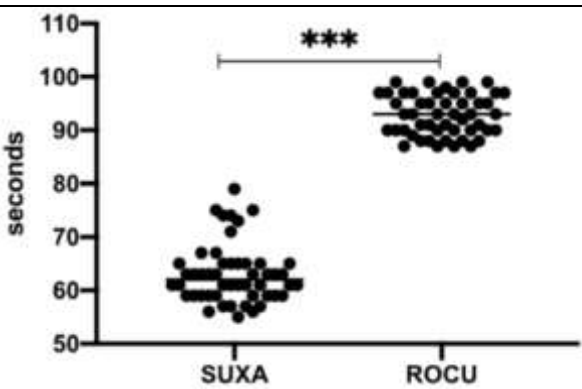

Figure 2. Time of Intubation (Seconds)

The time of intubation in group II (rocuronium) was significantly longer with a mean of 92 86 seconds than for group I (suxamethonium) with a mean of 63 04 seconds (p-value < 0.001).

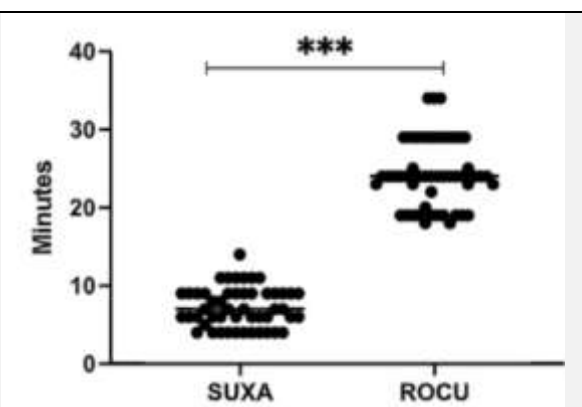

Figure 3. Duration of Action in the Present Study

The length of action compared in our sample, Group I (suxamethonium) showed that the standard deviation was 2 514 in a period of 5 - 15 minutes with an average of 7,260, whereas in Group II (rocuronium) with a mean of 24 30, the range was 18 - 34 minutes, the standard deviation was 4 330. Thus, these findings showed that rocuronium had a longer period of action compared to suxamethonium.

No significant complications observed in both the groups at the time of intubation.

DISCUSSION

The anesthetized patient's airway is unprotected and is very vulnerable to pharyngeal content aspiration. For the rapid onset of intubating conditions, suxamethonium has long been used as the neuromuscular agent of choice. But because of its depolarizing mode of action, suxamethonium has many undesirable side effects. It is either contraindicated, or its use in patients with elevated intracranial pressure, hyperkalaemia, burns, etc is problematic. It should not be used in patients with a history of malignant hyperthermia, and where pseudocholinesterase has an irregular function.

Rocuronium is a non-depolarizing relaxant drug that came into clinical usage in the early 90s and demonstrated a much quicker onset of neuromuscular inhibition compared to other non-depolarizing drugs. Many experiments using different doses, rocuronium regimes show that with a rapidity it produces appropriate intuitive conditions that approach, if not equal, that of suxamethonium. These studies have also shown that rocuronium in the rapid sequence induction of anaesthesia is a successful alternative to suxamethonium.[1,2]

Previous research found that intuitive conditions at 60 seconds were usually excellent or decent at a dose of 0 6 mg Kg-1.[3] Different workers recommended the use of a higher dose of rocuronium to accelerate the initiation of intuitive conditions during rapid sequence inductions.[1,2]

In our study, we compared the time of intubation between rocuronium and suxamethonium by the administration of 1 mg / Kg of suxamethonium to the group I and 0 6 mg / Kg of rocuronium to group II. The time of intubation in group II (rocuronium) was significantly longer with a mean of 92 86 seconds than for group I (suxamethonium) with a mean of 63 04 seconds (p-value < 0 001).

We also compared the intubating conditions in both groups, our findings were excellent in 45 out of 50 patients (90 %) and right in 5 out of 50 (10 %) of patients in Group I (suxamethonium) and excellent in 44 out of 50 (88 %) and good in 6 out of 50 (12 %) patients in Group II (rocuronium). The duration of action compared in our study, Group I (suxamethonium) showed that in a range of 5 - 15 minutes with a mean of 7 260, the standard deviation was 2 514, whereas in Group II (rocuronium) the range was 18 - 34 minutes with a mean of 24 30, the standard deviation was 4 330. Therefore, these results showed that the duration of action was longer for rocuronium compared to suxamethonium. No significant complications were found in either 0f the groups at the time of intubation.

Our results were very similar to those obtained in a study performed by Cooper et al (1992).[3] Rocuronium 0 6 mg Kg-1 developed excellent intuitive conditions in 12 out of 20 patients (60 %) at 60 seconds compared to 19 out of 20 patients (95 %) receiving suxamethonium. Intubating outcomes were outstanding or strong in all subjects in both sixty seconds and ninety seconds following suxamethonium. Intubating circumstances after rocuronium in nineteen out of twenty (95 percent) cases at sixty seconds were acceptable, being outstanding in 13 cases. At the 90s, the conditions were appropriate in all cases, with 17 out of 20 (85 percent) rated as outstanding. Due to closed vocal cords, the trachea could not be intubated at sixty seconds in one patient receiving rocuronium, but intubation was possible sixty seconds later. There was no substantial difference between suxamethonium and rocuronium in the appropriate intubating conditions.

The grade of rocuronium neuromuscular block was eighty nine percent in the 60s and 98 (3 0) percent in the 90 s. For suxamethonium the lag and start times of 23 s and 60. 4s were substantially quick than the corresponding times of 25.8s and 88.9s for rocuronium ($p < 0\ 05$). Ninety percent recovery from suxamethonium block happened in 13.3 min, while clinical relaxation period (time up to 25 percent recovery) was 30.5 minutes.

Our results were very comparable to those obtained in a study conducted by Singh Ajeet et al (2004)[4] in which the mean onset of action for suxamethonium was 65. 89 seconds and for rocuronium was 87 94 seconds.

The mean time of action in suxamethonium and rocuronium was 5 3 and 28 41 minutes, with a standard deviation of 1 and 2 minutes, respectively. No major complications related to drug administration were observed in either of of the groups at the time of intubation. Magorian et al,[5] studies found that the mean onset of action for rocuronium was 89 seconds with a range of 48 - 156 seconds and the mean onset of action was 37 minutes with a range of 23 - 75, which was consistent with our study. The onset times were identical for patients receiving 0 9 mg / Kg (75 + / - 28s) and 1.2 mg / Kg rocuronium (55 + / - 14s) and succinylcholine (50 + / - 17s). The onset time was significantly longer for the groups given 0 6 mg / Kg rocuronium (89 + / - 33s) and vecuronium (144 + / - 39s). The longest clinical duration of action was 1.2 mg / Kg rocuronium, equivalent to 0.6 and 0.9 mg / Kg rocuronium, and vecuronium, and at least succinylcholine.

The administration times for the two larger doses of rocuronium were comparable to those for succinylcholine, but the clinical period of rocuronium action was considerably longer

Our results were also more or less similar to those of Huzinga et al[6] reported clinically appropriate intubating conditions in patients with rocuronium 0 6 mg Kg – 1 at 60 seconds after administration.

In patients under different experimental conditions the intubating conditions and neuromuscular blocking profile following 600 µg / Kg rocuronium were examined. They were compared with conditions following 1 5 mg / Kg of suxamethonium, preceded by a precurarising dose (10 mg) of gallamine, and in the absence of a muscle relaxant in a control group rocuronium provided good to excellent intubating conditions at 60 as well as 90 s after administration, though the adductor pollicis muscle was only partially blocked.

Intubating conditions after suxamethonium have been similar to those after rocuronium. Half the patients in care were unable to be intubated the clinical period and recovery time of rocuronium 600 µg / Kg was 24 (4) and 9 (3) minutes, respectively. Owing to the early existence of excellent cognitive conditions, rocuronium may have a significant advantage over current non-depolarizing muscle relaxants. Results show that rocuronium may replace suxamethonium in procedures requiring rapid sequence induction.

At 60 seconds after administration, Puhringer et al (1995)[7] recorded 100 percent appropriate intuitive conditions for both suxamethonium and rocuronium. The start time for suxamethonium was found to be 72 seconds, and 130 seconds for rocuronium. In this study, T C Wicks[8] and Latorre F (1994) et al (1996)[9] reported that rocuronium 0 6 mg Kg-1 produced good to excellent intuitive conditions similar to 60 seconds of suxamethonium 1 mg Kg-1. At Latorre F Et al (1996)[9] study intubating conditions after rocuronium and suxamethonium were found to be clinically acceptable (excellent or good) in 90 percent of patients, although rocuronium muscle adductor pollicis (71 ± 23 percent) was only partially blocked compared with suxamethonium (95 ± 14 percent) ($p < 0,05$). After suxamethonium, the onset time and clinical relaxation duration were shorter ($p < 0\ 05$) and occurred at 0 8 ± 0 2, 7 ± 2 1 and 3 2 ± 1 3, 29 ± 11 min after suxamethonium and rocuronium respectively, which was consistent with our study showing that 63 ± 5 25 seconds, 7 260 ± 2 514 minutes and 92 86 ± 3 817 seconds, 24 30 ± 4 330 minutes for suxamethonium and rocuronium respectively.

As a consequence, rocuronium is accessed with a rapid onset of action, which is close to suxamethonium, choosing it as an acceptable substitute to the latter. However, rocuronium has a drawback of possessing an intervening duration of action, with the normal intuitive dose of 0 6 mg Kg-1, creating a 20 – 35 minute neuromuscular block. Having said that, its use cannot be considered in subjects with expected intubation difficulties.

CONCLUSIONS

Although suxamethonium provides ideal intubating conditions very rapidly, it has numerous side effects due to its depolarizing mechanism of action. It is either contraindicated, or its use is controversial in patients with raised intracranial pressure, hyperkalaemia, burns, etc. It should not be used in subjects with a previous episode of malignant hyperthermia, in whom there is abnormal activity of pseudocholinesterase. Due to its comparatively long term of action compared to suxamethonium, a failed intubation in patients have been given rocuronium may prove dangerous with its quick ending of action (5 - 10 minutes). Suxamethonium is a safe agent in subjects with anticipated intubation problem.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
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