# INTUBATING CONDITIONS 60 SECONDS AFTER GIVING MUSCLE RELAXANT FOR RAPID SEQUENCE INDUCTION.COMPARISON BETWEEN SUCCINYLCHOLINE AND ROCURONIUM

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## Abstract

**Objectives:** To compare efficacy of Succinylcholine with Rocuronium for rapid sequence induction
**Study Design:** Randomized control trail
**Place and Duration of Study:** The study was done in Anaesthesia department, Combined Military Hospital Kharian from 17th march 2007 to 16th march 2008
**Patients and Methods:** a total of 100 cases of elective surgery for haemorrhoids were taken and patients were randomly assigned in two equal groups using random number table. American Society of Anesthesiologist (ASA) status was assessed. Informed consent and approval of ethical committee was obtained. Patients were divided into group A and B. In both groups there were 25 males and 25 females of 20-40 years. In group A, patients were preoxygenated for 3 min then propofol was given followed by succinylcholine. After 60 seconds of giving muscle relaxant intubating conditions were assessed by vocal cords movements on laryngoscopy, apnea and abdominal jerky movements on intubation. In group B, rocuronium was given instead of succinylcholine.
**Results:** In group A one (2%) patient was having movement of vocal cords at the time of laryngoscopy while in group B nine (18%) patients had vocal cord movement (p=0.016). As far as apnea is concerned, in group A one (2%) patient was not having apnea after 60 seconds but in group B eight (16%) patients were not having apnea (p=0.031). At the time of intubation in group A three (6%) patients showed jerky movements of abdomen while in group B that movement was present in eleven (22%) patients (p=0.041).
**Conclusion:** Intubating conditions with rocuronium were not superior to those with succinylcholine.

**Keywords :** Intubation, Neuromuscular block, Rocuronium, Succinylcholine.

## Article

### INTRODUCTION

In addition to other measures to prevent aspiration at time of induction and throughout conduct of general anaesthesia, techniques like “rapid sequence induction (RSI)” and intubation are accepted and being practiced all over the world. This technique is practiced by the use of rapidly acting muscle relaxants, which provide satisfactory intubating conditions very quickly. The RSI is a life saving procedure developed for quick and safe securing of air way. It is often chosen over other intubation techniques because deep sedation and paralysis which occur simultaneously, followed by quick tracheal intubation, decreases risk of aspiration of gastric contents1. RSI therefore became the technique of choice for intubation of patients with full stomach such as trauma patients2 and lower segment caesarean section (LSCS).The success of RSI depends on medicines that can rapidly and reliably establish sedation and complete neuromuscular blockade (NMB). We can use midazolam, propofol, etomidate, thiopental and ketamine for induction of anaesthesia3. Propofol, with strong evidence of anticonvulsant property, under certain conditions, act as a proconvulsant, and should, be avoided or cautiously used in some patients4. Etomidate can be used alone for intubation but intubating conditions are inferior to RSI5. RSI is a technique which is also used by paramedics but inadvertent hyperventilation is common following paramedic RSI6. As far as children are concerned, for RSI etomidate, propofol and thiopental can be used but later these two can cause reduction in blood pressure, while succinylcholine is the preferred agent7. Until now only one NMB agent has

been shown to provide rapid and adequate paralysis in less than one minute2,3,8. It is safe in most patients and is being used for RSI in LSCS and other cases of general anaesthesia (GA)9. However succinylcholine does possess some side effects that can limit its use. These include increase potassium level, malignant hyperthermia, muscle fasiculations, increase intra ocular pressure, increase in gastric pressure, and increase in intra cranial pressure and muscle pains8,10,11. Succinylcholine induced paralysis raises potassium level by 0.5mEq/L but it is insignificant in patient with normal potassium level but can be life threatening in patients with pre-existing hyperkalaemia , in patients of burns, massive trauma and neurological disorder11.

Because of risks associated with succinylcholine usage, there was search for non depolarizing NMB agent with quicker onset and that resulted in development of Rocuronium. It is claimed to fulfil the above requirements almost completely. In a dose of 0.9- 1.2 mg/kg body weight it has an onset time of 60 -90 sec that approaches the onset time of succinylcholine which is 30-60 sec10. It does not increase potassium level and neither causes increase in intra cranial pressure. This study was conducted with the purpose to determine whether rocuronium can replace succinylcholine for RSI or not. The intubating conditions achieved for RSI by rocuronium were compared with those achieved by succinylcholine to judge their effectiveness in our population.

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**PATIENTS AND METHODS**

These randomized controlled trials (RCT) were conducted in anaesthesia department Combined Military Hospital, Kharian from March 2007 to March 2008. One Hundred patients were randomly assigned to two study groups using random number table. Patients aged 20 – 40 years were selected for the study. Such consideration was based on our desire to deal with low risk group for our study. Another consideration was to have uniform body conditions for drug handling and avoiding age as confounding variable.

As rocuronium is contraindicated in patients with suspected difficult intubation, only the subjects having no anticipated difficulty in intubation were included in the study. They were having airway classification I or II according to the Mallampatti Scoring system. Non hypertensive patients were selected because laryngoscopy and intubation are the procedures which are associated with great degree of stress and sudden shoot up of blood pressure. All patients in the study were elective cases for haemorroidectomy, so they were properly prepared before surgery under GA. Another consideration was, subjects with conditions and diseases that could modify the course of action of the drugs or they could be harmful to patients like cardiac patients, patients with raised intracranial pressure, patients with burn/multiple trauma and full stomach, should not enter the study. Permission was obtained from hospital ethical committee. Patients were explained about the procedure and informed consent was taken.

First group was A and second group was B. First male of the study was placed in group A and second male subject was placed in group B, then 3rd male subject again was placed in group A and so on. Similarly 1st female of the study was placed in group A and 2nd female was placed in group B, again 3rd female was placed in group A and so on. For group A, muscle relaxant used was succinylcholine in dose of 1.5 mg/kg body weight and rocuronium was used in group B in a dose of 1 mg/kg body weight.

Before bringing to operation theatre, a NPO status of patients was confirmed. On table patency of intra venous lines was checked and monitors were applied, including ECG, haemoglobin oxygen saturation and non invasive blood pressure. All the apparatus including laryngoscope and the cuff of endotracheal tube was checked. It was ensured that kit for emergency tracheostomy, laryngeal mask airway and stylets were present on emergency table.

Patients were pre-oxygenated for 3 minutes. After that they were given drugs. The sequence of administration of drugs was such that Group A received succinylcholine 1.5 mg/kg immediately after administration of the induction agent, whereas Group B was given rocuronium 1 mg/kg immediately after administration of the induction agent. Induction was done with propofol 2 mg/kg. After it was given, cricoid pressure was applied. No positive pressure ventilation was done as to avoid gastric

distension. High flow of oxygen was maintained.
After an interval of 60 seconds of giving muscle relaxants to each group subjects were observed for 3 seconds for any respiratory activity and presence of apnea. Immediately after observation for apnea laryngoscopy was performed. On laryngoscopy vocal cords were observed whether they were still moving or there was no movement of vocal cords. After that patients were intubated with cuffed endotracheal tubes. Again at this time of passing the tube subjects were observed for jerky movements of the abdomen by the consultant anaesthetist. These three observations of apnea, movements of vocal cords and jerky movements of abdomen were recorded on a proforma prepared for the study.
During the whole procedure described above, non invasive blood pressure, haemoglobin oxygen saturation and ECG of every patient was continuously monitored. Monitoring of neuromuscular function was omitted because of anticipated discomfort with baseline nerve stimulation in an awake state. Further, the aim of our study was to investigate intubating conditions based on clinical observations.
Anaesthesia was maintained with 0.8 % - 1% isoflorane, and 60 % nitrous oxide in oxygen. In group A who had been given succinylcholine, atracurium was given when spontaneous respiratory activity returned. For analgesia nalbuphine in dose of 0.1 mg/kg was given, as indicated clinically. At the end of the surgery, the NMB was antagonised in both groups with injection neostigmine 2.5 mg, having atropine 1 mg added to it, given slowly intravenously. Extubation was performed after clinical recovery. Patients were kept in post anaesthesia care until fully conscious.
All the data collected through the Proforma was entered into the statistical package for social sciences (SPSS) version 13.0. Frequency and percentage were computed for categorical variables like, Apnea, vocal cord movements and jerky movements of abdomen and mallampatti status. Mean and standard deviation was computed for age for both groups. Independent samples t test was used to compare age of both the groups. Chi-square test was applied for qualitative data (mallampati status, movements of vocal cords, jerky movements of abdomen and apnea).
A p-value ≤ 0.05 was considered as significant.
RESULTS
In this study 100 patients were included, that is 50 patients in each group A and B (Table-1).

**Table-1: Age Description of Patients**

| Group | N | Age | | | |
|---|---|---|---|---|---|
| | | Mean | Minimum | Maximum | Std deviation |
| A | 50 | 33 | 22 | 40 | 5.602 |
| B | 50 | 34 | 24 | 40 | 4.872 |
| P-value | 0.334 | | | | |

Age was compared by using independent T test and mallampatti status was compared using chi square test. Both groups were comparable with respect to age and mallampatti status as p-value for both age (p>0.05) and mallampatti status (p>0.05) (Table-2).

**Table-2: Chi-square test for mallampatti status (n=100)**

| Group | N | Mallampatti status | | | |
|---|---|---|---|---|---|
| | | I | II | III | IV |
| A | 50 | 31 | 19 | Nil | Nil |
| B | 50 | 24 | 26 | Nil | Nil |
| P-Value | 0.228 | | | | |

There was only one variable for each group viz. intubating conditions, which was inferred from three parameters, which were apnea, vocal cords movements and jerky movements of abdomen and all were being observed at 60 seconds after giving muscle relaxant. These results are tabulated in table-3.

**Table-3: Comparison of intubating condition.**

| Variable | Group | N | Yes (%age) | No (%age) | P value |
|---|---|---|---|---|---|
| Movement of vocal cords | A | 50 | 1 (2%) | 49 (98%) | 0.016 |
| | B | 50 | 9 (18%) | 41 (82%) | |
| Apnea | A | 50 | 49 (98%) | 1 (2%) | 0.031 |
| | B | 50 | 42 (84%) | 8 (16%) | |
| Jerky movements of abdomen | A | 50 | 3 (6%) | 47 (94%) | 0.041 |
| | B | 50 | 11 (22%) | 39 (78%) | |

There was significant difference in all the parameters.

**DISCUSSION**

The muscle relaxant which has shortest duration of action, in nondepolarizing agents, is rocuronium and is now available in Pakistan. Succinylcholine has rapid onset of action and excellent relaxation for intubation but also has some undesirable effects which makes the justification of introduction of newer and safer drugs. Although much work has been done in western countries on the subject concerned, literature in our country is lacking because ours is a developing country and rocuronium until recently was not available in the market and we lack detailed data about the efficacy of the drug.

Keeping this thing in mind our study was planned on a small scale, to check the efficacy of drug in our population. Although we knew that the results of our study would not be truly representative of complete population yet this study may help in future researches.

RSI is a technique which is commonly used for both emergency cases and obstetric cases. As we designed our study to check efficacy of the drug and suitability for RSI, only elective cases were taken and to further ensure safety of the subjects, only healthy patients were included.

Rocuronium proved to be a good drug for RSI. Eighty percent patients fulfiled the parameters for intubating conditions at 60 seconds. All patients were intubated in first attempt and without any problem during intubation. This showed that rocuronium, although not superior to succinylcholine, is an excellent substitute for succinylcholine for RSI. Succinylcholine appeared to be superior to rocuronium in creating intubating conditions12 and in emergent cases it also allows for a more rapid endotracheal intubation sequence compared with rocuronium13. Even if RSI is required, succinylcholine remains the neuromuscular blocking agent of choice, if there is no contraindication14.

A study was done in Switzerland which compared the two drugs for RSI. The p-value of intubating conditions was significant (<0.05). But they used propofol in dose of 1.5 mg/kg, succinylcholine 1 mg/kg and rocuronium in a dose of 0.6 mg/kg while we used propofol 2 mg/kg, succinylcholine 1.5 mg/kg and rocuronium 1.0 mg/kg. In contrast to our study the number of patients was one hundred and eighty as well as they took only emergency cases. Those workers also assessed intubating conditions after 60 seconds but by a 9 point scale but we assessed by apnea, movement of vocal cords and abdominal movements on intubation13.

A study was done in October 2005 on RSI. In contrast to our study they found both drugs almost equally effective. But they used rocuronium in a dose of 0.6 mg/kg and succinylcholine 1.0 mg/kg while we used succinylcholine and rocuronium in doses of 1.5 mg/kg and 1.0 mg/kg respectively. Secondly they used narcotic agent along with propofol. The number of patients was two hundred and twenty two and all were emergency cases. Again in contrast to our study which was convenient sampling, the anaesthetist intubating patients was blinded15.

In March 2006 a study was done in Germany for intubating conditions as well as post operative hoarseness and vocal cord injuries. That study showed that in terms of intubating conditions succinylcholine is superior to rocuronium (p-value<0.001). In that study thiopental was used for induction along with narcotic. Succinylcholine was used in dose of 1.0 mg/kg and rocuronium in 0.6 mg/kg while we used in dose of 1.5 mg/kg and rocuronium in 1.0 mg/kg16.

In another study in Jordon succinylcholine and rocuronium were compared. But results were

contradicting to our study that rocuronium produces similar intubating the conditions. The reason could be that the duration of that study was only five months and they used both elective and emergency cases of cesarean section. Secondly they used succinylcholine in dose of 1.0 mg/kg. Another reason for this could be difference of race17.
In another study in 2007 from Norway intubating conditions of only rocuronium were assessed. The study showed that >95% of patients had optimal intubating conditions but in our study in case of rocuronium only 78 % patients fulfilled intubation criteria. But those workers used thiopental and alfentanil for induction. In that study intubating conditions were assessed at 40 seconds instead of 60 seconds. Lastly patients in that study were sixty18.
A randomised comparison of succinylcholine and rocuronium was done for true RSI and modified RSI in Switzerland. We used rocuronium only in one dose but in that study rocuronium was used both in conventional and high doses. In that study one thousand four hundred and seventy one patients were selected and it was with both propofol and thiopental. The result of that study was that effectiveness of rocuronium for RSI is although less than succinylcholine but it is also affected by induction agent used19.
In USA a study was designed in which laryngoscopy and intubating conditions were assessed using etomidate. In that study 92 % of patients given succinylcholine were successfully intubated while in our study 94 % patients fulfilled criteria of our study and all were successfully intubated. P-value of the variables used in that study was < 0.0001 which was well below of our value. The reason is in that study only induction agent was used in second group without muscle relaxant. Secondly number of patients used was only forty nine in that study. Lastly they used laryngoscopy conditions but we used intubating conditions5.
Intubating conditions produced by succinylcholine were worked out in a randomised, double blind clinical trial in 2005 November. In that study 96 % of patients met acceptable intubating conditions given succinylcholine. This small difference could be as a result of difference in dose of succinylcholine. Secondly one hundred and seventy five patients were selected for that study and we used one hundred20.
A meta- analysis was done in December 2006 to compare the effects of succinylcholine and rocuronium on endotracheal intubation conditions. Although number of patients were one thousand three hundred and sixty two as compared to hundred patients of our study but results were in favour of our study that succinylcholine appears to be superior to rocuronium in creating excellent intubating conditions12.
We had very encouraging results but this observation requires further research in other medical conditions and in other races and ages of patients mainly because scope of study was very limited and sample size very small. Secondly majority of our study was done on military personnel and their families and is not truly representative of general population. Lastly patients were not randomised and we had used convenient sampling.
The answer to the question, that whether rocuronium is a true substitute of succinylcholine, should cover all the aspects of drug including onset of action, undesirable effects and duration of action. The major drawback with rocuronium is its longer duration of action and it cannot be reversed immediately after its administration. In case of failed intubated and ventilation, patient may land up in a very serious condition. However it can only be used if the anaesthetist is very confident about ease of intubation or we have some strong contraindication for the use of succinylcholine.

**CONCLUSION**

We conclude that succinylcholine, in a dose of 1.5 mg/kg, when administered just after induction of anaesthesia with propofol 2 mg/kg, provides intubating conditions superior with those produced by rocuronium 1.0 mg/kg, at 60 seconds after induction, in at least patients undergoing elective surgery for haemorroidectomy.

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