

## **To assess the effects of Rocuronium pretreatment on Succinylcholine induced Fasciculations and postoperative Myalgias**

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### **Abstract**

**Objective:** To assess the effects of Rocuronium pretreatment on Succinylcholine induced Fasciculations and postoperative Myalgias.

**Methods:** A randomized double blind case control study was conducted in Department of Anaesthesia and Surgical Intensive Care Unit, Liaquat National Hospital, Karachi from October 2003 - April 2004. Sixty adults ASA I or II patients who presented for elective general surgical procedures were included in the study. The patients were divided in two groups of thirty each by a simple lottery method. Group "A" received placebo and group "B" received Rocuronium 0.1 mg/kg, one minute prior to induction with Pentothal Sodium 5 mg/kg, Suxamethonium, 1.5 mg/kg and Nalbuphine 10 mg / 70 kg.

Fasciculations and intubation condition was assessed immediately after the induction of anaesthesia while post operative myalgias were assessed 6, 12 and 24 hours after surgery.

**Results:** Fasciculations were noticed in group "A" as 100 % (mild to severe) and in group "B" 13.3% (mild). Post operative myalgias at 6 and 12 hours after surgery were 76.66 % in group "A" and 16.66 in groups "B". After 24 hours in group "A" post operative myalgias were 93.33% and group "B" 23.33 %.

**Conclusion:** It is concluded that pretreatment with Rocuronium reduced the incidence of myalgias, fasciculations and produced rapid precurarization in one minute thereby saving time on busy operating lists. They also allowed the early ambulation of patients in minor surgeries (JPMA 59:847; 2009).

### **Introduction**

Patients undergoing general anaesthesia usually need endotracheal intubation. Although many relaxing agents can be used for this purpose; Succinylcholine is still the most popularly used agent in our setup. Succinylcholine is a depolarizing muscle relaxant, produces profound neuromuscular block with rapid onset but short duration. When used in a dose of 0.5 - 1.5 mg/kg, it produces excellent muscle relaxation in 30 seconds and its effects last for 3 - 5 minutes. Its short half life becomes life saving in the event of difficult intubation or failed intubation and rapid sequence induction in patients with full stomach. Succinylcholine produces undesired side effects such as muscle fasciculations; post operative myalgias, increased serum levels of creatinine kinase and potassium, succinyl apnea, malignant hyperthermia and raised intraocular pressure and intra cranial pressure. Post operative myalgia is particularly prominent in the muscles of neck, back and abdomen. It is influenced by age, sex and physical fitness. The exact mechanism is not known but stimulation of presynaptic acetylcholine receptors and contraction of intrafusal fibers of muscle spindles may contribute. The longer the interval between injection of an intravenous barbiturate and succinylcholine the more intense is the post operative discomfort. Pain may be delayed until the third or the fourth post operative day. Pain is frequent in

patients who are muscularly fit than the unfit and when the injection is given slowly. Precurarization<sup>1</sup> has been tried to prevent the muscle pain. An intravenous injection of a small dose of non depolarizing muscle relaxant e.g. Pancuronium 1 mg 3 min before succinylcholine and Rocuronium 0.1 mg/kg 1 minute before the succinylcholine. Other drugs like Lidocaine,<sup>2</sup> diclofenac,<sup>3</sup> aspirin,<sup>4</sup> and phenytoin,<sup>5</sup> have also been found to decrease incidence of post operative myalgias to some extent. Visible fasciculations are not really related to severity of any subsequent symptoms.

Rocuronium is a monoquaternary steroid analogue of vecuronium. It has rapid to intermediate onset of action and intermediate duration. Rocuronium is less potent than most other steroidal muscle relaxants (potency appears to be inversely related to speed of onset). It requires 0.45 - 0.9 mg/kg intravenously for intubation and 0.15 mg/kg boluses for maintenance. Intramuscular Rocuronium (1 mg/kg for infants; 2 mg/kg for children) provides adequate vocal cord and diaphragmatic paralysis for intubation but not until after 3 to 6 minutes (deltoid injection has a faster onset than quadriceps), and can be reversed after about one hour. Rocuronium at a dose of 0.9 - 1.2 mg/kg has an onset similar to succinylcholine (60 - 90 sec), making it suitable for rapid sequence induction but at the cost of a much longer duration of action. This intermediate duration of action is comparable

to vecuronium and atracurium. Rocuronium (0.1 mg/kg) has proved to be rapid (90 seconds) and a more effective agent (decreased fasciculations and postoperative myalgias) for precurarization prior to succinylcholine administration.<sup>6</sup>

Smaller doses have been used by other researchers. Martin R et al<sup>7</sup> performed study in 1998 using Rocuronium 0.06 mg/kg 3 min before induction for prevention of fasciculations and post operative myalgias. Motamed et al<sup>8</sup> used rocuronium in the dose of 0.05 mg/kg 1.5 or 3 min before suxamethonium in their study.

We used bigger doses of Rocuronium with 0.1 mg/kg which can provide ideal intubating conditions 1 minute prior to induction.

Despite its limitations and side effects, succinylcholine is still used for endotracheal intubation. No other drug can compete in muscle relaxation, speed of onset and short duration of action. The anaesthetists are therefore almost dependant on succinylcholine in most cases. Keeping in view its safety margin, active research is being done in two directions, to find a suitable substitute of succinylcholine with fewer side effects and to minimize its effects till the suitable substitute is available. Our purpose of study was to assess the effects of Rocuronium pretreatment on succinylcholine induced fasciculations and post operative myalgias.

### Patients and Methods

This study was conducted in the department of Anesthesiology Liaquat National Hospital Karachi from October 2003 to April 2004 after approval of the study project by research and ethics committee. Written informed consents was observed from all subjects.

It was a double blind, randomized, case control study including 60 patients who were allocated randomly to one of the two groups. Patients in group "A" received placebo and patients in group "B" received Esmeron (Rocuronium). There were 30 patients in each group.

Both groups were comparable in respect to age, sex and weight and under going general surgical procedures.

Patients of either sex aged from 15 - 50 years of ASA I and II undergoing elective general surgery procedures were included in this study. Patients with no proper medical history, intraocular hypertension, history of malignant hyperthermia, ASA status III and above, Diabetes mellitus, morbidly obese, pregnant patients and suspected difficult intubation patients were excluded from this study.

Preoperative evaluation included detailed history, general physical, systemic and upper airway examination. Investigations including blood CP, serum Na<sup>+</sup>, K<sup>+</sup>, Cl<sup>-</sup>, Ca<sup>++</sup> and serum urea and creatinine were noted.

Routine monitoring was done after receiving the

patient in theater. Standard anaesthesia technique was employed in all patients. I/V line was secured with 18g cannula. Pretreatment was done with either placebo (2 ml of normal saline) or Esmeron (Rocuronium bromide) 0.1 mg/ kg in 2ml solution, blindly one minute prior to induction with Pentothal sodium 5mg/kg and succinylcholine 1.5 mg/kg and Nalbuphine 10mg/70kg. Patients were randomized and grouped in group "A" and group "B". Group "A" received placebo. Group "B" received Esmeron (Rocuronium). Direct laryngoscopy was performed and the patients were intubated via oral route, 60 seconds after succinylcholine. Anaesthesia was maintained by 67% nitrous oxide and 1% halothane in oxygen. The presence of fasciculations and their severity were assessed and recorded on Performa immediately after induction of anaesthesia on four point scale (Table-1). The intubation conditions were assessed and recorded on Performa after the induction of anaesthesia on four point scale (Table-2). After completion of surgery, an investigator who was blind to pretreatment agent used recorded. The presence and severity of myalgia was assessed, by visual analogue scoring on four points scale (Table-3). Assessment of myalgia was done after 6 hours, 12 hours and 24 hours after completion of surgery, and data was recorded on Performa.

The data was entered in SPSS version 10.0 for analysis. Chi Square test was used to calculate the percentages with respect to Fasciculations, Intubating conditions and post-operative myalgias.

**Table-1: Fasciculation Score**  
[Naquid M, Faraz H, Maghabajed JAO; 1987].

00	Absent	
01	Mild	Slight eyelid and facials fluttering.
02	Moderate	Large muscle twitching
03	Severe	Major limbs movements.

**Table-2: Intubation Condition: [Eisenberg M, Balsely S, Katz: 1979].**

Poor	Difficult passage or / with coughing more than 10 seconds
Fair	Easy passage with cough
Good	Easy passage with slight cough.
Excellent	Easy passage without cough.

**Table-3: MYALGIA SCORE: [White DC. 1962].**

00	No pain
01	Pain at one site without functional disability.
02	Pain involving more than one site without functional disability.
03	Pain involving more than one site with functional disability.

### Results

There was no significant difference in patient characteristics in two groups and they were well matched for age, weight, and sex.

Each group had 30 patients (Group A: 15 males and 15

**Patients were comparable in respect of age, sex, and weight.**

**Age:**

Group "A": 16 - 50 years (Mean  $37.67 \pm 10.15$ ).

Group "B": 18 - 50 Years (Mean  $40.73 \pm 9.62$ ).

**Weight:**

Group "A": 40 - 72 (Mean  $60.23 \pm 11.85$ ).

Group "B": 50 - 75 (Mean  $67.77 \pm 6.25$ ).

**Sex:**

Group "A": Male - 15 (50%), Female - 15 (50%).

Group "B": Male - 11 (36.7%), Female - 19 (63.3%).

females. Group B: 11 males and 19 females). The mean age of Group A patients was  $37.67 \pm 10.5$  years (range 16-50 years) and of Group B  $40.73 \pm 9.62$  years (range 18-50 years).

All patients in group "A" had mild to severe (100%) fasciculations, compared to four patients out of thirty in group "B" who had mild fasciculations (13.3%) ( $P < 0.001$ ).

Endotracheal intubation was accomplished in 100% of the patients of both groups with no adverse effects due to pretreatment regimens.

In group "A" 16 patients suffered from mild, four from moderate and three from severe pain. In group B, four patients developed mild and one moderate pain, at 6 and 12 hours after surgery.

After 24 hours of surgery, nineteen patients suffered from mild, six from moderate and three from severe pain in group "A" where as five patients had mild and two moderate pain in group "B".

The statistical analysis showed the frequency of post operative myalgias with Rocuronium (16.66%) to be significantly less than with placebo (76.66%,  $P < 0.001$ ) at 6 and 12 hours after surgery. After 24 hours the frequency of myalgias was (23.33%) in the Rocuronium group and (93.33%,  $P < 0.001$ ) in the placebo group.

## Discussion

Suxamethonium is the best drug for rapidly providing ideal conditions for short procedures requiring endotracheal intubation. However, the usefulness of succinylcholine is limited by its side effects especially the frequent occurrence of post operative myalgias. This is often listed as minor side effect of the drug but it may be one of the most distressing consequences of minor surgery for the patients. It occurs more commonly in females and resembles the aches experienced after unaccustomed exercise.

There are many regimens that have been proposed as a means of reducing the frequency of myalgias.<sup>9-11</sup> The most effective method is pretreatment with a small dose of non depolarizing agent.

Rasheed in 1997,<sup>10</sup> compared the effect of pretreatment with atracurium and ketorolac for the prevention of Suxamethonium myalgias. He found that the incidence of

myalgias after 48 hours with saline were 88 %, with ketorolac 88 % and with atracurium 18%.

Moeenullah Khan et al<sup>12</sup> studied the frequency of post suxamethonium myalgias in patients induced by Propofol and Suxamethonium and pretreated with 0.025 mg/kg atracurium. They found that frequency of myalgias were 24% without pretreatment and 1% in pretreated patients with atracurium. They concluded that atracurium reduces the incidence of myalgias very significantly.

In this study we selected Rocuronium 0.1 mg/kg to assess the effect on the prevention of fasciculation and post operative myalgias caused by Suxamethonium.

Administration of the pretreatment agent both on a weight related<sup>13</sup> basis and fixed dose regimen<sup>14,15</sup> has been recommended. We used the weight related dose.

One of the main concerns regarding pretreatment with non depolarizing agents is that intubation conditions may be affected adversely. It is therefore recommended that a larger dose of suxamethonium should be given to pretreated patients.<sup>16</sup>

In this study we used Suxamethonium 1.5 mg/kg and found that pretreatment had no effect on intubation conditions. It has been suggested that increasing the dose of succinylcholine is not associated with accentuation of its adverse effects,<sup>17</sup> but recent studies have refuted this conclusion.<sup>18</sup>

In our study Rocuronium pretreatment was particularly effective in reducing the fasciculations after suxamethonium. It decreased the frequency of post operative myalgias significantly.

A study performed by Martin et al in 1998,<sup>7</sup> showed that from the non-depolarizing agents as d-tubocurarine, atracurium, mivacurium and rocuronium, Rocuronium 0.06 mg/kg 3 minutes before induction, was the most effective agent to prevent fasciculations and post operative myalgias caused by suxamethonium.

Motamed et al<sup>8</sup> in their study concluded that the incidence and severity of suxamethonium fasciculations can be reduced by giving 0.05 mg/kg rocuronium either 1.5 minutes or 3 minutes before suxamethonium.

There has been much discussion about the interval between administration of the pretreatment and suxamethonium. Intervals of 2, 3, and 4 minutes or larger have been recommended.<sup>17,19</sup> Obviously such lengthy intervals are required for slow onset drugs.

In our study, the dose of rocuronium was 0.1 mg/kg which was given one minute before the induction. Rocuronium produced rapid precurarization that is in one minute as compared to other non depolarizing agents, because of rapid onset of action.

This is supported by Tsui BCH et al,<sup>20</sup> who evaluated a rapid and time saving precurarization technique by using the rocuronium 0.1 mg/kg one minute before induction. They found that rocuronium pretreatment decreased the frequency of fasciculations to 21.4% and post operative myalgias to 14.2% on first post operative day and 7.1% on second post operative day but there was no difference among three groups on seventh post operative day.

Findlay GP and Spittal MJ,<sup>21</sup> suggested that rocuronium, because of its rapid onset of action, was effective at reducing myalgias when only a short interval was allowed as one minute before induction. They found that rocuronium pretreatment decreased the frequency of myalgias to 20% on first post operative day and to 28.6% by day 4.

Using reduced doses of suxamethonium alone can decrease myalgias. In a dose of 0.5 mg/kg suxamethonium, Stewart et al,<sup>18</sup> reported that 41% of patients complained of myalgias while Nimmo et al<sup>19</sup> using succinylcholine 0.25 mg/kg, found it to be 20%. Intubation conditions in both studies were good.

Shukla A et al<sup>22</sup> in 2004 concluded that rocuronium can be a better and safer alternative to succinylcholine for endotracheal intubation. However 90 seconds are required with rocuronium in a dose of 0.6 mg/kg to achieve intubating conditions similar to succinylcholine.

Another study performed by Sluga M in 2005<sup>23</sup> compared rocuronium with succinylcholine in patients requiring rapid sequence induction of anaesthesia and endotracheal intubation. They found succinylcholine to provide a more rapid endotracheal intubation sequence and created superior intubation conditions compared to rocuronium, concluding in favour of succinylcholine.

Our results compare well with most studies.

### Conclusion

We concluded that myalgia after succinylcholine is fairly common in our population undergoing surgery. Pretreatment with rocuronium was helpful in reducing the symptoms of myalgias and fasciculations, produced rapid precurarization in one minute and allowed early ambulation of patients in minor surgeries.

As we know that rocuronium bromide is an expensive drug and for using it as a pretreatment drug, patients will have to pay more. It would therefore be unfair to use the drug without documented evidence of the benefit of this technique.

Our study proved the use of rocuronium to be cost effective due to reduced post-operative analgesic requirements resulting in early ambulation.

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