

## Evaluation of intubation condition following administration of rocuronium in comparison to atracurium in paediatric patients

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### Abstract

**Background.** Optimum intubation condition is paramount important for early and easy passage of endotracheal tube through the glottis and that results from adequate muscle relaxation. Rocuronium and atracurium are muscle relaxants used for short and intermediate duration of surgical processes.

**Objective:** This study, compares the intubation condition and haemodynamic changes in paediatric patients following administration of rocuronium and atracurium to get rid of the side effects of succinylcholine.

**Method.** The study was carried out in 60 patients aged 1<sup>1</sup>/<sub>2</sub> to 10 years, ASA I-II, under general anaesthesia. The patients were divided into two groups: rocuronium Gr R and atracurium Gr A. Induction was done with halothane 3.5-4% and for intubation rocuronium 0.6 mg/kg and atracurium 0.46 mg/kg were given to patients of Gr R and Gr A respectively. The intubation condition was assessed and graded at 60 seconds after neuromuscular blocking agents. At the same time TOF ratios were recorded.

**Results.** Rocuronium produced good to excellent intubation condition (score  $3.80 \pm 0.07$ ) in all patients at 60 seconds whereas that of atracurium poor intubation condition (score  $2 \pm 0.00$ ). TOF ratios showed more relaxation of adductor pollicis muscle in Gr R than Gr A (Gr R =  $60.43 \pm 0.87$ , Gr A =  $78.90 \pm 0.72$ ). ( $p < 0.001$ ). Cardiovascular stability was not significantly difference in both the groups before induction and intubation.

**Conclusion.** Rocuronium produced better intubation condition in comparison to atracurium.

**Keywords:** Paediatric patients, intubation, rocuronium, atracurium

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### Introduction

In anaesthetic practice muscle relaxation is used to serve two prime purposes; one, to facilitate endotracheal intubation and the other to provide surgical relaxation<sup>1</sup>. Adequate muscle relaxation plays an important role in the concept of balanced anaesthesia<sup>2</sup> and it demands for intubations to maintain artificial ventilation. Rapid sequence intubation is very important for paediatric patients because of their high metabolic rate, less functional residual capacity and more O<sub>2</sub> requirement, during which there is a chance of

hypoxia<sup>3</sup>. Children are more susceptible than adult to cardiac arrhythmias, hyperkalaemia, rhabdomyolysis, myoglobinemia, masseter spasm and malignant hyperthermia after succinylcholine administration. Unlike in adult patients, profound bradycardia and sinus node arrest develop in paediatric patients following the first dose of succinylcholine without atropine pretreatment<sup>4</sup>.

Atracurium was developed in an attempt to obtain a non-depolarizing agent which had a more rapid onset, was shorter acting and had less

cardiovascular effects than did the older agents but may release histamine and may be accompanied by a slight fall in arterial pressure<sup>5</sup>. Good to excellent intubating conditions after rocuronium 0.6mg/kg obtained within 60 seconds when compared with vecuronium and atracurium in young children with intravenous anaesthetic agents<sup>6</sup>. Aleksandra J. Mazurek et al.1998 found that rocuronium (1.2 mg/kg) can be substituted for succinylcholine during rapid sequence intubation in paediatric patients with intravenous anaesthetic agents<sup>7</sup>.The remarkable advantage of rocuronium is that one drug is used for intubation and maintenance of anaesthesia. In spite of these advantages, this drug is not used in our daily practice. So, this study was done to determine and compare the intubation condition following administration of rocuronium and atracurium in paediatric patients combined with halothane induction with the aim of good to excellent intubation condition and reduction of intubation time.

### Subjects and methods

This randomized prospective clinical study was carried out on sixty patients of both sex, aged between 1½ to 10 years for operations of an average duration of ½ to 2 hours.

This study was approved by the ethical committee of the University and written informed consent was obtained from patients undergoing variety of surgical procedures requiring general anaesthesia. Patients were excluded if overweight, if they or their family had a history of neuromuscular diseases and if they received antibiotics before anaesthesia. Induction was done with halothane 3.5-4% and at the same time venous access was secured. Fentanyl was used 1.5 µgm/kg in both the groups. Rocuronium 0.6 mg/kg and atracurium 0.46 mg/kg were given to patients of Gr R and Gr A respectively. Laryngoscopy was performed and intubation conditions were assessed and graded at 60 seconds after neuromuscular blocking agents using the 4 step scale proposed by Goldberg and his colleagues scoring system<sup>8</sup> (4= excellent [easy passage of the tracheal tube without coughing, vocal cord relaxed], 3= good [slight coughing, vocal cord relaxed], 2 = poor [ passage of the tracheal tube with moderate coughing, some movement of the vocal cord], and 1= impossible), and at the same

time TOF ratios were recorded. TOF ratio indicates the degree of neuromuscular block. In the event of unsuccessful intubation ventilation was continued for another 30- 45 sec until the next attempt was made. Pulse, mean arterial pressure, oxygen saturation were recorded just before induction, before intubation and after intubation. The results were compiled and analyzed statistically using unpaired Student's 't' test. P < 0.05 was considered as significant (by using SPSS version-12 software).

### Observation and Results

There were no significant differences in the patients characteristics including age, weight and sex (Table I). Rocuronium produced 20% good and 80% excellent intubation condition. But atracurium produced poor intubation condition in all patients (Table II).

The mean ± SEM values of intubation scores at 60 seconds were  $3.80 \pm 0.07$  and  $2 \pm 0.00$  in Gr R and Gr A respectively. They showed highly significant difference between the two groups (Table II). ( $p < 0.001$ ).

The mean ± SEM values of train of four ratio at 60 seconds were  $60.43 \pm 0.87$  and  $78.90 \pm 0.72$  in Gr R and Gr A respectively. They showed highly significant difference between the two groups (Table II). ( $p < 0.001$ ).

The mean ± SEM values of heart rate, mean arterial pressures and oxygen saturation before induction were  $103.33 \pm 3.29$ ,  $78.03 \pm 0.64$  and  $99.33 \pm 0.09$  in Gr R and  $97.13 \pm 0.96$ ,  $78.53 \pm 0.59$  and  $99.37 \pm 0.09$  in Gr A respectively. They showed no significant difference between the two groups (Fig.1,2,3 and Table-III).

The mean ± SEM values of heart rate, mean arterial pressures and oxygen saturation before intubation (when eye-lash reflex was lost), were  $88.83 \pm 1.00$ ,  $74.03 \pm 0.60$  and  $99.40 \pm 0.09$  in Gr R and  $86.80 \pm 1.06$ ,  $72.90 \pm 0.56$  and  $99.37 \pm 0.09$  in Gr A respectively. They showed no significant difference between the two groups (Fig.1,2,3 and Table-III).

The mean ± SEM values of heart rate and mean arterial pressures after intubation were  $103.33 \pm 1.37$  and  $78.47 \pm 0.65$  in Gr R and  $115.80 \pm 1.53$  and  $74.93 \pm 0.54$  in Gr A respectively. They showed

highly significant difference between the two groups (Fig.1,2 and Table-III). ( $p < 0.001$ ).

The mean  $\pm$  SEM values of oxygen saturation after intubation were  $99.47 \pm 0.09$  and  $99.40 \pm 0.09$  in Gr R and Gr A respectively. They showed no

significant difference between the two groups (Figure-3 Table-III). After discreet scrutiny it is revealed that before intubation oxygen saturation was a little bit less than after intubation in Gr A and it was due to poor intubation condition.

**Table-I**  
*Demographic characteristics of patients.*

|             | Age<br>(yrs)    | Weight<br>(kg)   | Sex        |            |
|-------------|-----------------|------------------|------------|------------|
|             |                 |                  | Male       | Female     |
| Gr R (n=30) | $5.20 \pm 0.48$ | $16.13 \pm 1.03$ | 19 (63.3%) | 11 (36.7%) |
| Gr A (n=30) | $5.55 \pm 0.41$ | $16.17 \pm 0.83$ | 18 (60.0%) | 12 (40.0%) |
| t-value     | 0.551           | 0.025            | 37 (61.7%) | 23 (38.3%) |
| p-value     | 0.584           | 0.980            |            |            |

Values were expressed as Mean  $\pm$  SEM, values are regarded significant if  $< 0.05$ .

**Table II**  
*Intubation Scores, Train of four ratios and intubation condition recorded at 60 seconds*

|             | Intubation<br>scores | Train of four<br>ratios (T4/T1) | Intubation condition  |                     |                      |
|-------------|----------------------|---------------------------------|-----------------------|---------------------|----------------------|
|             |                      |                                 | Poor                  | Good                | Excellent            |
| Gr R (n=30) | $3.80 \pm 0.07$      | $60.43 \pm 0.87$                |                       | 20% = 6<br>patients | 80% = 24<br>patients |
| Gr A (n=30) | $2 \pm 0.00$         | $78.90 \pm 0.72$                | 100% = 30<br>patients |                     |                      |
| t-value     | 24.233               | 16.408                          |                       |                     |                      |
| p-value     | 0.001                | 0.001                           |                       |                     |                      |

Values were expressed as Mean  $\pm$  SEM,  $P < 0.001$  was considered as highly significant

**Table III**  
*Heart Rate, MAP (mm of Hg) and SpO<sub>2</sub> %*

|                  | Before induction |                  |                  | Before intubation |                  |                  | After intubation  |                  |                  |
|------------------|------------------|------------------|------------------|-------------------|------------------|------------------|-------------------|------------------|------------------|
|                  | Heart rate       | MAP              | SpO <sub>2</sub> | Heart rate        | MAP              | SpO <sub>2</sub> | Heart rate        | MAP              | SpO <sub>2</sub> |
| (Gr R)<br>(n=30) | $103.3 \pm 3.29$ | $78.03 \pm 0.64$ | $99.33 \pm 0.09$ | $88.83 \pm 1.00$  | $74.03 \pm 0.60$ | $99.40 \pm 0.09$ | $103.33 \pm 1.37$ | $78.47 \pm 0.65$ | $99.47 \pm 0.09$ |
| (Gr A)<br>(n=30) | $97.13 \pm 0.96$ | $78.53 \pm 0.59$ | $99.37 \pm 0.09$ | $86.80 \pm 1.06$  | $72.90 \pm 0.56$ | $99.37 \pm 0.09$ | $115.80 \pm 1.53$ | $74.93 \pm 0.54$ | $99.40 \pm 0.09$ |
| t-value          | 1.811            | 0.574            | 0.266            | 1.398             | 1.386            | 0.261            | 6.065             | 4.174            | 0.513            |
| p-value          | 0.075            | 0.568            | 0.791            | 0.167             | 0.171            | 0.795            | 0.001             | 0.001            | 0.610            |

Values were expressed as Mean  $\pm$  SEM,  $P < 0.001$  was considered as highly significant.

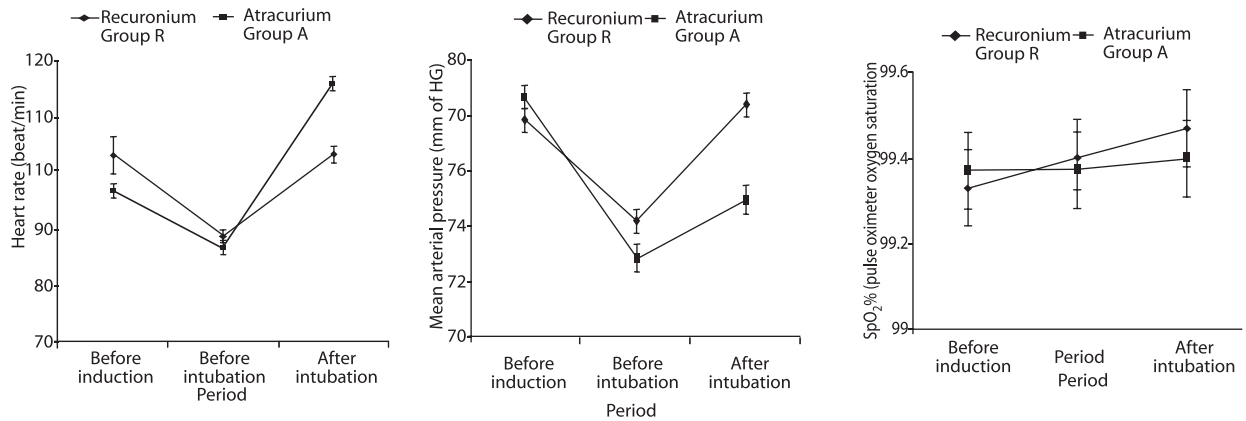


Fig.-1 : Changes of heart rate

Fig.-2 : Changes in mean arterial pressure

Fig.-3 : Changes in oxygen saturation

## Discussion

Early intubation is a very essential part of general anaesthesia particularly in paediatric patients. Rocuronium is popular in adult patients but clinical experience is less in our country in paediatric patients.

Intubation was done at 60 seconds following administration of rocuronium 0.6 mg/kg and atracurium 0.46 mg/kg, with 3.5-4% halothane as an induction agent in 50% nitrous oxide and oxygen.

Rocuronium had shown 20% good and 80% excellent intubation conditions at 60 seconds whereas that of atracurium poor intubation condition in all patients.

Our study is supported by M. Bock et al. 2000<sup>9</sup>, Zhou et al. 2000<sup>10</sup>, Fuschs-Buder T and Tassonyi E, 1996<sup>11</sup> and M. Eikermann et al. 2000<sup>12</sup>.

The mean  $\pm$  SEM values of train of four ratio at 60 seconds were  $60.43 \pm 0.87$  and  $78.90 \pm 0.72$  in Gr R and Gr A respectively. They showed highly significant difference between the two groups ( $p < 0.001$ ).

This result indicates that in our study the neuromuscular blockade at 60 seconds at the adductor pollicis muscle after rocuronium was greater than that of atracurium. TOF ratios are also comparable to intubation grading system. So, TOF ratios quantitatively supported the intubation condition in this study.

Mogorian et al. 1993 and De Mey JC 1994, found in adults that the onset of neuromuscular blockade at the adductor pollicis muscle after rocuronium is more rapid compared with atracurium<sup>13</sup>. This finding is also comparable to present study.

Before induction and before intubation there was no significant difference between Gr R and Gr A in terms of heart rate, mean arterial pressure and oxygen saturation. The mean  $\pm$  SEM values of heart rate and mean arterial pressures after intubation were  $103.33 \pm 1.37$  and  $78.47 \pm 0.65$  in Gr R and  $115.80 \pm 1.53$  and  $74.93 \pm 0.54$  in Gr A respectively. They showed highly significant difference between the two groups ( $p < 0.001$ ). The above findings are of rise of heart rate and fall of mean arterial pressure in the atracurium group and slight rise of heart rate, almost no change in mean arterial pressure in rocuronium group just after intubation. In case of atracurium increases of heart rate may be due to poor intubation condition<sup>14</sup> and fall of blood pressure may be due to histamine release<sup>15</sup>.

It is also supported by Samia Elbaradie, 2004, and reported that following administration of 0.6mg/kg atracurium resulted with the decrease in mean arterial pressure and increase in heart rate<sup>16</sup>.

## Conclusion

Our findings suggest that rocuronium is very much effective and produced good to excellent intubation condition at 60 seconds in paediatric patients.

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