Rocuronium with alfentanil and propofol allows intubation within 45 seconds

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J. F. Crul et al. (1995) European Journal of Anaesthesiology, 12 (Suppl. 11), 111-112
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Summary
Following induction with alfentanil (20 μg kg⁻¹) and propofol (2.0–2.5 mg kg⁻¹), four groups of patients were given rocuronium to determine conditions for rapid sequence intubation. Two groups received 0.9 mg kg⁻¹ and two groups received 0.6 mg kg⁻¹. In one of each dose groups, intubation was attempted after 45 s and in the other after 60 s. Intubating conditions were scored on a four point scale but all were rated as excellent or good. Almost all intubating conditions were excellent in the 0.9 mg kg⁻¹ groups.

Keywords: NEUROMUSCULAR RELAXANTS, ROCURONIUM; INTUBATION, TRACHEAL, TIMING; INDUCTION, RAPID SEQUENCE.

Introduction
Succinylcholine was, until recently, the only muscle relaxant which allowed tracheal intubation in less than 60 s after induction of anaesthesia [1]. However, its use is accompanied by many potentially dangerous side effects. Only by using the ‘priming’ principle or by giving the relaxant before the hypnotic [2] is such a rapid sequence possible with non-depolarizing relaxants. Both techniques have clear restrictions.

Rocuronium bromide is known to have a rapid onset in the muscles of the hand [3]. For rocuronium to be a real substitute for succinylcholine, onset of excellent intubating conditions should occur in less than 60 s.

The objective of this study was to evaluate, in a blinded fashion, the intubating conditions with rocuronium within 45 or 60 s after administration of 2–3 × ED₉₅ (0.6–0.9 mg kg⁻¹).

Study design
After approval from the Hospital Ethical Committee, 80 ASA I–II patients scheduled for elective surgery entered the study. Induction of anaesthesia was with alfentanil (20 μg kg⁻¹) and propofol (2.0–2.5 mg kg⁻¹) until loss of eyelash reflex. Patients were divided into four groups of approximately 20 patients each

<table>
<thead>
<tr>
<th>Group</th>
<th>Dose (mg kg⁻¹)</th>
<th>Time to intubation (s)</th>
<th>Intubation score</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0.6</td>
<td>45</td>
<td>Excellent</td>
<td>12</td>
</tr>
<tr>
<td>II</td>
<td>0.6</td>
<td>60</td>
<td>Excellent</td>
<td>10</td>
</tr>
<tr>
<td>III</td>
<td>0.9</td>
<td>45</td>
<td>Good</td>
<td>17</td>
</tr>
<tr>
<td>IV</td>
<td>0.9</td>
<td>60</td>
<td>Good</td>
<td>19</td>
</tr>
</tbody>
</table>

(Table 1). Patients in groups I and II received 0.6 mg kg⁻¹ of rocuronium; those in groups III and IV received 0.9 mg kg⁻¹. Groups I and III were intubated after 45 s; groups II and IV after 60 s. All intubations were carried out by one investigator (J.F. Crul), blinded for dose and delay time.

Intubating conditions were scored according to a modification of Goldberg et al. [4] and Krieg et al. [5], viz.:

Excellent: visualization of larynx easy, vocal cords relaxed and open, easy passage of the endotracheal tube without bucking or coughing.

Good: visualization of larynx easy, vocal cords relaxed and open, easy passage of endotracheal tube with slight bucking or coughing.
Poor: visualization of larynx difficult, vocal cords moving, reaction of vocal cords on intubation with moderate bucking or coughing.

Bad: visualization of larynx difficult, vocal cords closed, intubation not possible.

**Statistical analysis**

Ratings for intubating were analysed by two-way ANOVA in which delay time (45 vs. 60 s) and dose (0.6 vs. 0.9 mg kg$^{-1}$) were the two factors of influence. Intubation groups were tested by Fisher’s exact test according to delay time and dose.

**Results**

Only good and excellent intubating scores were noted. The frequency distribution of intubating scores of the patients in the four groups is shown in Table 1.

Both ANOVA and Fisher’s exact test showed no difference in scores between the different intubation times ($P=0.93$), but showed a highly significant influence of dose ($P<0.01$).

**Discussion**

For safe rapid-sequence induction not only the muscles involved in intubation should be completely paralysed within 60 s, but also diaphragm and intercostal muscles to prevent bucking or coughing on placement of the endotracheal tube. This study shows that such a condition can be achieved with a $3 \times \text{ED}_{95}$ dose of rocuronium within 45 s after induction of anaesthesia. Only in two out of 19 patients was slight bucking present. This slight movement did not influence smooth placement and securing of the endotracheal tube. To achieve a full paralysis of the diaphragm a dose of $4 \times \text{ED}_{95}$ (1.2 mg kg$^{-1}$) is required [6].

Type and depth of anaesthesia have always played an important role in providing good intubating conditions. Propofol, especially in combination with alfentanil, provides such a suitable induction environment. Vigorous coughing reflexes, however, follow the placement of the endotracheal tube after a single dose of these induction agents. A rapid onset muscle relaxant is therefore obligatory even with this type of induction.

**Conclusions**

All intubating conditions, whether at 45 s or 60 s were either good or excellent. Almost all intubating conditions were excellent in the 0.9 mg kg$^{-1}$ groups. A combination of induction with alfentanil and propofol with rocuronium 0.9 mg kg$^{-1}$ enables safe rapid-sequence intubation to be carried out within 45 s. This is comparable with succinylcholine but without its side effects. Increasing the dose of rocuronium from 0.6 to 0.9 mg kg$^{-1}$ improves the conditions in a rapid-sequence intubation significantly.

**References**


