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Low-dose rocuronium improves conditions for tracheal intubation after induction of anaesthesia with propofol and alfentanil†

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Summary

We studied 60 adult patients to assess if low doses of rocuronium improved conditions for tracheal intubation during induction of anaesthesia with propofol 2.5 mg kg^{-1} and alfentanil 10 μg kg^{-1}. In a double-blind, randomized design, patients were allocated to one of three groups: group P = saline; group R_1 = rocuronium 0.1 mg kg^{-1}; and group R_3 = rocuronium 0.3 mg kg^{-1} Intubation conditions were judged as optimal, suboptimal or failure, based on the scoring of ease of jaw opening and laryngoscopy, position of the vocal cords and degree of straining after tracheal intubation. Intubation conditions were judged as optimal in one patient in group P, in six patients in group R_1, and in 18 patients in group R_3. Conditions were judged as a failure in seven patients in group P, in one patient in group R_1 and in none in group R_3. No laryngospasm or other complications were observed in any patient. The addition of low doses of rocuronium significantly improved intubation conditions ($P << 0.001$). Ventilation was controlled during surgery, and in no patient was any problem encountered with antagonism of neuromuscular block with neostigmine. Injection of rocuronium 0.3 mg kg^{-1} (ED_{95}) with propofol and alfentanil provided a high proportion of optimal intubation conditions. (*Br. J. Anaesth*. 1997; **78**: 92–94)

Key words

Anaesthetics i.v., propofol. Analgesics opioid, alfentanil. Intubation tracheal. Neuromuscular block, rocuronium.

Tracheal intubation may be accomplished after concurrent injection of alfentanil and propofol (without a neuromuscular blocking agent),[1] but a relatively high dose of alfentanil (40 μg kg^{-1} or greater), which may not be suitable for minor surgery of short duration, is required to obtain reliably satisfactory conditions.[1]

A low dose of neuromuscular blocking agent partially paralyses the laryngeal adductor muscles.[2] Thus concurrent injection of a low dose of a neuromuscular blocking agent, propofol and alfentanil may improve intubation conditions. In addition, the use of low doses of a neuromuscular blocking agent, in theory, shortens the time for recovery from neuromuscular block and reduces the requirement for anticholinesterase drugs. Rocuronium 0.3 mg kg^{-1} is the ED_{95} at the adductor pollicis muscle (as estimated by supramaximal single twitch stimulation at 0.1 Hz)[3] and the ED_{50} at the laryngeal adductor muscles,[2] and is half the recommended intubating dose.[3]

The aim of this study was to examine if injection of a low dose of rocuronium during induction of anaesthesia with propofol and alfentanil improved intubation conditions.

Methods and results

In a double-blind, randomized design, we studied 60 patients, aged 18–50 yr, after obtaining local Research Ethics Committee approval and written informed consent from all patients. Patients were excluded if they were obese or at risk of pulmonary aspiration, smoked more than 10 cigarettes per day, their tracheas were known to be difficult to intubate or where coughing or straining after tracheal intubation might be detrimental.

Patients were allocated randomly (in blocks of nine) to one of three groups: group P, placebo (10 ml of 0.9% saline); group R_1, rocuronium 0.1 mg kg^{-1} made up to 10 ml with saline; group R_3, rocuronium 0.3 mg kg^{-1} made up to 10 ml with saline.

Temazepam 20–30 mg was given orally, 1 h before induction of anaesthesia. The patient's lungs were preoxygenated with 100% oxygen via a face mask for 3 min. Immediately after injection of alfentanil 10 μg kg^{-1}, propofol 2.5 mg kg^{-1} containing lignocaine 10 mg was injected. If the patient did not lose consciousness after injection of propofol 2.5 mg kg^{-1}, the patient was withdrawn from the study. The study drug was then given and the i.v. cannula flushed with saline 20 ml. Anaesthesia was maintained with 50% nitrous oxide in oxygen and an i.v infusion of propofol 10 mg kg^{-1} h^{-1}. The lungs were ventilated manually to maintain normocapnia. Two minutes

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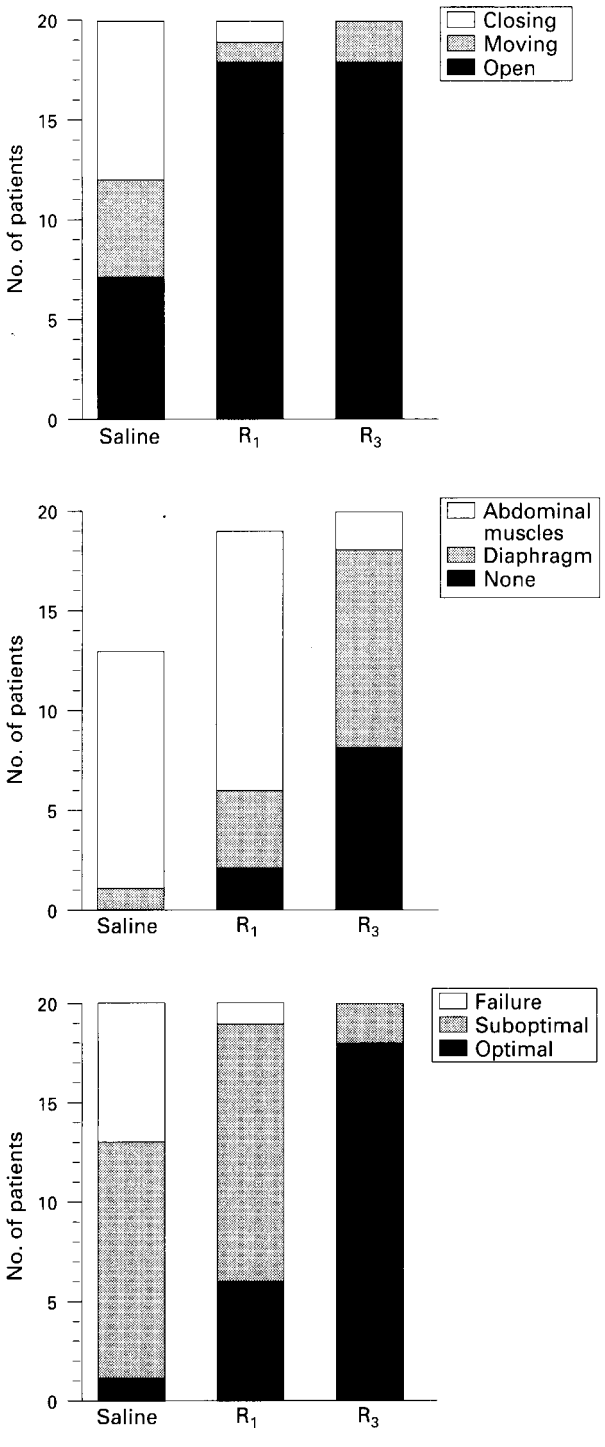

Figure 1 Position and movement of the vocal cords (top), degree of straining after tracheal intubation (middle) and overall conditions for tracheal intubation (bottom). Saline = no rocuronium, R_1 = rocuronium 0.1 mg kg^{-1} and R_3 = rocuronium 0.3 mg kg^{-1}. In all groups, propofol 2.5 mg kg^{-1} and alfentanil 10 μg kg^{-1} were given.

after administration of the study drug, an investigator, who was blinded as to the allocation, opened the patient's mouth and attempted to intubate the trachea using a Macintosh laryngoscope. A 9.0-mm id tracheal tube was used in males and a 8.0-mm id tube in females. Tracheal intubation was not attempted if the vocal cords were nearly or fully closed and if there was a possibility of injury to the vocal cords.

The investigator assessed three factors: ease of jaw opening and laryngoscopy (1 = easy; 2 = fair; 3 = difficult), position of the vocal cords and their movement (1 = open; 2 = moving; 3 = closing) and degree of straining ("bucking") after tracheal intubation and cuff inflation (1 = none; 2 = with diaphragm; 3 = with abdominal muscles). The occurrence of any significant complication was recorded.

Overall conditions for tracheal intubation were scored in three grades: optimal, suboptimal and failure. Tracheal intubation was judged as optimal when all scores were 1 or 2, and judged as suboptimal if any of the scores were 3. Failure to intubate was scored as a failure.

Chi-square test for trend was used to compare intubation conditions between group P and groups R_1 and R_3 (pooled) and if this proved significant, it was used to compare intubation conditions between groups R_1 and R_3. $P<0.05$ was considered significant. Confidence intervals (CI) for the proportion of optimal intubation conditions in groups R_1 and R_3 were also calculated.

We expected that intubation conditions would be optimal in 30% of patients in group P and in 80% of patients in group R_3.[4] Thus 20 patients in each group would be sufficient to detect a difference of 50% between groups P and R_3 with a power of 80–90% at $P=0.05$.

Each group consisted of 20 patients: mean ages in the three groups were similar (27 yr (group P), 30 yr (group R_1) and 29 yr (group R_3)), but mean weights were different (64 kg (group P), 74 kg (group R_1) and 72 kg (group R_3)).

Rocuronium 0.1 and 0.3 mg kg^{-1} (pooled) significantly improved intubation conditions ($P<<0.001$) (fig. 1). Intubation conditions were significantly better in group R_3 than in group R_1 ($P<0.001$). Laryngoscopy was easy in all patients. The proportions of optimal intubation conditions were 30% (95% CI 10–50%) in group R_1 and 90% (68–99%) in group R_3. In no patient did laryngospasm, bronchospasm, hypoxaemia or other significant complications occur.

Comment

We have shown that a low dose of rocuronium during induction of anaesthesia with propofol 2.5 mg kg^{-1} and alfentanil 10 μg kg^{-1} improved conditions for tracheal intubation, and that rocuronium 0.3 mg kg^{-1} (half "initial dose") provided optimal conditions in most patients.

The proportion of optimal intubation conditions after administration of propofol 2.5 mg kg^{-1} was greater when the time between injection of propofol and tracheal intubation was short.[5] Therefore, the choice of a neuromuscular blocking agent with a short onset time may be necessary to obtain a high proportion of optimal intubation conditions. Rocuronium 0.25 mg kg^{-1} has an onset time to maximum neuromuscular block of the laryngeal adductor muscles of 1.6 min, which is shorter than that of other non-depolarizing neuromuscular blocking agents currently available.[2,6]

Onset time shortens as the dose of rocuronium increases for doses producing complete neuromuscular block; however, when lower doses which are insufficient to produce complete block are given (<0.68 mg kg^{-1}, ED_{90} at the laryngeal adductor muscles[2]), onset time is similar, regardless of the dose.[6]

In this study, rocuronium 0.1 mg kg^{-1} appeared to relax the laryngeal adductor muscles; however, rocuronium 0.3 mg kg^{-1} would be required to minimize the incidence of straining after tracheal intubation.

After injection of rocuronium 0.25 mg kg^{-1}, maximum neuromuscular block of the adductor pollicis is approximately 70%, and the time to spontaneous 90% recovery of T1 twitch height at this muscle is about 10 min.[2] Therefore, it should be possible to antagonize neuromuscular block immediately after injection of this dose of rocuronium, and the incidence of residual neuromuscular block after surgery is likely to be low. In this study, ventilation was controlled during surgery, and in no patient were there problems with antagonism of neuromuscular block with neostigmine, although we did not study this formally.

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