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Thiopental or etomidate for rapid sequence induction with rocuronium?†

T. FUCHS-BUDER, H. J. SPARR AND T. ZIEGENFUß

Summary

We have assessed the effect of the choice of i.v. induction agent on intubation conditions, 60 s after administration of rocuronium 0.6 mg kg^{-1}. We studied 60 adult patients, allocated randomly to one of two groups. Anaesthesia was induced with alfentanil 10 μg kg^{-1} followed by thiopental 5 mg kg^{-1} (AT-R group; $n=30$) or etomidate 0.3 mg kg^{-1} (AE-R group; $n=30$). Both groups received rocuronium 0.6 mg kg^{-1}. Laryngoscopy was started 60 s later and intubation conditions were evaluated according to a standard score, which considered ease of laryngoscopy, condition of the vocal cords and reaction to intubation. In the AT-R group, overall intubation conditions were scored as excellent in 20 patients, good in nine and fair in the remaining patient. In the AE-R group, overall intubating conditions were excellent in 24 and good in six patients. The difference between the two groups was not significant. Of the three components of the intubation score assessed, response to intubation stimulus was significantly less pronounced in group AE-R compared with group AT-R ($P<0.05$): group AE-R, no reaction in 24 patients, slight diaphragmatic movement in five and mild coughing in one patient; group AT-R, no reaction in 13, slight diaphragmatic movement in 14, mild coughing in two and severe coughing in one patient. We conclude that etomidate as part of an induction regimen containing alfentanil and rocuronium attenuated the reaction to intubation to a greater extent than thiopental. (*Br. J. Anaesth*. 1998; **80**: 504–506)

Keywords: anaesthetic techniques, induction; anaesthetics i.v., thiopental; anaesthetics i.v., etomidate; neuromuscular block, rocuronium

Rocuronium has the fastest onset of action of the clinically available non-depolarizing neuromuscular blocking agents. Compared with the adductor pollicis muscle, the diaphragm is more resistant to the neuromuscular blocking properties of rocuronium, and onset of neuromuscular block is slower.[1] Thus neuromuscular block at the diaphragm may not be completely established when rocuronium is used for rapid sequence induction, leading to a diaphragmatic response to intubation in more than 50% of patients.[2] Using rocuronium ($2\times ED_{95}$) for rapid sequence induction, the choice of i.v. anaesthetic induction agent may be important in attenuating the reaction to intubation. It has been shown that opioids as part of the induction regimen improve rocuronium intubating conditions.[2] Gill and Scott reported that onset of vecuronium neuromuscular block was significantly shorter when anaesthesia was induced with etomidate (144±16 s) compared with thiopental (197±21 s) or propofol (206±21 s). They proposed etomidate as the i.v. induction agent of choice if rapid intubation of the trachea is required with a non-depolarizing neuromuscular blocking agent.[3] However, there is no information on whether etomidate rather than any other currently used i.v. induction agent improves the intubating conditions provided by other non-depolarizing neuromuscular blocking agents.

We hypothesized that induction of anaesthesia with etomidate may improve rocuronium intubating conditions at 60 s, by attenuating the diaphragmatic response to intubation. The aim of the study was to compare the effect of etomidate and thiopental on rocuronium ($2\times ED_{95}$) intubation conditions during rapid sequence induction.

Methods and results

After obtaining Ethics Committee approval and informed consent, we studied 60 ASA I–II patients, aged 18–70 yr, undergoing elective surgery under general anaesthesia. Patients with known neuromuscular disease or receiving medication known to influence neuromuscular function were excluded.

Patients were allocated randomly to one of two groups ($n=30$ in each), to receive thiopental (AT-R group) or etomidate (AE-R group) as the i.v. induction agent. Anaesthesia was induced with alfentanil 10 μg kg^{-1} followed by thiopental 5 mg kg^{-1} or etomidate 0.3 mg kg^{-1}, and rocuronium 0.6 mg kg^{-1} ($2\times ED_{95}$). All drugs were administered into a rapidly running i.v. infusion. Alfentanil, thiopental and etomidate were given over 10 s, followed by rocuronium, which was injected over 5 s. Sixty seconds after the end of injection of rocuronium, the trachea was intubated in all patients by the same experienced anaesthetist who was blinded to the drugs used. He assessed intubating conditions using the

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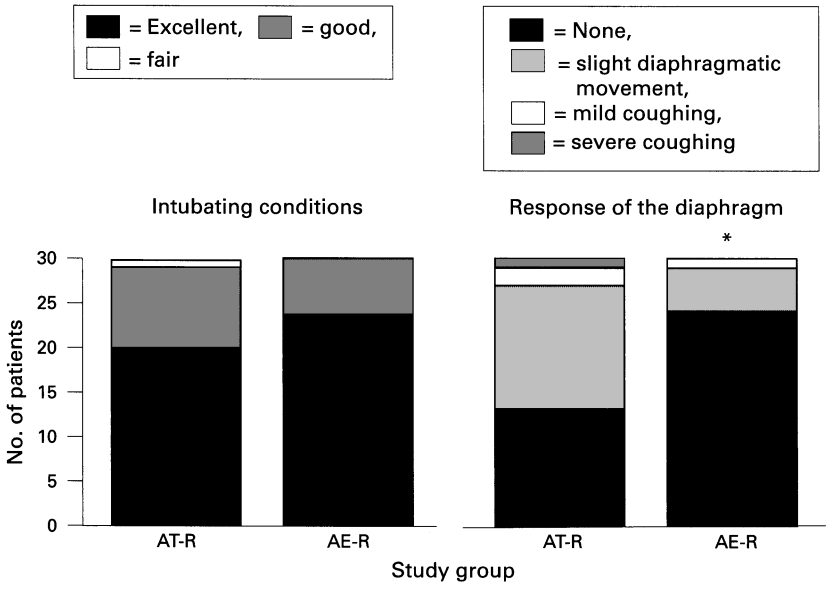

Figure 1 Overall intubation conditions (excellent, good or fair) and response of the diaphragm to tracheal intubation (none, slight diaphragmatic movement, mild coughing or severe coughing) after rapid sequence induction with alfentanil, thiopental and rocuronium (AT-R group) or alfentanil, etomidate and rocuronium (AE-R group). *$P<0.05$ compared with group AT-R.

criteria of Cooper and colleagues[4] : ease of laryngoscopy (0 = impossible, 1 = difficult, 2 = fair, 3 = easy), condition of the vocal cords (0 = closed, 1 = closing, 2 = moving, 3 = open), response to tracheal intubation (0 = severe coughing or bucking, 1 = mild coughing, 2 = slight diaphragmatic movement, 3 = none). The three components are added together to give an overall intubation score for each patient. A score of 8–9 was considered excellent, 6–7 good, 3–5 fair and 0–2 poor. Cricroid pressure was applied during placement of the tracheal tube. Intubating time (time from start of intubation until definitive placement of the tube) was measured in both groups.

Analysis of overall intubation conditions between the two study groups was performed using Fisher's exact test. In both groups (AT-R and AE-R), there were insufficient numbers of patients who had fair or poor overall intubation conditions, and therefore for analysis, patients scoring excellent were compared with those not scoring excellent (good, fair or poor). The same procedure was performed for analysis of each of the three components of the intubation score. For an 80% chance of demonstrating a significant difference ($P<0.05$) between the AT-R and AE-R groups, a sample size of 28 was required.[5] The Mann–Whitney *U* test was used for statistical comparison; differences were considered significant when $P<0.05$. Patient characteristics and intubating time are expressed as mean (SD) or range.

The study groups did not differ in age or weight; group AT-R, mean age 45 (range 18–70) yr, mean weight 73 (SD 11.5) kg; group AE-R, age 45 (18–69) yr, weight 75 (15.8) kg. Intubating time was similar in both groups: group AT-R, 12.6 (3.0) s; group AE-R, 12.0 (2.5) s (ns). In group AT-R, overall intubating conditions were rated excellent in 20, good in nine and fair in one patient; in group AE-R, conditions were excellent in 24 and good in six patients (ns) (fig. 1). Of the three components of the intubation score, ease of laryngoscopy and condition of the vocal cords were similar in both groups (ease of laryngoscopy in group AT-R, easy in 26, fair in three and difficult in one patient, and in group AE-R, easy in 27 and fair in three patients (ns); condition of the vocal cords in group AT-R, open in 26 and moving in four patients, and in group AE-R, open in 28, moving in two patients (ns). However, the response to intubation was more pronounced in group AT-R (no reaction in 13, slight diaphragmatic movement in 14, mild coughing in two and severe coughing in one patient) compared with group AE-R (no reaction in 24, slight diaphragmatic movement in five and mild coughing in one patient) ($P<0.05$) (fig. 1).

Comment

We have investigated if induction of anaesthesia with etomidate, an anaesthetic with few side effects, may improve intubation conditions produced by rocuronium. The most important findings were that overall intubating conditions 60 s after administration of rocuronium ($2 \times ED_{95}$) were good to excellent regardless of whether thiopental 5 mg kg^{-1} or etomidate 0.3 mg kg^{-1} was used as the i.v. induction agent. However, etomidate attenuated the reaction of the diaphragm to intubation to a greater extent than thiopental.

This may seem surprising as i.v. anaesthetics, in contrast with volatile anaesthetics, are generally thought not to interact with neuromuscular blocking drugs. However, they may influence intubation conditions in several ways: first, by depression of laryngeal and pharyngeal reactivity to the intubation stimulus. Propofol rather than thiopental may further facilitate intubation, as propofol depressed these reflexes to a greater extent than thiopental.[6] This may be relevant in situations in which the trachea is intubated without the use of neuromuscular blocking agents. However, when the induction regimen contains a neuromuscular blocker, intubating conditions after propofol did not differ from those after thiopental.[2] Second, the effects of some neuromuscu-

lar blocking agents may be potentiated directly by the i.v. anaesthetic. In this context, it has been shown that etomidate potentiates the neuromuscular blocking effect of pancuronium.[7] This has not been confirmed for rocuronium,[8] and the definitive role of this interaction remains speculative. Third, onset of neuromuscular block depends on both circulatory and non-circulatory factors. Circulatory factors determine the distribution of the neuromuscular blocking agents from the site of injection to the different muscles. Thus muscle perfusion, and consequently onset of neuromuscular block, may be affected by the i.v. anaesthetic. In this context, Gill and Scott reported a significant negative correlation between onset of neuromuscular block and change in mean arterial pressure; onset time was shortest when anaesthesia was induced with etomidate compared with thiopental or propofol.[3]

In this study, etomidate attenuated the reaction to intubation to a greater extent than thiopental; less diaphragmatic reaction occurred in group AE-R. If opioids (equivalent to alfentanil 20 $\mu g\,kg^{-1}$) and a higher dose of rocuronium ($3 \times ED_{95}$ rather than $2 \times ED_{95}$) are used, etomidate may improve intubating conditions further. This may be of interest if succinylcholine is contraindicated and rapid sequence induction is performed with rocuronium.

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