Effect of remifentanil on the auditory evoked response and haemodynamic changes after intubation and surgical incision


Summary
We have observed the effect of intubation and incision, as measured by the auditory evoked response (AER) and haemodynamic variables, in 12 patients undergoing hernia repair or varicose vein surgery who received remifentanil as part of either an inhaled anaesthetic technique using isoflurane or as part of a total i.v. technique using propofol. Anaesthesia was induced with remifentanil 1 μg kg⁻¹ and propofol, neuromuscular block was achieved with atracurium 0.6 mg kg⁻¹ before intubation, and anaesthesia was maintained with a continuous infusion of remifentanil in combination with either a continuous infusion of propofol or inhaled isoflurane. The AER and haemodynamic variables were measured before and after intubation and incision. The effects of intubation and incision on the AER and haemodynamic variables were not significantly different between the remifentanil–propofol and remifentanil–isoflurane groups. However, the study had a low power for this comparison. When the data for the two anaesthetic combinations were pooled, the only significant effects were increases in diastolic arterial pressure and heart rate immediately after intubation; these were not seen 5 min after intubation. There were no cardiovascular responses to incision. There were no significant changes in the AER after intubation or incision. (Br. J. Anaesth. 1998; 81: 785–786).

Keywords: analgesics; opioid; remifentanil; anaesthesia, depth; brain, evoked potentials; cardiovascular system; effects; intubation; tracheal

In this study, we have observed two different anaesthetic techniques, each in combination with remifentanil. We assessed cortical and autonomic arousal by examining the auditory evoked response (AER) and haemodynamic changes in response to intubation and incision. The AER has been shown to be a useful monitor of depth of anaesthesia; the amplitude of the early cortical waves of the AER has been shown to be a sensitive measure of anaesthetic concentration and to respond to laryngoscopy and surgical stimulation. Therefore, the AER reflects the balance between CNS depression caused by anaesthetic drugs and arousal caused by surgical or other stimuli.

Methods and results
After obtaining approval from Harrow Research Ethics Committee and written informed consent, we studied 12 ASA I–II patients undergoing elective hernia repair or varicose vein surgery. They were allocated randomly to receive maintenance anaesthesia with either remifentanil–isoflurane or remifentanil–propofol. None received premedication. All patients were given Hartmann’s solution 5 ml kg⁻¹, glycopyrrolate 0.2 mg i.v., and the lungs were preoxygenated with 100% oxygen for 3 min. A loading bolus dose of remifentanil 1 μg kg⁻¹ was administered over 30–60 s, followed by infusion of remifentanil 0.5 μg kg⁻¹ min⁻¹. Propofol (mean 80 mg) was then administered by slow injection, 10 mg every 10 s, until loss of consciousness. After achieving neuromuscular block with atracurium 0.6 mg kg⁻¹, the trachea was intubated. Those receiving inhaled isoflurane for maintenance of anaesthesia were administered 0.6% end-tidal isoflurane in an air–oxygen mixture. Those receiving propofol were given a continuous infusion of propofol 9 mg kg⁻¹ h⁻¹, reducing to 6 mg kg⁻¹ h⁻¹ after 10 min. The infusion of remifentanil was decreased to 0.25 μg kg⁻¹ min⁻¹, 5 min after intubation, and rectal diclofenac (100 mg) was administered. Intraoperative surgical stress responses (e.g. hypertension or tachycardia) were controlled by adjustments of the propofol infusion or end-tidal isoflurane concentration and/or remifentanil infusion, as was hypotension. Persistent hypotension or bradycardia was treated with epididine or glycopyrrolate.

Details of the AER recording have been described previously. The EEG was recorded from adhesive silver–silver chloride electrodes attached at the mastoid and forehead. A rarefaction click stimulus was delivered at 6 s⁻¹ to each ear simultaneously through close-fitting ear pieces at 75 dB above the average hearing threshold. Average AER waveforms corresponding to 2 min 40 s (1024 sweeps) before and after intubation and skin incision were derived. Pa and Nb amplitudes and latencies were measured from these waveforms. Haemodynamic measurements were obtained 1 min before and 1 and 5 min after intubation and incision. Analysis of variance was used to study differences between variables. The results from the 12 patients are summarized in table 1. There was no significant difference between the remifentanil–propofol group and the remifentanil–isoflurane groups for the AER or haemodynamic variables. Nb amplitude increased on intubation in the propofol group while it decreased in the isoflurane group (P = 0.04). As this change was
not supported, as would be expected, by other related AER variables, we dismissed it as a chance finding. There was no significant difference in the use of rescue medication between groups. The data were pooled and we found that there was no overall response to laryngoscopy, intubation or incision, as measured by the AER. On intubation, the only significant changes were increases in diastolic arterial pressure and heart rate. There were no haemodynamic changes associated with incision.

**Comment**

After induction of anaesthesia with remifentanil 1 μg kg⁻¹ and propofol (mean 80 mg), intubation produced no significant change in the AER. In this study we were dependent on historical controls because it was not considered ethical to substitute either a placebo or nitrous oxide for remifentanil. Previous studies by our group have demonstrated increases in Pa amplitude of 53%, 36% and 60% in response to succinylcholine, laryngoscopy and intubation. Studies by our group have demonstrated increases in Pa amplitude of 53%, 36% and 60% in response to succinylcholine, laryngoscopy and intubation. In this study, we found heart rate and diastolic arterial pressure responses to intubation. The fact that no AER response was seen could indicate that the AER is a less sensitive measure of depth of anaesthesia compared with cardiovascular changes. However, it is more likely that these variables measure different aspects of depth of anaesthesia.

It is very difficult to determine equipotent concentrations of inhalation or i.v. anaesthetics, such as isoflurane and propofol, and in particular in combination with remifentanil. However, there was no significant difference between changes in any of the variables measured in the isoflurane group compared with the propofol group, with the concentrations used in this study. The study had low power for comparing the remifentanil–isoflurane and remifentanil–propofol regimens because of the small number of subjects in each group (n = 6).

In summary, we conclude that remifentanil (bolus dose of 1 μg kg⁻¹ followed by infusion) in combination with either propofol 6 mg kg⁻¹ h⁻¹ or 0.6% endtidal isoflurane obtunded the early cortical effects of intubation and incision.

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**References**