Effectiveness and sequelae of very low-dose suxamethonium for nasal intubation

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Summary

We have studied the effectiveness and sequelae of low-dose suxamethonium in 60 day-case oral surgery patients requiring nasal intubation. Anaesthesia was induced with propofol and alfentanil; 60 patients were allocated randomly to three groups of 20 patients and received no suxamethonium, suxamethonium 0.25 mg kg\(^{-1}\) or 0.5 mg kg\(^{-1}\). All patients received i.v. fentanyl and diclofenac 100 mg rectally for analgesia. Good intubating conditions were produced in all 20 patients receiving suxamethonium 0.25 mg kg\(^{-1}\), in 19 patients receiving suxamethonium 0.5 mg kg\(^{-1}\) and in 11 patients not receiving a neuromuscular blocker. The incidence of postoperative myalgia after suxamethonium 0.25 mg kg\(^{-1}\) (20%) did not differ significantly from the incidence after propofol and alfentanil alone (28%). (Br. J. Anaesth. 1995; 74: 31–34)

Key words
Neuromuscular block, suxamethonium. Intubation nasotracheal, complications.

Patients undergoing dental extractions under general anaesthesia frequently require nasal intubation and are often suitable candidates for day-case surgery. Suxamethonium remains the most effective neuromuscular blocker for rapid intubation and short duration of action, with the exception of patients with abnormal pseudocholinesterase.

Studies have shown that oral intubation can be produced safely and effectively without the use of a neuromuscular blocker. However, nasal intubation frequently requires increased manipulation of the tracheal tube with a consequent risk of laryngeal spasm and trauma caused by excessive coughing and movement. The use of a neuromuscular blocker avoids these problems.

However, suxamethonium is associated with several side effects, in particular debilitating myalgia. This complication may prevent discharge of day-case patients or may render them bed-bound for several days on their return home. Recently it has been suggested by Stewart, Hopkins and Dean that the use of low-dose suxamethonium (0.5 mg kg\(^{-1}\)) reduces the incidence of myalgia, while providing satisfactory intubating conditions [1].

This study was designed to test the hypothesis that the dose of suxamethonium could be reduced further to avoid suxamethonium-induced myalgia, while still providing satisfactory intubating conditions.

Patients and methods

We studied 60 ASA I and II patients attending for elective oral surgery under general anaesthesia necessitating nasal intubation. Written informed consent was obtained from all patients and local Ethics Committee approval was obtained. Patients aged less than 16 yr or more than 50 yr were excluded, as were patients who appeared clinically to present difficulty in intubation or for whom the anaesthetic technique was unsuitable.

Patients were premedicated with temazepam 10 mg, 1 h before operation. On arrival in theatre, a vein was cannulated and monitoring commenced with ECG, pulse oximetry and non-invasive arterial pressure. Anaesthesia was induced with propofol 2.5 mg kg\(^{-1}\) given at a bolus rate of 1200 ml h\(^{-1}\) using a Graseby 3400 syringe driver. This was followed immediately by alfentanil 15 μg kg\(^{-1}\). The propofol infusion was continued at 10 mg kg\(^{-1}\) h\(^{-1}\) and 30 s later patients received sterile water (group 1), suxamethonium 0.25 mg kg\(^{-1}\) (group 2) or 0.5 mg kg\(^{-1}\) (group 3), each made up to 2 ml. These were prepared by one of the investigators not participating in the anaesthetic and 20 patients were allocated randomly to each of the three groups. Intubation was performed 60 s after administration of suxamethonium or water. Portex North polar preformed tubes, size 6.5 for females and 7.0 for males, were used. Jaw and cord relaxation were graded according to Young, Clarke and Dundee [2] (table 1), and an assessment of overall intubating conditions made according to the scheme of Lund and Stovner [3] (table 2). Coughing both on intubation and cuff inflation was also scored on a four-point scale: 0 = no coughing, 1 = minimal cough, 2 = moderate coughing and 3 = severe coughing. The presence of fasciculations was noted, as was the time to re-
sumption of spontaneous respiration, following which patients were allowed to breathe spontaneously for the remainder of the operation.

Anaesthesia was maintained with a propofol infusion, nitrous oxide and oxygen. All patients received fentanyl 0.001–0.002 mg kg⁻¹ i.v. and diclofenac 100 mg rectally for analgesia after induction.

Later on the day of operation (day 1) patients were interviewed by one of the investigators (not participating in the anaesthetic) regarding muscle pain and sore throat and were given a questionnaire to return 5 days after operation (day 5) with the same questions. Muscle pain and sore throat were scored as none, mild, moderate or severe. In the case of myalgia, patients complaining of jaw pain only, which could be attributed to their operation, were scored as having no pain.

Statistical analysis was carried out on Minitab Statistical Software Release 8.2 (1991). Analysis of variance and chi-square tests were used to compare patient groups and chi-square tests to compare intubating conditions, incidence of muscle pain and sore throat.

Results

We studied 60 patients and full follow-up was successful in all patients (table 3). Overall intubating conditions were significantly better in both groups receiving suxamethonium compared with the group which received propofol and alfentanil alone (groups 2 and 3 compared with group 1, \( P = 0.005 \) and \( P = 0.025 \), respectively). In contrast there was no significant difference in intubating conditions between the two groups receiving suxamethonium (table 4). In group 1, intubation was unsuccessful in two patients because of a combination of poor vision and poor cord relaxation. In both patients the trachea was successfully intubated after a dose of suxamethonium 50 mg and the data from these patients were omitted from further analysis.

There was a significant difference in the incidence of coughing on intubation between the groups who received suxamethonium and the group who did not (table 5). Postoperative sore throat was present in more than 50 % of patients in all three groups at both 1 and 5 days after operation. However, there was no significant difference in the incidence of sore throat between the three groups.

Patients in group 2 had a similar incidence of myalgia as patients in group 1 on day 1 and day 5 after operation. Group 3 patients had a higher incidence of muscle pain on both day 1 and day 5. However, there was no significant difference in the incidence of muscle pain between the three groups (table 6). Muscle fasciculation was noted in 70 % of patients in group 2 and 90 % of patients in group 3. The duration of apnoea between the three groups was comparable, with no significant difference between the groups (table 7).

Discussion

Suxamethonium currently remains the only neuromuscular blocking agent which provides satisfactory intubating conditions of rapid onset and brief
duration of action (with the exception of patients with deficient or abnormal pseudocholinesterase). Although a selection of rapid onset, short-acting non-depolarizing neuromuscular blockers has become available, they have not to date replaced suxamethonium [4]. There are however several adverse effects which limit the usefulness of suxamethonium. One of the most frequent and disabling of these is myalgia, occurring in up to 60% of patients receiving a standard dose of 1 mg kg\(^{-1}\). The mechanism of this myalgia is unknown. It may be related to the degree of muscle fasciculation which occurs before the onset of neuromuscular block. Additionally, activation of phospholipases with membrane phospholipid degradation and release of free fatty acids has been postulated [5]. After the use of suxamethonium there is often evidence of muscle damage, as demonstrated by an increase in creatine kinase. Several methods of attenuating suxamethonium myalgia have been tested on the basis of these hypotheses, including pretreatment with a non-depolarizing neuromuscular blocker, benzodiazepine, chlorpromazine, aspirin and vitamin E [6, 7]. Pretreatment with a non-depolarizing blocker appears to be most effective at reducing both myalgia and elevation of creatine kinase. However, this may be to the detriment of intubating conditions [8]. Stewart, Hopkins and Dean [1] demonstrated a reduction in postoperative myalgia using a reduced dose of suxamethonium (0.5 mg kg\(^{-1}\)) and found that intubating conditions were equivalent to those seen with suxamethonium (1.5 mg kg\(^{-1}\)), but that the incidence of myalgia was reduced from 70% in the standard-dose group to 41% in the low-dose group assessed over the first 4 days after surgery.

In this study we found that a reduction in suxamethonium dose to 0.25 mg kg\(^{-1}\) provided equally satisfactory intubating conditions which were superior to those after propofol and alfentanil alone. Although the incidence of myalgia after operation appeared to be reduced with the smaller dose of suxamethonium, the differences were not statistically significant possibly because of the number of patients studied.

It is interesting that three patients who did not receive suxamethonium complained of severe muscle pain on day 5 after operation. There were no notable intraoperative factors which could account for this. All three patients reported jaw pain which was presumed to be a result of the operation itself, in addition to more generalized myalgia. This may have contributed to the severity of pain described. In addition, factors other than suxamethonium have been identified as causes of postoperative muscle pain, including poor patient positioning.

In the study by Stewart, Hopkins and Dean [1], anaesthesia was induced with thiopentone. It is interesting that some studies suggest that both propofol [9] and thiopentone [10] may attenuate suxamethonium-induced myalgia, although other workers have failed to confirm this [11]. We used propofol as the induction agent as it is currently the drug of choice for day-case surgery. The incidence of myalgia after suxamethonium 0.5 mg kg\(^{-1}\) was similar in the two studies.

All of our patients received alfentanil at induction and a diclofenac suppository immediately after induction. In the light of work suggesting that prostaglandin activation may play a role in suxamethonium-induced myalgia and that aspirin may reduce the incidence, it is possible that diclofenac may have contributed to the low incidence of myalgia. However, for the 0.5-mg kg\(^{-1}\) group, the incidence of myalgia was comparable with that seen in the study of Stewart, Hopkins and Dean [1] where the patients did not receive non-steroidal anti-inflammatory drugs.

It has been shown that propofol and alfentanil alone, or supplemented with lignocaine, provide satisfactory conditions for oral intubation in the majority of patients [12, 13]. Nasal intubation often requires more manipulation of the tracheal tube and hence is more likely to induce coughing and laryngospasm. Coghlan, McDonald and Cserep gained successful nasal intubation using propofol and alfentanil only, in 83% of subjects [14]. In our study, in 90% of patients receiving propofol and alfentanil alone, intubation was successful. However, we have demonstrated that intubating conditions were significantly better with the addition of a low dose of suxamethonium, such that intubation was successful in 100% of patients and that coughing on intubation was significantly less.

With increasing emphasis on day-case surgery it is important that anaesthetic techniques are tailored to allow early patient recovery with minimal side effects. While the high incidence of suxamethonium-induced myalgia may preclude its use at standard doses, our data suggest that very low-dose suxamethonium may be effective in providing good intubating conditions without significant myalgia.

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References


11. Maddineni VR, Mirakhur RK, Cooper AR. Myalgia and biochemical changes following suxamethonium after induction of anaesthesia with thiopentone or propofol. *Anaesthesia* 1993; 48: 626-628.

