Remifentanil sedation for awake fibreoptic intubation with limited application of local anaesthetic in patients for elective head and neck surgery*

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Summary

The aim of this study was to investigate the performance of awake fibreoptic intubation using remifentanil sedation with topical anaesthesia limited only to the nasal mucosa. Twenty-four patients presenting for elective head and neck surgery were sedated using remifentanil titrated to effect and local anaesthetic was applied to the nasal mucosa. Vital signs were recorded throughout the procedure and both the anaesthetist and an observer rated the ease of the procedure. Intubation was successful in all patients and the procedure was rated as easy in 15 (63%) of patients. Mean arterial pressure remained within 8% of baseline in all cases and respiratory rate remained > 8 breaths.min⁻¹ in all but three patients. Although 56% of patients interviewed postoperatively said they recalled the procedure, all but one would undertake the same procedure again if necessary. This technique appears reliable in providing adequate sedation whilst maintaining cardiovascular and respiratory stability.

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Awake fibreoptic intubation is an established technique for the management of a difficult or a potentially difficult airway. Key requirements of this technique include adequate preparation of the patient, whilst maintaining patient safety and minimising discomfort. In addition to topical anaesthesia of the airway, a number of drugs have been described to provide sedation for this procedure [1–7].

Remifentanil is a potent short-acting synthetic opioid with fast onset and rapid metabolism. It provides profound analgesia, suppresses airway reflexes and has minimal effect on cognitive function [8, 9]. Such properties make it an attractive sedative drug for awake fibreoptic intubation and we have used remifentanil for awake fibreoptic intubation in patients requiring head and neck surgery and found that the procedure not only appears well tolerated but the requirement for topical anaesthesia may be reduced.

Whilst previous studies have evaluated remifentanil as a single sedative agent for awake fibreoptic intubation, there are no reports of its use without the application of local anaesthetic to the larynx and/or trachea. Reducing the use of local anaesthetic may have advantages in terms of reduced risk of local anaesthetic toxicity, reduced potential for coughing and laryngospasm and improved visualisation of the larynx. By limiting local anaesthetic application the overall complexity of the procedure might also be reduced.

The aim of this study was to investigate the use of remifentanil for conscious sedation for awake fibreoptic nasotracheal intubation without the application of local anaesthetic to the larynx or trachea. We aimed to study the dose range of remifentanil infusion required, cardiovascular and respiratory changes during the procedure, ease of intubation, occurrence of complications and the acceptability of the technique to the patient.
Methods

Following approval by the Local Research Ethics Committee and written informed consent, 24 starved patients presenting for non-emergency head and neck surgery requiring nasotracheal intubation were studied. Patients were excluded from the study if they refused awake fibreoptic intubation, had acute upper airway obstruction or if they were currently receiving high dose opiate medication.

Two anaesthetists were present during the procedure; one responsible for performing the awake fibreoptic intubation and the other for observation and data collection. On arrival in the anaesthetic room, intravenous access was established and standard monitoring was commenced (electrocardiogram, pulse oximetry, non-invasive blood pressure). Patients were asked to breathe through each nostril to assess patency. The nostril with the greatest patency was prepared using two drops of Otrivine® (xylometazoline hydrochloride 0.1%) and 2 ml of Instillagel® (lidocaine hydrochloride 2%, chlorhexidine gluconate solution 0.25%). Oxygen was delivered at 4 l.min⁻¹ via a nasal sponge placed in the other nostril. Remifentanil infusion was commenced at 0.3 µg.kg⁻¹.min⁻¹ and infusion rates were titrated up or down to achieve adequate sedation. Adequate sedation was defined as the point at which the patient would fall asleep if undisturbed but would respond immediately to verbal command.

A fibreoptic bronchoscope (Olympus LF-2) loaded with a size 6 reinforced tracheal tube (Mallinckrodt Safety-Flex™, Athlone, Ireland) was passed through the prepared nostril and into the trachea. The tracheal tube was gently advanced over the fibreoptic bronchoscope into the trachea and general anaesthesia was then induced using propofol. With the exception of the instillagel® applied to the nasal mucosa, no further local anaesthetic was used to anaesthetise the airway during the procedure.

Blood pressure, pulse, oxygen saturation and respiratory rate were recorded prior to starting the remifentanil infusion and then at three minute intervals until the fibreoptic bronchoscope was passed through the nose. Thereafter, vital signs were recorded every minute until tracheal intubation was achieved. The time taken to achieve adequate sedation and the time to successful tracheal intubation were recorded. The difficulty of the procedure was independently assessed as ‘easy’, ‘moderate’ or ‘difficult’ by both the anaesthetist performing the procedure and by the observing anaesthetist.

A short postoperative interview was conducted the day after surgery to establish recall, side effects and how acceptable the procedure was to the patient.

Results

Twenty-four patients were studied and awake fibreoptic intubation was successfully completed in all patients (patient characteristics are shown in Table 1). The time taken to achieve adequate sedation and intubation are shown in Table 2. The dose of remifentanil infusion ranged between 0.2–0.5 µg.kg⁻¹.min⁻¹. The anaesthetist who performed the procedure and the observing anaesthetist rated the procedure as follows: ‘easy’ in 17 (71%) and 15 (63%) patients, ‘moderate’ in five (21%) and seven (29%) and ‘difficult’ in two (8%) and two (8%) respectively. Heart rate, blood pressure and respiratory rate changes during sedation and endoscopy are shown in Figs 1, 2, and 3 respectively. Mean arterial blood pressure remained within 8% of the baseline in all cases. Respiratory rate was reduced during the remifentanil infusion but remained > 8 breaths.min⁻¹ in 21 of 24 subjects (88%). The lowest respiratory rate recorded was 2 breaths.min⁻¹ and this was associated with a reduction in oxygen saturation to 78%. All three patients whose respiratory rate fell to < 8 breaths.min⁻¹ responded to verbal command and were able to immediately increase respiratory rate to 8 or more breaths.min⁻¹. Oxygen saturation fell to < 94% in three (12.5%) patients. This fall in oxygen saturation was transient in all patients.
and increased following a reduction in the remifentanil infusion rate. Coughing during placement of the tracheal tube was recorded in 13 (54%) patients and grimacing in six (25%) patients.

Data from postoperative follow up was available for 18 of the 24 patients (75%) (Table 3). Ten (56%) patients recalled the procedure and all but one patient stated they would agree to the same procedure again if necessary. Events recalled included the application of instillagel and otrivine to the nose and discomfort during passage of the endotracheal tube through the nose.

**Discussion**

Fibreoptic intubation was successfully performed in all patients undergoing elective head and neck surgery using remifentanil for conscious sedation with topical anaesthesia limited to the nasal mucosa. Cardiovascular and respiratory stability were maintained throughout and although patients frequently recalled the procedure, the technique studied was acceptable to most patients.

Remifentanil has previously been used as a sole agent and also in combination with propofol and midazolam for sedation for awake fibreoptic intubation [2, 3, 5–7]. Neidhardt and colleagues studied 40 patients sedated with propofol 2 mg.kg$^{-1}$.h$^{-1}$ and remifentanil commenced at 0.05 µg.kg$^{-1}$.min$^{-1}$ and adjusted thereafter according to respiratory rate [5]. Intubation was successful in all patients and oxygen saturation remained above 93%. Changes in blood pressure and heart rate exceeded 30% from baseline in one patient only. Coughing occurred in five patients and only three of the 40 patients recalled the procedure. In addition to propofol and remifentanil, lidocaine spray was used to provide topical anaesthesia to the nose, pharynx and larynx.

Remifentanil has been administered at different set rates of infusion, by bolus dose followed by infusion and more recently by target-controlled infusion in studies investigating its use as the principal agent for sedation for awake fibreoptic intubation [3, 6, 7]. Consistent with the findings of our study, these studies found that remifentanil provided haemodynamic stability and good conditions for fibreoptic intubation. In contrast to our study however,

**Table 3** Postoperative follow up data.

<table>
<thead>
<tr>
<th>Event</th>
<th>Count (Proportion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recalled procedure</td>
<td>10 (56)</td>
</tr>
<tr>
<td>Described procedure as comfortable</td>
<td>12 (67)</td>
</tr>
<tr>
<td>Would agree to undergo procedure again</td>
<td>17 (94)</td>
</tr>
<tr>
<td>Sore throat</td>
<td>3 (17)</td>
</tr>
<tr>
<td>Sore nose</td>
<td>3 (17)</td>
</tr>
</tbody>
</table>

Data was available from 18 of the 24 patients who underwent awake fibreoptic intubation. Values are number (proportion)
all patients received local anaesthetic to the larynx in addition to remifentanil sedation. Puchner et al. found that remifentanil infusion over a range of 0.1–0.5 μg.kg\(^{-1}\).min\(^{-1}\), a dose similar to that used in our study, reduced coughing during advancement of the nasotracheal tube through the nose and into the trachea compared with sedation provided by a combination of fentanyl and midazolam [3]. Supraglottic and subglottic topical anaesthesia was applied in both groups of patients and recall of the procedure was significantly higher in the remifentanil group. Smaller doses of remifentanil have been studied for awake fibreoptic intubation. A bolus dose of 0.75 μg.kg\(^{-1}\) followed by a continuous infusion of 0.075 μg.kg\(^{-1}\).min\(^{-1}\) compared with 1.5 μg.kg\(^{-1}\) bolus followed by 0.15 μg.kg\(^{-1}\).min\(^{-1}\) infusion, conferred similar haemodynamic stability and intubating conditions but resulted in less sedation than the higher dose regimen [6]. The authors concluded that the higher dose regimen did not provide any additional benefit despite demonstrating less coughing and reduced recall of the procedure in this group. In contrast to our study, midazolam 0.05 mg.kg\(^{-1}\) was administered to both groups before the start of the procedure and lidocaine was applied to the supraglottic region and vocal cords. More recently, remifentanil target controlled infusion (TCI) has been compared with propofol TCI for conscious sedation during awake fibreoptic intubation. A bolus dose of 0.75 μg.kg\(^{-1}\) followed by a continuous infusion of 0.075 μg.kg\(^{-1}\).min\(^{-1}\) compared with 1.5 μg.kg\(^{-1}\) bolus followed by 0.15 μg.kg\(^{-1}\).min\(^{-1}\) infusion, conferred similar haemodynamic stability and intubating conditions but resulted in less sedation than the higher dose regimen [6].

Patients with acute airway compromise were not investigated in this current study and we are unable to extrapolate our findings to this group. Remifentanil sedation for awake fibreoptic intubation has been successfully reported in a case of impending airway obstruction in a morbidly obese patient with severe inflammation of the neck [12]. A remifentanil infusion was commenced at 0.07 μg.kg\(^{-1}\).min\(^{-1}\) and topical anaesthetic applied to the nasal mucosa and vocal cords via the working channel of the fibrescope. The patient tolerated passage of the endotracheal tube through the vocal cords without grimacing or coughing and oxygen saturations remained above baseline throughout the procedure with supplemental oxygen provided via a facemask.

Despite the intense analgesia and sedation provided by remifentanil, in common with other studies [3, 7], we found that patients were likely to recall details of the fibreoptic procedure. Despite this, acceptability of the technique was high and this has implications when
repeated surgical procedures are often performed in this group of patients. Addition of a benzodiazepine might reduce the incidence of recall but this may be at the expense of increased sedation and reduced ability to titrate sedation.

Several sedative agents and different methods of topical anaesthesia of the upper airway have been described to optimally prepare the patient for awake fibreoptic intubation. We have found that remifentanil infusion with topical anaesthesia of the nasal mucosa only is sufficient to reliably enable fibreoptic intubation without the need for additional local anaesthetic to the larynx.

References