Awake intubation is usually performed by anaesthetists with the aid of a fibreoptic laryngoscope or bronchoscope under local anaesthetic with supplementary sedation. Awake fibreoptic intubation is indicated when there is concern about the ability to ventilate the lungs after induction of anaesthesia due to anticipated difficulty with facemask ventilation or anticipated difficult tracheal intubation [1]. Awake fibreoptic intubation (AFOI) is a well-established technique with a reputation for safety [2] and a broad evidence base to support its use. Unfortunately the scientific basis for the selection or use of sedation techniques is less clear.

Role of awake intubation

The safety of AFOI relies on the fact that an immediate escape route is available. When a patient is conscious and breathing spontaneously, oxygenation is preserved. If necessary the intubation attempt can be abandoned, alternative techniques may be employed, or AFOI can be re-attempted later, perhaps with a more experienced anaesthetist. The central pillar of safe awake intubation is, therefore, maintenance of spontaneous ventilation and avoidance of apnoea.

Complications of AFOI

Despite the established role of awake fibreoptic intubation in the management of anticipated difficult airway, AFOI is not suitable for all airway problems. Closed claim insurance analyses performed by the American Society of Anesthesiologists (ASA) show loss of airway control and hypoxia may follow administration of sedation or develop during instrumentation of the airway during awake intubation [3]. The greatest potential for these complications occurs in the presence of severe upper airway obstruction, and complete obstruction is described in this patient group [3-5]. Loss of muscle tone resulting from administration of sedation reduces the lumen [6] of the airway leading to airway obstruction and hypoxia. Application of local anaesthetic to the airway precipitates coughing, increases oxygen demand and in the presence of extra-thoracic lesions may lead to airway collapse during forceful inspiration. If endoscopy is attempted in a narrowed airway the airway resistance will be increased by the placement of the endoscope into the narrowed airway; this has been likened to placing a cork in a bottle. Serious airway problems have also occurred at induction of general anaesthesia when used to manage a failed awake intubation [3].

Sedation for AFOI

Fibreoptic intubation may be performed purely under local anaesthesia in a fully conscious patient, or under general anaesthesia. By using a combination of local anaesthetic with sedation the procedure may be performed at any level of consciousness between these two extremes. Many patients will need repeated intubations under local anaesthesia, therefore it is important to provide a pleasant experience to ensure the patient will accept awake intubation in the future. Sedation should make the performance of AFOI less stressful and more comfortable for the patient. An objective indicator of this is that tracheal intubation under local anaesthetic combined with sedation can be performed with great haemodynamic stability [7]. Excessive sedation in patients with known airway problems reduces the margin of safety, often in a situation where the safety record is the very reason for which awake intubation was selected.
AFOI without sedation

AFOI can be performed under local anaesthesia alone with no sedation [8], and this has been advocated for diagnostic bronchoscopy. An unsedated patient will often remain still and respond to instructions from the endoscopist to perform manoeuvres such as head extension, mouth opening or tongue protrusion. These manoeuvres may aid the view obtained by the endoscopist. A report of a self-selected group of 200 anaesthetists who underwent AFOI on a training course [9] provides an indication of the least acceptable parts of the procedure. Fifty four percent of subjects experienced some degree of pain or discomfort and 55% were anxious before or during the procedure. The most commonly reported unpleasant aspect of the procedure was coughing and gagging, which 62% rated as uncomfortable to some degree. Perhaps surprisingly, 93% of those subjects found fibreoptic nasotracheal intubation under local anaesthetic to be acceptable without sedation. Nasal pain or discomfort was the commonest reason for abandoning intubation attempts in that series. Other sensations reported as distressing during awake intubation include the unpleasant taste of local anaesthetic drugs, the sensation of swelling within the airway and tingling in the face, hands and feet. The haemodynamic stability previously achieved [7] whilst performing AFOI with sedation was absent from this unsedated group. When sedation was omitted, 23% showed an increase in blood pressure of more than 20%, and 58% showed a similar increase in systolic blood pressure. These data suggest that without sedation it is likely to be difficult to perform this procedure without anxiety, coughing or gagging.

Effect of sedation

The beneficial effects of sedation include reduced pain, anxiety and improved blood pressure control during the procedure. Abolition of recall has been advocated to render AFOI acceptable but this may require deeper sedation.

Sedative drugs reduce airway muscle tone and, therefore, space within the airway cavity [8]; this makes endoscopy more difficult. In a narrowed or obstructed airway the tip of the endoscope, by necessity, passes closer to the mucosa resulting in the light from the endoscope light source reflecting directly into the optical lens causing a white-out. White-out is common in a narrow or obstructed airway and the endoscopy becomes a blind procedure. Furthermore, in this situation the ability to effectively direct and apply topical local anaesthetic via the endoscope is also diminished with the result that when the endoscope inevitably comes into contact with the mucosa it produces pain, coughing, gagging or swallowing; such movements during endoscopy can render the procedure impossible.

Lightly-sedated patients will often remain immobile and co-operative, able to respond to requests from the endoscopist to perform the manoeuvres described above to aid the view. The response of patients to opioid and sedative drugs is highly variable; age is a significant factor [10]. Even if light sedation is intended, unexpected heavy sedation may still result. Excessive sedation with benzodiazepines can lead to restlessness or disinhibition with loss of patient co-operation. Administration of additional sedation in an attempt to overcome lack of co-operation may complicate matters leading to reduced respiratory drive, possible airway obstruction and failure of the procedure. An appropriate response is to improve topical analgesia and restore airway patency rather than increase sedation.

Preparation of the patient

Patient selection and assessment

Awake intubation is a time consuming technique and patient co-operation is required. If time constraints or co-operation problems preclude intubation under local anaesthetic it is probably preferable to employ general anaesthesia. It may be tempting to provide sedation in an attempt to make a patient more co-operative or to speed the process, but unintentional general anaesthesia must be avoided. Planned general anaesthesia with optimal oxygenation at the outset and an airway management plan including a series of options to secure the airway and maintain oxygenation is preferable to unexpected general anaesthesia in a hypoxic patient.
**Explanation**

The patient will need an explanation of why awake intubation is necessary; the alternatives should be outlined and they should be told what to expect during the procedure. Their co-operation will be enhanced if they fully understand the justification for the procedure. It is sensible to avoid providing an unrealistic explanation of what the subject might expect to experience during the procedure. Patients find it useful to know that they will be able to assist the endoscopist by following simple instructions such as ‘breath through your mouth’ or ‘stick out your tongue’. It is useful to establish a non-verbal form of communication so that the patient may indicate any distress and the endoscopist can then reassure the patient that additional local anaesthetic or sedation may be administered as required.

**Premedication**

When nasal intubation is planned nasal vasoconstrictors should be considered and sedative or opioid premedication may be given pre-operatively, if clinically indicated. The addition of an anti-cholinergic agent such as glycopyrrolate significantly enhances the intensity and duration of topical local anaesthesia [14] and improves the view during fibreoptic bronchoscopy. This may be given with a sedative pre-operatively or intravenously immediately after IV access has been gained.

Antacid prophylaxis and or nasogastric drainage may be employed to reduce the volume of gastric contents and with it the likelihood of regurgitation in patients at risk of aspiration.

**Oral hygiene**

Some form of assessment of oral hygiene should be made and if the airway is heavily contaminated mechanical cleaning methods using a toothbrush and mouthwash will help. The patient should be encouraged to clear the airway and expectorate directly before the endoscopy commences to improve endoscopy conditions and visibility.

**Sedation techniques**

**Monitoring**

Sedation offers obvious benefits to patients and it may permit comfortable treatment in some patients who might otherwise refuse but since it also creates additional risks the indication for sedation should be noted. The intended level of sedation should be determined before the procedure. It is helpful to use a grading system to monitor the depth of sedation during the procedure. The system recommended by the ASA [11] is useful (Table 1), although others are in common use.

Unfortunately it is not always possible to predict how patients will respond to sedative drugs, therefore there is always the risk that sedation may be deeper than intended. This is most troublesome with deep sedation and a means of reversing ‘over-sedation’ should be available. For these reasons there is an obvious requirement for prior IV access, supplementary oxygen via nasal cannulae, ECG monitoring and peripheral oximetry, as a minimum. As a sensible precaution it is wise to check the depth of sedation before the start of the procedure.

Ideally the practice of an operator acting also as the anaesthetist should be avoided. The endoscopist will be occupied and unable to monitor the depth of sedation and since the procedure is indicated for an actual or anticipated airway management problem a second anaesthetists should be responsible for drug administration and monitoring of the patient. Good communication is essential and the endoscopist must heed the instructions of the person administering the sedation.
Drugs and delivery systems

There is considerable experience with well-established drugs such midazolam and fentanyl for fibreoptic intubation and bronchoscopy but a wider variety of drugs and delivery systems are also available. These include bolus administration, infusions and, more recently, plasma or effect site target controlled infusions. Some sedation techniques employ a combination of some or all of the methods described below. It is difficult to directly compare agents as they are often used in combination and produce varying degrees of analgesia, amnesia, respiratory depression and sedation. Furthermore side-effects and complications depend not only upon the drug or delivery technique but also on the administration end-point selected.

Benzodiazepines

Benzodiazepines provide anxiolysis and have a readily available antagonist - flumazenil. In higher doses they may induce amnesia for the procedure making the procedure more acceptable to patients.

Opioids

Opioids provide sedation with anxiolysis and analgesia. They may be rapidly antagonised with naloxone if necessary.

Both opioids and benzodiazepines can produce respiratory depression or airway obstruction and there is a wide variation in patient response. The elderly may be very sensitive to these drugs; therefore adequate time should be allowed for drugs to circulate and to assess the effect before repeating administration or commencing endoscopy.

Propofol

Propofol depresses airway reflexes and can be used to provide anxiolysis and amnesia. Unfortunately no readily available antagonist is available. Despite this sedation using propofol is a well-established technique; a loading dose of 1mg/kg followed by continuous infusion of 1 mg/kg/h is reported as satisfactory [12].

Remifentanil

Remifentanil has potent analgesic properties and is short-acting which makes it attractive for use during airway endoscopy [13]. Remifentanil has little effect on memory and some patients report greater recall of events when compared with propofol [14, 15] or midazolam [16]. Despite its rapid hydrolysis overdose can cause prolonged apnoea and hypoxia. Xu Ya-Chao reported two episodes of hypoxia due to bradypnoea in a dose finding study for a midazolam plus remifentanil infusion to provide sedation for AFOI in 36 patients [17].

Dexmedetomidine

Dexmedetomidine is an alpha-2-agonist which provides sedation, anxiolysis, and a dry mouth without producing respiratory depression. It has been used effectively as a sole sedative agent for AFOI [18, 19]. It would appear to offer great promise but it is very expensive, not widely available and experience of its use is limited.

Overview of sedative drugs

All commonly used sedative drugs can lead to respiratory depression and airway obstruction. Benzodiazepines provide anxiolysis, sedation and impair recall but may also impair patient co-operation. Opioids provide anxiolysis, analgesia and enhanced patient co-operation with beneficial effect on endoscopy conditions but memory is preserved and this does not lead to an increase in patient satisfaction. Benzodiazepines and opioids are frequently used in combination but their actions may be synergistic leading to episodes of airway obstruction.
A plan for sedation should include a rapid escape route. Opioids provide analgesia with some sedation and may be reversed rapidly with naloxone unless they are present in overdose. Benzodiazepines such as midazolam provide a degree of amnesia and may be reversed with flumazenil.

**Conduct of local anaesthesia**

Careful and meticulous provision of airway anaesthesia should reduce the patient’s requirements for sedation and improve patient cooperation. Local anaesthesia is usually provided by topical analgesia of the nose, mouth or both, supplemented by either spray-as-you-go topical analgesia of the lower airway or translaryngeal administration of local anaesthetic. The British Thoracic Society recommends a maximum lidocaine dose of 8.2 mg/kg for diagnostic bronchoscopy [20]. When used topically, local anaesthetic requirements are high since much of the drug is expectorated or swallowed (undergoing first pass metabolism when absorbed from the gut). Dose limits are lower if lidocaine is injected to perform nerve blocks or in the presence of advanced liver disease. The application of local anaesthetic precipitates coughing and gagging which has been shown to be the least acceptable part of the procedure and the prior nebulisation or gargling of local anaesthetic may make the subsequent local anaesthetic application more acceptable.

**Aspiration risk**

Topical local anaesthesia of the airway impairs the sensory limb of airway protective reflexes whilst the motor side is mainly preserved, thus offering partial protection against aspiration. Sedatives and analgesics tend to impair airway reflexes in proportion to the degree of sedation and analgesia achieved [11]. Fasting is considered to decrease the risk of aspiration during moderate and deep sedation. In an emergency situation when pre-procedural fasting is not practical, the target level of sedation should be reduced [11]. In patients at risk of aspiration, physical and pharmacological methods of emptying the stomach should be considered prior to AFOI. Consideration may be given to performing endoscopy in the lateral position to promote drainage of gastric contents away from the airway should regurgitation occur.

**Conclusion**

Appropriate patient selection is important and the patient should be prepared psychologically and pharmacologically to provide optimal intubation conditions. A means of rapidly reversing over sedation should be compatible with the sedation regime selected. Light sedation should be established and monitored before the endoscopy and poor endoscopy conditions are best treated with supplementary local anaesthesia rather than additional sedation.

**Key learning points**

- Avoid awake intubation in unsuitable patients
- Perfect preparation is required
- ‘Oxygen, oxygen, oxygen’ during the procedure
- Spontaneous respiration and an unobstructed airway is the key
- Avoid over-sedation
- Plan an escape route should accidental over-sedation occur
- Provide excellent topical analgesia
- Treat inadequate analgesia with local anaesthetic, not supplementary sedation
- Sedation is no substitute for poor local anaesthesia or technique
References

Table 1

Levels of sedation/analgesia (modified version of ASA system [11]).

<table>
<thead>
<tr>
<th>Level of sedation</th>
<th>Minimal sedation (anxiolysis)</th>
<th>Moderate sedation (conscious sedation)</th>
<th>Deep sedation</th>
<th>General anaesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsiveness</td>
<td>Cognitive impairment, otherwise normal response to verbal stimulus</td>
<td>Purposeful response to verbal or tactile stimulus</td>
<td>Purposeful response after repeated or painful stimulus</td>
<td>Unrousable, even with painful stimulus</td>
</tr>
<tr>
<td>Airway</td>
<td>Unaffected</td>
<td>No intervention required</td>
<td>Intervention may be required</td>
<td>Intervention often required</td>
</tr>
<tr>
<td>Spontaneous</td>
<td>Unaffected</td>
<td>Adequate</td>
<td>May be inadequate</td>
<td>Frequently inadequate</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>Unaffected</td>
<td>Usually maintained</td>
<td>Usually maintained</td>
<td>May be impaired</td>
</tr>
</tbody>
</table>

Minimal sedation (anxiolysis)

Cognitive function and co-ordination may be impaired, but patients respond normally to verbal commands. Ventilatory and cardiovascular functions are unaffected.

Moderate sedation (conscious sedation)

Patients show signs of sedation such as eye closure, but respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained.

Deep sedation

Patients may be roused following intense, repeated or painful stimulation. Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained.

General anaesthesia

Patients are unrousable, even with painful stimulation. Patients often require assistance to maintain a patent airway, ventilatory function is often impaired and positive pressure ventilation may be required. Cardiovascular function may be impaired.