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Preparing to Perform an Awake Fiberoptic Intubation

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Fiberoptically guided tracheal intubation represents one of the most important advances in airway management to occur in the past thirty years. Perhaps its most important role is in management of the anticipated difficult airway. This is a situation in which the dangers of encountering the life-threatening "can't intubate, can't ventilate" situation can be avoided by placement of an endotracheal tube while the patient is awake. Although skill at the procedure of endoscopy is obviously necessary in this setting, these authors hold that success or failure of the technique frequently depends on the adequacy of preparation. These measures include 1) pre-operative assessment of the patient; 2) careful explanation of what lies in store; 3) "setting the stage"; 4) preparing the equipment to be used; and 5) preparing the patient (antisialogue, sedation, application of topical anesthesia to the upper airway). If these preparatory measures are carried out meticulously, the likelihood of performing a successful and comfortable awake fiberoptic tracheal intubation is greatly increased.

INTRODUCTION

Adverse outcomes associated with respiratory events constitute the single largest class of injury associated with anesthesia. This was documented by The American Society of Anesthesiologists Closed Claims Study in which respiratory events accounted for 522 of 1541 injury cases (34 percent) [1]. The overall incidence of difficult intubation has been estimated to be 1:2,000 in the general surgical population and 1:300 in the obstetric population [2]. In addition to the high prevalence of the problem, it is important because of the associated likelihood of bad outcome. Eighty-five per cent of respiratory management failures resulted in death or brain damage [1].

Tracheal intubation using a "railroad" technique (i.e., advancing an endotracheal tube over an endoscope that is positioned in the trachea) was first performed by Murphy et al. in 1967 [3]. The most important indication for this technique is in the management of the anticipated difficult airway in the co-operative patient. In this setting, the risk of loss of upper airway patency during an inhalational induction is avoided. Other important indications include the patient with cervical spine injury and situations where a potentially difficult airway management problem and the need to maintain spontaneous ventilation coexist, e.g., bronchopleural fistulae. Learning to perform an awake fiberoptic intubation requires practice and, in skilled hands, has a high degree of patient acceptability. The key to success is thorough preparation.

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PRE-OPERATIVE ASSESSMENT

The likelihood of performing a successful fiberoptic intubation is greatly increased if the reason for choosing this technique is explained to the patient in a detailed and unhurried fashion. The patient should be given a thorough description of what to expect. Awake fiberoptic intubation will proceed more easily in the well-informed, co-operative patient who understands the procedure. Specific instructions should be explained/illustrated to the patient, for example, not to speak during the intubation, to raise a hand if he/she would like the endoscopist to withdraw, to take deep breaths or to "pant."

In addition to a thorough anesthetic history and physical examination, the patient should be asked specifically about previous airway trauma or surgery and a history of epistaxis or bleeding. Details of previous unsuccessful or difficult intubation attempts should be sought from anesthetic records, and the anesthesiologist involved should be contacted if necessary. An explanatory note on the reason difficulty was encountered, or techniques which proved unsuccessful, are particularly useful. Although extremely rare, knowledge of patient's allergies to local anesthetics should be sought [4]. Because topical anesthesia is applied to the upper airway, the possibility of aspiration of gastric contents has to be borne in mind. This is particularly true in those at increased risk; for example the presence of a "full stomach," raised intra-abdominal pressure, hiatus hernia, etc.

The safety of performing an awake fiberoptic intubation in this group of patients is controversial. Ovassapian has pointed out that, while the proximal airway (to the level of the vocal cords) is anesthetized, the distal protective reflexes remain intact and will enable the patient to cough forcibly if foreign material should enter the trachea [5]. In practice, it is necessary to individually balance the risks of pulmonary aspiration of gastric contents with the benefits of the safety of performing an awake intubation in each case. Administration of an H_2 antagonist, a non-particulate antacid or a prokinetic agent should be considered. Ranitidine (150 mg) orally in the average 70 kg patient is a common choice. Alternatively, 50 mg intravenously infused over 15 minutes produces peak blood levels in 60 to 90 minutes [6]. There are few contraindications to an awake fiberoptic intubation; namely: patient refusal, an uncooperative patient (such as a child or a mentally handicapped patient) or a true allergy to amide local anesthetics.

OPERATING ROOM PREPARATION: "SETTING THE STAGE"

The Difficult Airway Task Force (ASA-1992) emphasized that "preparatory efforts enhance success and minimize risk to the patient" [7]. There should be at least one qualified assistant to help manage the airway if difficulties arise. The assistant's functions are:

1. To observe the patient clinically.
2. To use standard monitoring during the endoscopy.
3. To administer intravenous sedatives.
4. To inject local anesthetic through the working channel of the fiberscope under the direction of the endoscopists.
5. To optimize the position the patients head and neck.
6. To pass and receive the fiberscope.

A calm, quiet room is optimal; good lighting with the ability to dim if required is desirable. A patient table, the height and tilt of which can be adjusted, should be used. A foot stool for the endoscopist to stand on should be available to allow him/her to hold the insertion cord of the fiberscope taut. This allows for consistent, accurate movement of the fiberscope tip.

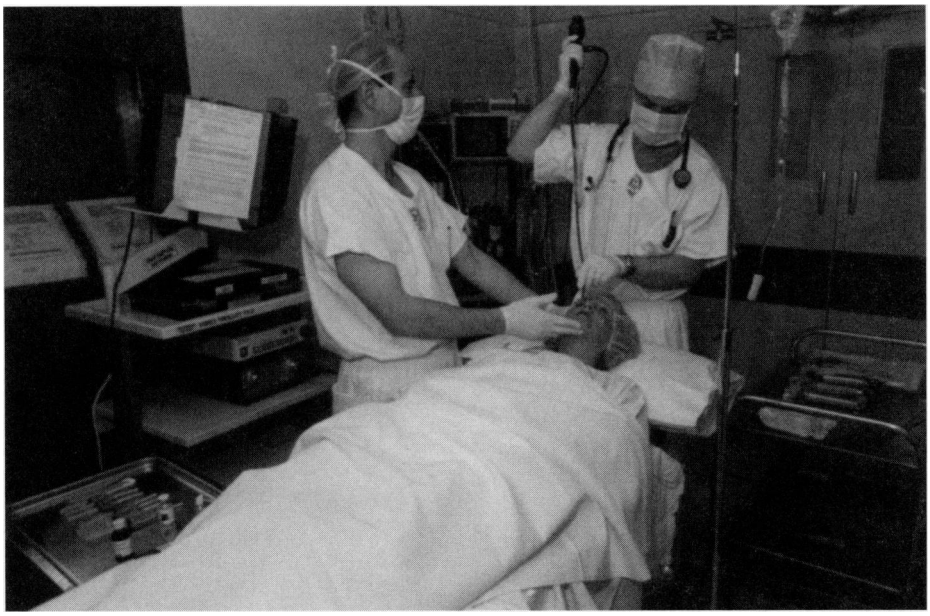

Figure 1. Operating room set-up.

All equipment and supplies for administration of anesthesia, resuscitation and monitoring should be available in the induction room and should be checked following a standard protocol. Basic intra-operative monitoring should include a precordial stethoscope, ECG, non-invasive blood pressure, pulse oximetry and capnometry. Standard difficult airway equipment should to be available and organized carefully on a separate mobile trolley. This trolley should include the following:

1. Range of laryngoscopes.
2. Range of endotracheal tubes.
3. Gum elastic bougies, Magill's forceps.
4. Retrograde intubation equipment (e.g., epidural catheter or guide wire).
5. Laryngeal mask airway.
6. Combitube.
7. Cricothyroidotomy set and connections for jet ventilation.

This trolley should be readily accessible. The fiberoptic equipment should be positioned so that it can picked up easily by the endoscopist. It is important that care is taken to avoid draping the camera cable or the light source cable across the patient's face. The fiberscope should be stored in a vertical plastic holder to avoid coiling (Figure 1).

EQUIPMENT PREPARATION

The necessary equipment include a range of oral/nasal armored/regular tubes, a lubricant, a defogging agent, lidocaine in its various forms (solution, gel, aerosol), cocaine 4 percent, oral intubation airways, soft nasopharyngeal airways, suction, needles, syringes, pledgets, cotton-tipped applicators, tongue blade, epidural catheter, nebulizer, Krause forceps and an appropriate sized laryngeal mask airway. The chosen endotracheal tube is loaded over the lubricated fiberscope, having removed the 22 mm connector. The distal 20 cm of the insertion tube should be kept free of lubricant so that the endoscopist's gloved

hand can grip and manipulate this portion. The connector should be placed in a secure place for convenient reconnection. There are a number of oral intubating airways to choose from. Each is designed to fulfill three functions:

1. To protect the fiberscope from injury if the patient were to bite down.
2. To direct the scope in the midline towards the vocal cords.
3. To displace the tongue posteriorly, out of the path of the fiberscope.

INTUBATING AIRWAYS

Patil-Syracuse intubating airway

This aluminum airway is only available in one size. There is a small central groove on the lingual surface of this airway and a slit at the distal end. This slit allows for good anteroposterior manipulation of the fiberscope tip, but lateral movement is limited [8] (Figure 2).

Williams' intubating airway

The proximal half of this airway is cylindrical, and the distal half has an open lingual surface. This airway is made in two sizes (90 and 100 mm I.D.) which admit endotracheal tubes up to 8 and 8.5 mm I.D., respectively. If the distal end of this airway is not in line with the glottis, exposure of the cords becomes difficult, necessitating partial withdrawal of the airway (Figure 3).

Ovassapian intubating airway

This airway has a flat lingual surface in the proximal half, which minimizes movement of the airway. The wide distal half curves to prevent the tongue and soft tissues of the anterior pharyngeal wall from falling back and obstructing the view of the glottis. It can accommodate an endotracheal tube up to 9.0 mm I.D. (Figure 4).

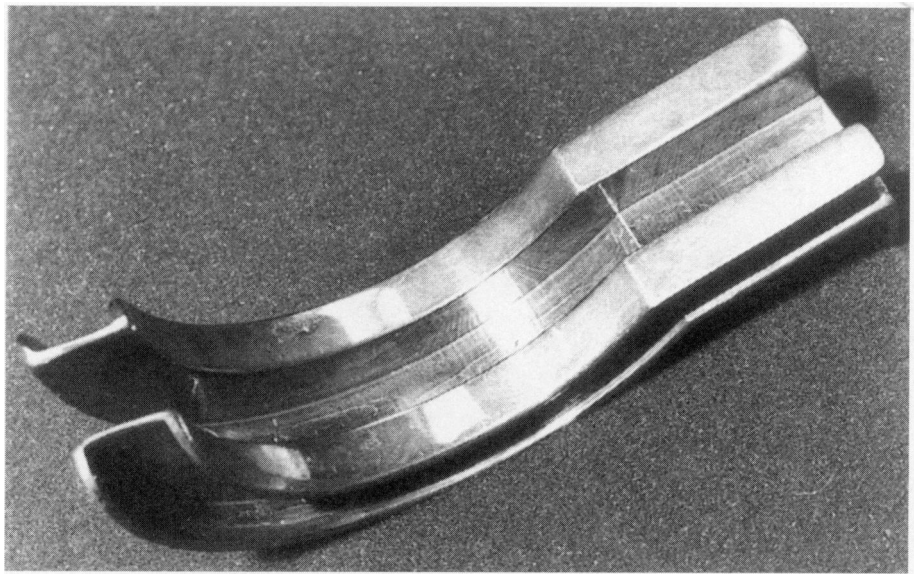

Figure 2. Patil-Syracuse intubating airway.

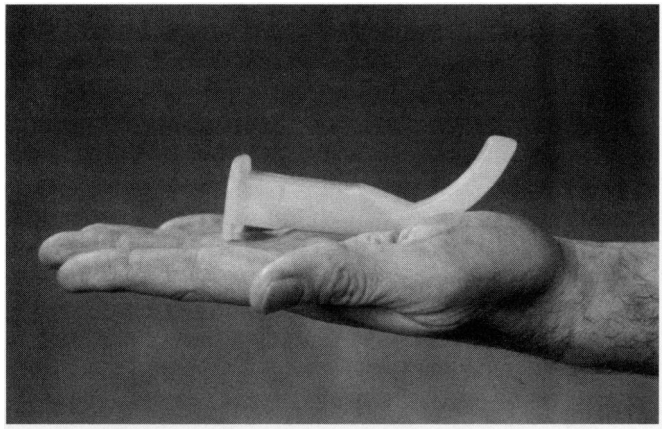

Figure 3. Williams intubating airway.

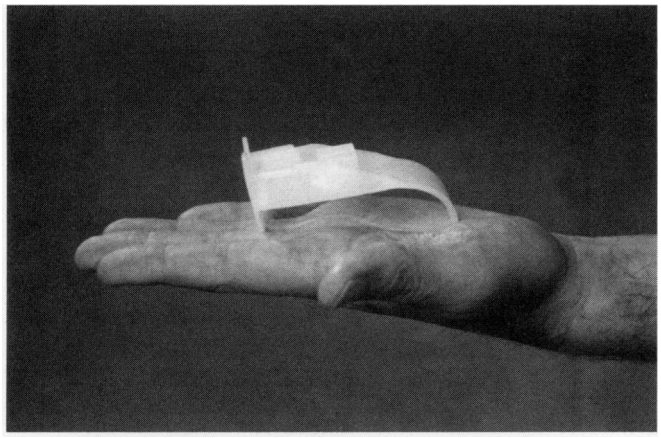

Figure 4. Ovassapian intubating airway.

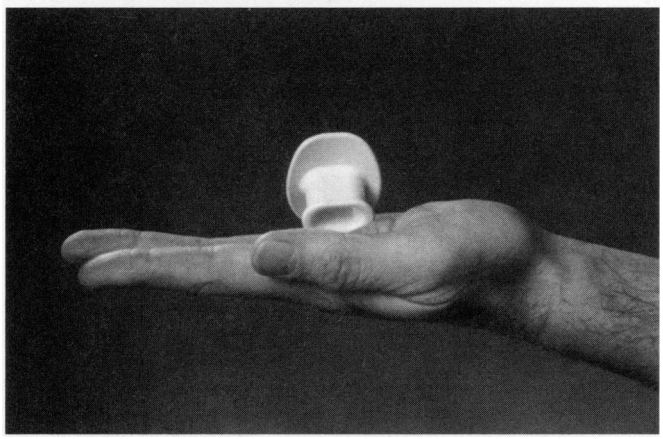

Figure 5. Olympus airway.

Olympus Airway

This airway is better described as a bite block. It does not displace the tongue and does not maintain the fiberscope in the midline. It does protect the fiberscope, and the endotracheal tube can be passed through it (Figure 5).

The fiberoptic scope, light source and ancillary equipment are carefully inspected to ensure that they are in proper working condition. Commonly used fiberoptic equipment is listed in Table 1. Damage commonly occurs to the fiber bundles when the insertion tube is sharply bent or trapped in a closing drawer. The insertion tube should be inspected for dents and bulges and the angulation lever manipulated to ensure that the distal tip responds appropriately.

PROCEDURES FOR USING THE VIDEO AIRWAY CART

1. Plug in the master power cord.
2. Turn on the VCR, light source, camera, monitor, and mavigraph.
3. Fiberoptic bronchoscope:
   - Connect insertion cord to light source.
   - Choose MANUAL light intensity adjuster.
   - The light source intensity is adjusted to an adequate level of illumination.
   - The minimum necessary light intensity is chosen to avoid thermal mucosal damage.
   - Hold tip in palm of left hand, eyepiece in right and focus using the diopter ring. This is achieved by holding the fiberscope tip 6 mm from written material and bringing this picture into focus.
   - Connect oxygen 3-4 L/min to working channel. Orient the working channel to lie under the left index finger while the left thumb controls the angulation lever, thus leaving the right hand free to manipulate the insertion tube.
   - Connect a 10cc non-luer lock syringe of 1 percent lidocaine onto the biopsy valve diaphragm if a "spray as you go" technique is planned.

Table 1. Characteristics of fiberoptic bronchoscopes.

Instrument	Insertion cord diameter (mm)	Insertion cord length (mm)	Working channel (mm)	Tip bending (degrees)	Field of view (degrees)
Olympus					
LF-2	4.0	600	1.5	Up 130/down 130	90
LF-P	2.2	600	None	Up 120/down 120	75
Pentax					
FB-10X	3.5	600	1.2	Up 180/down 130	95
FB-15X	4.9	600	2.2	Up 180/down 130	100
VB-1530	5.5	600	1.2	Up 180/down 130	120

Adapted from Benumof. Airway management: principles and practice (with permission.)

Ensure a new biopsy valve is snapped onto the biopsy port before each use.

- Defog the tip. Dip the tip in defogger liquid once or twice and let it dry.
- Alternatively, warm the fiberscope and fiber bundles in warm saline. The lens should be wiped with a clean gauze lightly moistened with 70 percent alcohol.
- Place the endotracheal tube over the fiberscope and lightly secure it with tape to the upper end of the insertion cord.

4. Video and Camera: A coupler is used to connect the camera to the fiberscope. Adjust the divot to 12 o'clock, if you are at the patient's head and change it 3 o'clock if you are at the right side. This allows for correct orientation of fiberscope tip. Focus the camera by twisting the diopter ring just above the camera. (Note: this is a separate step from focusing the bronchoscope itself). Olympus has developed an autofocus camera head for use during endoscopy (OTV-S5 OES VIDEO SYSTEM). Most video systems designed for use during endoscopy contain automatic resolution, brightness and color controls.

SUCTION

If central wall suction is not available, an appropriate portable suction apparatus should be part of the emergency airway trolley. Either a soft-tipped flexible suction catheter or a stiff Yankauer suction tip should be used for the oropharynx. In our experience, applying suction to the working channel of the commonly used Olympus LF2-Fiberscope is ineffectual (I.D. of 1.5 mm), and it serves only to draw secretions towards the object lens, obscuring the endoscopist's view.

OXYGENATION

Arterial hypoxemia has been well documented during bronchoscopy. The safety of the procedure is enhanced by the use of supplemental oxygen. Nasal cannulae can be used at 2-3 liters /minute if the oral route is chosen. When performing a nasal intubation, an ordinary facemask can be modified by cutting out a window for the fiberscope. Administration of oxygen or application of suction via the working channel can be alternated as required using a 3-way stopcock. High flow rates (>5 L/min) are inadvisable because they will result in gastric insufflation if the tip of the fiberscope inadvertently enters the esophagus.

PHARMACOLOGICAL AIDS

Antisialogogues

A dry airway is desirable because secretions obscure an already limited view through the scope. In order for topical application of local anesthetics to be effective, they must actually contact the mucosa [9]. An intervening layer of secretions prevents this contact and dilutes the anesthetic solution. The antimuscarinic drugs dry the airway by decreasing salivary and mucus secretion. The antisialogogue most commonly used is glycopyrrolate, but atropine and scopolamine are also used. Atropine and scopolamine are tertiary amines and, therefore, cross the blood/brain barrier. Administration of atropine (0.3-0.6

Table 2. Sedatives used for awake fiberoptic intubation.

Sedatives	Pharmacological actions	Dose	Onset time	Duration	Side effects
Benzodiazepines:	Sedation. Anterograde amnesia. Antiepileptic.				
Midazolam		IV, IM=5-7 mg (0.075 mg/kg)	IV=1-3 min IM=15-30 min	IV, IM=2 hr	Respiratory impairment in high doses
Diazepam		IV=2.7 mg (0.03-0.1 mg/kg), IM=not recommended PO=3-11 mg (0.05-0.15 mg/kg)			Respiratory impairment in high doses. IV and IM are painful. Thrombophlebitis
Lorazepam		IV, IM, PO= 1-4 mg	IV=5-20 min IM=30-120 min PO=60-120 min	IV=4-6 hr IM, PO=8 hr	Respiratory impairment in high doses
Buytyrophenones:	Sedation. Antiemitic. Indifference.				
Droperidol		IV, IM=0.625-10 mg	IV, IM=5-10 min	IV, IM=6-12 hr	Dysphoria. Extrapyramidal symptoms. Mild alpha-adrenergic antagonists Prolonged emergence from anesthesia.
Narcotics:	Analgesia. Sedation.				
Morphine		IV, IM, SQ=2-10 mg	IV=5-10 min IM=30-60 min SQ=30-90 min	1-6 hr	Respiratory depression. Bronchospasm. Chest wall rigidity. Bradycardia. Vomiting. Hypotension.
Fentanyl		IV, IM=50-100 μg	IV=2 min IM=10-15 min	IV, IM= 30-45 min	Similar to morphine. Bronchospasm and hypotension are less common.

Dosages and times quoted are broad generalities.
IM, intramuscular; IV, intravenous; PO, orally; SQ, subcutaneous.
From Reed, A.P. and Han, D.G. Clinical management of the airway (with permission).

mg IV) causes significant tachycardia. Glycopyrrolate is a quaternary ammonium compound and, therefore, does not cross the normal blood brain barrier and does not cause sedation. Oral absorption of glycopyrrolate is poor and erratic with a bio-availability of 5 percent [10]. It should be administered intravenously, (0.1-0.2 mg). Its onset time is 1-4 minutes, and its duration of effect is 2-4 hours. Side effects of glycopyrrolate occur rarely but include cardiac arrhythmias, urinary retention, relaxation of lower esophageal sphincter tone, mydriasis and cycloplegia.

Sedation

Very anxious patients may benefit from an oral anxiolytic agent administered preoperatively. It should be borne in mind, however, that patients with significant airway compromise may require conscious muscle tone to maintain airway patency. In the awake patient, upper airway patency is dependent in part on pharyngeal reflexes, which activate pharyngeal dilator muscles during inspiration. The effectiveness of these reflexes, in maintaining airway patency is compromised by sleep, sedative agents and general anesthesia [11]. Sedation should be administered intravenously by the assistant at the time of endoscopy. The objective is to achieve anxiolysis without rendering the patient un-cooperative. The heavily-sedated patient will not co-operate well, may be unable to maintain adequate ventilation or even aspirate pharyngeal contents.

Agents with rapid onset and offset of effect are ideal. The choice of sedative agents includes benzodiazepines, opioids and butyrophenones (Table 2). The commonly used benzodiazepines are midazolam, diazepam and lorazepam. Midazolam is the most commonly used because of its rapid onset, short half-life and its ability to provide sedation and anterograde amnesia. Administered in increments of 0.25 mg, its effect are seen in three minutes. Unwanted effects include drowsiness, cardio-respiratory depression and, rarely, ataxia [12]. Lorazepam possesses a three-hydroxy substitution on the benzodiazepine nucleus and, therefore, is much less lipophilic than midazolam [12]. It has a long onset time (20-40 minutes) when given intravenously, and it has an elimination half-life of 10-14 hours.

Diazepam is poorly soluble in water, and the solvent (40 percent propylene glycol, 10 percent ethyl alcohol, 5 percent sodium benzoate and 1.5 percent alcohol) can cause discomfort on injection and add to patient anxiety. Diazepam metabolites, desmethyldiazepam and oxazepam have sedative effects and have reported half-lives of 48-96 hours. When benzodiazepines are administered, it is prudent to have flumazenil available should inadvertent overdose occur. Flumazenil at doses of 8-15 μg/kg reverses the sedative effects of the benzodiazepines but can cause convulsions in chronic users [13]. Its onset time is less than 5 minutes, and its duration of effect between 1 to 3.5 hours [12].

In addition to sedation, opioids provide analgesia, depress laryngeal reflexes and are antitussive. Side-effects include respiratory depression and euphoria [14]. Again, the ideal choice in this group is fentanyl, which is a rapid acting and short duration agent. Fentanyl administered in increments of 10 μg is very effective for "conscious sedation." Its sedative effect is seen within one minute. Opioid-induced respiratory depression can be easily reversed with naloxone 1-5 μg/kg. Opioid rigidity is not a problem when fentanyl is administered in these low doses.

Droperidol (30-50 μg/kg) can be used alone or in combination with fentanyl. It is given in doses of 30-50 μg/ kg. Although the patient may appear calm and pain-free, many report a feeling of mental restlessness and agitation not apparent to the observer: the "locked-in" syndrome [12].

Table 3. Local anesthetic agents used for upper airway anesthetic.

Agent	Preparation	Uses	Maximum dose
Lidocaine	0.5%, 1%, 2% hydrochloride solution.	Infiltration. Transcricoid. Nerve blocks. Gargle.	3-5 mg/kg
	4% hydrochloride solution.	Nebulization.	
	1% ointment.	Topical to oropharynx.	
	10% spray.	Topical to mouth and oropharynx	
	2% gel.	Lubricant on nasopharyngeal airways.	
Cocaine	4% solution. 10% solution	Topical nasal application	3 mg/kg
Benzocaine	100 mg lozenge	Oral cavity anesthesia	1.5 mg/kg

LOCAL ANESTHESIA

For the purpose of anesthetizing the upper airway, it can be thought of as having four parts:

1. Nasal cavity and nasopharynx.
2. Oral cavity and oropharynx
3. Larynx above vocal cords.
4. Larynx below vocal cords.

Adriani [15] summarized the principles and guidelines for the safe use of topical anesthetics. It is essential to know the optimum effective concentration of each drug, the rapidity of action, the recommended maximum safe dose, the rate of absorption and the appropriate technique of application. The most frequently used agents are lidocaine and cocaine, but the use of tetracaine and benzocaine are also well described [16] (Table 3).

Lidocaine is available as a clear colorless 0.5/1.0/1.5/2 percent solution for injection with or without epinephrine (1 in 200,000), a gel containing 21.4 mg/ml of lidocaine, a five-percent ointment, a 10 percent spray and a 4 percent viscous solution. Maximum recommended doses for application topically to the respiratory tract is 200-250 mg (3-4 mg/kg).

Lidocaine (5-10 mg/kg), used during topical application of local anesthetic to the upper airway results in plasma concentrations well below those that cause symptoms of toxicity (toxic level, 6 μg/ml) [17]. Symptoms of severe lidocaine toxicity include convulsions, respiratory failure and circulatory collapse. The onset of action of topical application of lidocaine is 3-5 minutes with a duration of action of 15-30 minutes. Lidocaine used for specific nerve blocks has a more rapid onset, with durations of anesthesia of 75 minutes using a plain 1 percent solution and 400 minutes when using a 1 percent solution with 1/200,000 epinephrine. Airway anesthesia at the time of extubation may be desirable, hence these time-scales should be borne in mind [4]. Allergic reactions to the amide local anaesthetic agents are extremely rare [4]. Cocaine is an ester local anesthetic, which is commercially available as a 1-4 percent solution and as a non-proprietary paste of varying

concentrations. Applied topically, its duration of action is 20-30 minutes (its toxic dose is 3 mg/kg). Cocaine's vasoconstrictive action results from interference with the re-uptake of catecholamines by adrenergic nerve endings. It should be used cautiously (or avoided) in patients with hypertension, angina, thyrotoxicosis or who are taking MAOIs. Allergic reactions occur occasionally, but side effects are predominately correlated with excessive plasma concentrations. A 3:1 volume mixture of 4 percent lidocaine and 1 percent phenylephrine provides both topical anesthesia and mucosal vasoconstriction of the nasal mucosa.

The nasal cavity's sensory innervation is via the sphenopalatine ganglia and the anterior ethmoidal nerve. The sphenopalatine ganglion is situated in the pterygopalatine fossa posterior to the middle turbinate. It is covered by a 1-5 mm layer of connective tissue and mucosa. If the nasal septum is deviated, it is important to choose the more patent nares.

The nasal mucosa can be anesthetized with one spray delivery of 10 percent lidocaine. Alternatively, three long cotton-tipped pledgets soaked in 4 percent cocaine or the lidocaine/phenlyephrine mixture can be painted methodically along the nasal mucosa and then left for 10 minutes. The nasal passage can be gently dilated with soft nasopharyngeal airways of increasing diameter that have been lubricated with lidocaine gel (2 percent). Oxymetazoline is a potent sympathomimetic drug available as a 0.1 percent hydrochloride (2-3 ml per nostril) solution, which can be easily mixed with lidocaine 2 percent. Instrumentation of the airway can cause fluctuations in blood pressure and heart rate. Using nebulizers to the entire airway with local anesthetic solution can minimize these. The nebulizer is filled with 5 ml of 4 percent lidocaine, and the oxygen flow rate is kept below 6 liters per minute. Higher flow rates create smaller droplets (<30 microns) that travel further distally into the bronchial tree and increase the rate of systemic absorption [18]. Larger droplets (>60 microns) are preferred because they precipitate out in the proximal airway where the topical anesthesia is required. It is important to allow adequate time (15-20 minutes) for inhalational anesthesia to be effective and to sit the patient upright during nebulization.

ORAL CAVITY

Techniques for application of local anesthetic to the oral cavity include, a benzocaine lozenge (100 mg) 30 minutes prior to the procedure, or by using lidocaine 10 percent spray, or by gargling viscous lidocaine 2 percent. Lidocaine ointment 2.5 percent may be pasted on the base of the tongue and tonsillar pillars to augment the sprays. A lingual nerve block may be performed in those with a particularly active gag reflex.

LARYNX AND TRACHEA

The two most commonly used nerve blocks in our practice are the superior laryngeal nerve block and transcricoid instillation. The superior laryngeal nerve is a division of the vagus and courses inferiorly medial to the carotid artery. At the level of the hyoid bone it pierces the thyrohyoid membrane and divides into internal and external branches. It can be blocked topically via the mouth or by infiltration through the anterior aspect of the neck. The success rate of this nerve block has been reported to be as high as 92 percent [19]. Internally, the nerve passes through the piriform fossa and lies submucosally and can be easily blocked by holding pledgets of local anaesthetic in the fossa with Krause forceps. This is done only after the tongue and oropharynx have been anesthetized. The patient is placed in the sitting position and asked to open the mouth wide and protrude the tongue. The tongue is grasped with a piece of gauze or depressed with a spatula.

The Krause forceps with lidocaine 4 percent soaked wool is placed firmly in the piriform fossa and held there for 5 minutes, and this is then repeated on the opposite side.

The external approach to the superior laryngeal nerve is slightly more uncomfortable for the patient. The patient is placed in the supine position, with the head extended. The hyoid bone and the superior aspect of the thyroid cartilage are identified. Three approaches have been described [16]. The first uses the cornu of the hyoid bone as its point of skin entry. The second uses the cornu of the thyroid cartilage, but both of these approaches require deep palpation, particularly in overweight patients. The third method uses the midline superior notch of the thyroid cartilage (Adam's apple) as the main landmark. From this point the upper border of cartilage is traced 2 cm laterally. Using a 2.5 cm, 25 gauge needle, the thyrohyoid membrane is pierced at this point in a posterior-cephalad direction to 1-1.5 cm depth. Following a negative aspiration test, 2 ml of lidocaine 2 percent is injected, and this is repeated on the opposite side. It is important to note that this block may require 5-10 minutes for full effect. Side-effects of this block are rare; the most important being hematoma formation (the superior laryngeal artery courses with the nerve). Other complications include perforation of the pharynx and intra-arterial injection. Contraindications are few but include local infection and local tumor.

TRANSLARYNGEAL INSTILLATION

Local anesthetic solution can also be injected through the cricothyroid membrane. The patient is placed in the supine position with the neck extended. Patients should be warned of the vigorous coughing this block causes. This coughing enhances the spread of local anesthetic. A 25 gauge needle on a 3 ml syringe is inserted through the membrane in the midline. Once correct placement is confirmed by aspiration of air, 2 ml of lidocaine 2 percent is injected quickly. Relative contraindications to this block include local malignancy, cervical spine instability and the presence of a goiter. The use of a catheter over the needle has been employed in an attempt to reduce risk of laryngeal trauma.

SPRAY AS YOU GO

This technique uses the working channel of the bronchoscope to anesthetize the supra-glottic structures and vocal cords. Ovassapian suggests using an epidural catheter (internal diameter 0.5-1.0 mm) in the channel [20]. Under direct vision, targeted areas are sprayed with 0.2-1.0 ml of lidocaine 2 percent. The endoscopist then waits 30 seconds before advancing further. This method is ideal for patients at risk of aspirating gastric contents because the local anesthetic is applied only seconds before the intubation is accomplished, allowing the patient to maintain the airway reflexes as long as possible.

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