Predicting difficult airways

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Key points

Take great notice of any difficulty reported by the patient

Always examine the airway – it takes less than 2 min

Do not use muscle relaxants until the airway is secured

Always be prepared for the unexpected

The key strategy is oxygenation followed by oxygenation and then by oxygenation

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What is a difficult airway?

The prediction of a difficult airway in a patient presenting for surgery is essential to enable the anaesthetist to be prepared properly. However, what constitutes a difficult airway is not so easy to define. The American Society of Anesthesiologists defined it as 'a clinical situation in which a conventionally trained anesthesiologist experiences difficulty with mask ventilation, difficulty with tracheal intubation or both'. Today, one could also reasonably include difficulties with the insertion of a laryngeal mask airway.

The airway can be divided arbitrarily into three regions, *i.e.* the upper, middle and lower zones. These zones can be associated with difficult laryngoscopy, intubation and ventilation, respectively. Any of these three categories can cause a difficulty and the worse scenario is when there are problems with them all. This article describes how to predict these difficulties before anaesthesia.

Clinical history

At the pre-operative visit, the patient may volunteer information regarding previous difficulties with anaesthesia and these should be discussed in detail. Furthermore, the patient may produce a letter from a colleague highlighting the difficulty or carry a bracelet warning of the problem. Information offered by the patient must be treated very seriously. Further details may be available from a NHS Website (supported by the Difficult Airway Society) held at St George's Hospital, London. This holds a register of airway difficulties that have occurred in such patients (UK-anaesthesia.co.uk).

Predicting a difficult laryngoscopy

Difficult laryngoscopy has been defined as a laryngoscopy where it is not possible to see any of the vocal cords when using conventional laryngoscopes. The prime objective of laryngoscopy is to produce an excellent view of the vocal cords. Thereafter, intubation should be relatively easy to perform. However, difficulties with both manoeuvres continue to cause morbidity and sadly, occasional mortality. Potential difficulties can be predicted, not only by taking a careful history, but also by clinical examination, measurement and investigation.

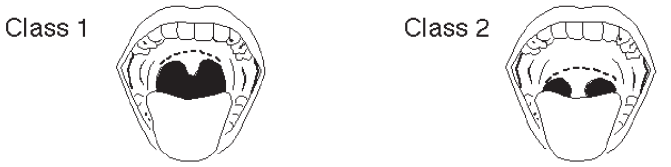
Clinical examination of the airway

Clinical examination of the airway is very important; its purpose is to assess laryngoscopic access and ease of subsequent manoeuvres. Any gross abnormality of the face, mouth, nose and neck should be immediately apparent. The mouth, when open fully, should allow access to the patient's middle three fingers when held in the vertical plane. This distance varies from 4–6 cm and gives an indication of temperomandibular joint mobility.

The view of the pharynx should be examined with the mouth as wide open as possible. Its quality is noted and categorised as 1–3 on the Mallampati classification, or occasionally, 4 (attributed to Samsoon and Young; Figs 1 & 2). Essentially, low scores are usually associated with easier laryngoscopy. High scores are caused mainly by difficulties in extending the head or opening the mouth or a large tongue.

Good forward movement of the jaw is associated with easy laryngoscopy and this should be should be assessed. Movement may be classified as A, B or C (Fig. 3).

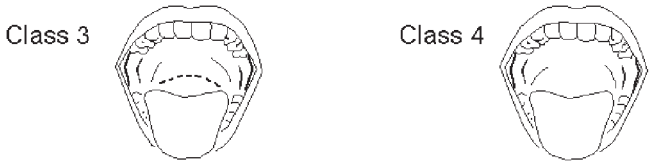
'Buck teeth' are associated with high scores in both classifications. There are two main consequences of grades B and C: (i) the laryngoscope cannot adequately move the jaw anteriorly; and (ii) the sublingual space is



Class 1 Flaucial pillars, soft palate and uvula visible

Class 2 Flaucial pillars and soft palate visible, uvula masked by base of tongue

Fig. 1 Mallampati classifications 1 and 2.



Class 3 Only soft palate visible

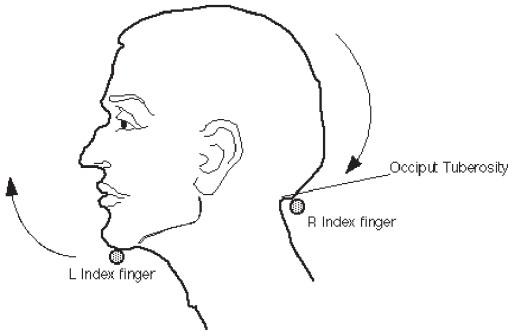
Class 4 Soft palate not visible

Fig. 2 Mallampati classifications 3 and 4.

restricted and, therefore, the tongue cannot easily be displaced anteriorly and inferiorly, *e.g.* Down's syndrome.

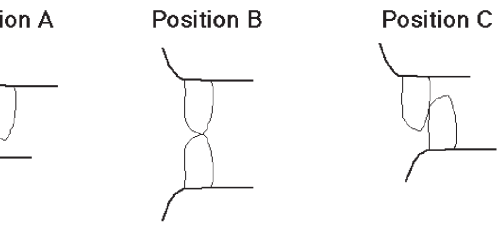
Movement of the cervical spine allows extension and flexion of the neck. The ability to fully flex the neck is important, but movement of the occiput on the atlas is possibly more important. This is more difficult to assess; one of the better tests is that devised by Delilkan (Fig. 4). The patient is asked to look straight ahead with the head in the neutral position. The index finger of the left hand is placed under the tip of the jaw while the index finger of the right hand is placed on the occipital tuberosity. The patient is then asked to look at the ceiling. If the left index finger becomes higher than the right, extension is considered normal. If the left index finger remains at the same level of the right or lower, extension is abnormal. Occasionally, as the head starts to extend a 'clunk' is felt and the movement stops. These outcomes are known as the Delilkan warning signs.

All these observations and tests can alter quite dramatically in pregnancy, which is associated with a 7-fold increase in the incidence of failed intubation. Probably, the main reason for this is fluid retention. With more deliveries occurring under either



L higher than R – Normal
L and R in line – difficult
L lower than R – Extremely difficult

Fig. 4 Testing movement of the occiput on the atlas – the Delilkan warning signs.



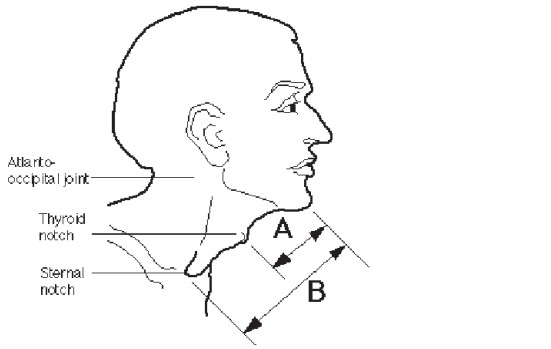
In A the lower teeth can protrude further than the upper teeth
In B both sets of teeth meet in the midline
In C The lower teeth do not reach the upper teeth

Fig. 3 Assessing forward movement of the jaw.

epidural or spinal anaesthesia (or a combination of both), anaesthetists have less exposure to pregnant patients who require general anaesthesia. This has the potential of increasing the incidence of failed intubations. All these tests and observations can alter very significantly when there is pathology in the upper airway, classically in patients presenting for ENT surgery.

Measurements

There are several measurements that can be of assistance but the two main ones are the Patel and Savva distances (Fig. 5). In the



Anatomical distance	*Critical distance*
A = Thyromental distance (Patel distance)	6.0 cm
B = Sterno-mental distance (Savva distance)	12.5 cm

Fig. 5 Patel and Savva distances.

former, the distance between the tip of the jaw and uppermost aspect of the thyroid cartilage should be >6.5 cm. In the latter, the distance from the jaw to the sternal notch should be >12.5 cm. If either measurement is below these figures, then there is usually difficulty with laryngoscopy.

Finally, there is the scoring system devised by Wilson, which incorporates most of these tests. Five predicting factors (weight, head and neck movement, jaw movement, receding mandible, buck teeth) are scored individually on a 3-point scale (0–2). A total score of 2 or more is associated with a increased incidence of difficult intubation.

It is generally accepted that one test or measurement is insufficient to predict difficult laryngoscopy accurately and it is recommended that all are performed. Normally, they can all be completed in under 2 min and they are just as easy to perform with the patient supine. This approach should increase both the sensitivity and specificity of the prediction. Sensitivity is the proportion of problems detected and specificity is the proportion of predicted problems which actually turn out to be a problem, *i.e.* specificity reduces with an increasing proportion of false-positives.

Investigations

Radiological imaging of the neck and head in the neutral position and with the head extended can be of great assistance, *e.g.* illustrating a bamboo spine or altanto-occipital restriction. However, this investigation is often performed when a difficult laryngoscopy or intubation occurs 'out of the blue'. When laryngopharyngeal pathology is present, a CT-scan can be extremely useful in demonstrating tracheal deviation and obstruction. In addition, the distal extension of a tumour within the airway can be delineated.

Recent developments

Fibre-optic instruments are being used more frequently and can predict difficult laryngoscopy and intubation. Such instruments include the nasolaryngoscope and the fibre-optic telescope with a 90° viewing facility. The former is passed through the nose while the latter is passed through the mouth into the pharynx. Both give excellent views of the larynx and can warn the anaesthetist of possible abnormalities and difficulties.

Predicting difficult intubation

Intubation has been defined as difficult when 3 or more attempts are made or >10 min is required to accomplish it. Intubation can be *via* the nasal or oral routes. The nasal route is used much less frequently. Potential problems include septal abnormalities, conchae, polyps and other masses (benign and malignant). Air flow through a nostril can be checked clinically by obstructing the other and the nostril with the best flow is normally used. If airflow is obstructed in both nostrils, difficulties can be expected. Currently, techniques and apparatus are available which enable direct inspection of the nostril and detection of hidden obstructions. Finally, haemorrhage may cause further difficulties.

Difficult intubation *via* the oral route is usually associated with a difficult laryngoscopy. However, it can also be associated with the following: (i) the tracheal tube may obstruct the view of the vocal cords; (ii) a tumour may prevent passage; (iii) unilateral cord paralysis; and (iv) difficulty in exposing the glottis.

Under such circumstances, many would use a gum elastic bougie or a fibre-optic intubation instrument with a smaller tracheal tube, *e.g.* 6.0 mm in an adult.

Predicting a difficult airway

Difficult airway is a more global concept. It can be divided into three zones.

Upper airway

This will include anatomical abnormalities of the face, mouth and nose which have potential to cause respiratory obstruction. These can be compounded by size, obesity and beards. Effective use of a face mask may be difficult and, under these circumstances, it is helpful to use 'four hand ventilation', *i.e.* one pair of hands holds the mask on the face and another compresses the reservoir bag. Very occasionally 'six hands' are required; the third pair of hands being used for cricothyroid pressure and supporting the cervical spine. Other causes of difficulty include facial and jaw fractures. All the factors associated with a difficult laryngoscopy are also important and may also make the insertion of an airway conduit more difficult.

Middle airway

Factors causing problems here include those that contribute to difficult laryngoscopy and intubation. They are usually associated with infection (*e.g.* epiglottis) and swelling due to fluid retention, tumour or other anatomical abnormalities.

Lower airway

Causes of difficulty in this area include both tracheal and bronchial abnormalities, *e.g.* tracheal stenosis caused by compression by a mediastinal mass. Acute bronchoconstriction

and chronic asthma can cause severe problems. All these difficulties are enhanced by smoking.

Anaesthetic management

What does the anaesthetist do when a diagnosis of potential difficulty with laryngoscopy, intubation or the airway has been made? It is prudent to remember the key strategy in all patients, *i.e.* oxygenation, followed by oxygenation and then by more oxygenation. Another traditional maxim is that no muscle relaxants should be administered until the airway has been fully established. This can be accomplished using various techniques and instruments which will be reviewed in a future article.

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See multiple choice questions 25 and 26.