Difficult and failed intubation in obstetrics

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Key points
The decline in general anaesthesia for Caesarean section has reduced many anaesthetists’ experience and confidence in obstetric airway management.
Correct patient positioning and pre-oxygenation is essential to provide optimal conditions for intubation.
Oxygenation and ventilation are the main priorities after failed intubation.
Videolaryngoscopy may be useful in obstetric airway management but only if the anaesthetist is familiar with the technique.
Knowing when to abandon each step of the failed intubation drill and move on to the next is vital.

Obstetric general anaesthesia is associated with a number of deleterious effects and it has long been recognized that airway management can be challenging and tracheal intubation more likely to fail. Failed intubation and subsequent inadequate ventilation is an important cause of maternal mortality and morbidity.

General anaesthesia for Caesarean section has dramatically declined in many nations around the world and it is used disproportionately more frequently for category 1 Caesarean section (immediate risk to life of mother or fetus) because of the perceived need for urgent delivery of the fetus. In this pressured situation, patient assessment, positioning, and pre-oxygenation may be compromised and anxiety may impair the performance of the anaesthetist.

A number of interesting developments have occurred over the last 5 yr which may already be influencing how the obstetric airway is managed. Rigid indirect laryngoscopy has become increasingly popular for performing tracheal intubation, established notions of the role muscle relaxation plays in difficult airway management have been questioned, and a novel drug which permanently reverses non-depolarizing neuromuscular block has entered clinical practice. These changes have implications for the modern and safe management of difficult and failed intubation in obstetrics.

Factors contributing to failed obstetric intubation

The incidence of failed obstetric intubation is widely reported to be around 1:300. It has been suggested that failure rate may be associated with the frequency with which general anaesthesia is provided for Caesarean section within different institutions. A recent retrospective audit from the UK found no cases of failed intubation in 3430 general anaesthesias for Caesarean section and the authors partly attributed this low incidence to the higher than average rate of obstetric general anaesthesia at their hospital resulting in greater experience of the technique.

Many factors have been reported to contribute to airway difficulties in obstetrics including the influence of pregnancy-related physiological, anatomical, and pathological changes (Table 1). In contrast to commonly held beliefs, a systematic review found no evidence that tracheal intubation is more difficult in the obstetric population than in the non-obstetric population. Whether or not this is true, the consequences of failure to intubate may be more serious in the obstetric patient.

Performance under stress

The trend away from Caesarean section under general anaesthesia has considerably reduced many anaesthetists’ experience in managing the obstetric airway. The fear of a poor neonatal outcome if delivery is delayed may compromise adequate airway examination and lead to suboptimal patient positioning, pre-oxygenation, and checking of equipment. Most anaesthetists are well aware of the reported difficulties and potential consequences of a failed intubation and it has been suggested that this knowledge may impair confidence leading to the expectation that intubation will be difficult.

Minimizing problems

Airway assessment

The time available to review a patient for Caesarean section is often limited, but a rapid assessment of the airway is necessary. It is important to consider not just potential difficult intubation but also difficult ventilation and difficult access to the airway from the neck.

Although many tests of difficult intubation have been described, usefulness is limited by the poor positive predictive value of what is a
Since most patients who are impossible to intubate can be ventilated, prediction of impossible mask ventilation would seem valuable. A recent large observational study of an adult general population found independent predictors of impossible mask ventilation were: neck radiation changes, male sex, sleep apnoea, Mallampati III or IV, and presence of a beard. Although the population studied was not obstetric, anaesthetists should be mindful of a Mallampati grade III or above and history of sleep apnoea.

Positioning, pre-oxygenation, and preparation

Optimal patient positioning is essential. The head elevated (ramped) position may be useful in pregnant women especially if obese (Fig. 1). Elevation of the upper back may facilitate insertion of the laryngoscope and a number of products have recently been developed to more easily achieve this position. The 30° head-up position has been reported to increase functional residual capacity in term parturients and improve the view at laryngoscopy.

Effective pre-oxygenation (aiming to achieve end-tidal oxygen of >85%) may delay the onset of desaturation providing more time to intubate the trachea free of the additional stress provoked by the diminishing tone of the pulse oximeter. Oxygen flow rates of 10 litre min⁻¹ using either 3 min of tidal volume breathing or 8 deep breaths provide optimal pre-oxygenation in a circle system. During pre-oxygenation, confirming the position of the cricoid cartilage may reduce the risk of incorrectly applied cricoid pressure which may impair the view at laryngoscopy and consideration of the following questions may be valuable:

- What is my plan if I fail to intubate?
- What is my plan if I fail to ventilate?
- In the event of a failed intubation, will I allow surgery to proceed if ventilation is adequate?

If intubation fails or is difficult, proceeding without a plan is more likely to lead to uncertainty of the different steps that need to be taken and performance and confidence may be undermined. The ability to recognize the point at which to abandon one step and move on to the next is imperative.

Failed intubation drill

Despite publication and widespread awareness of guidelines for the management of unanticipated difficult intubation in the non-obstetric population, no major anaesthetic association has published guidelines specifically addressing the obstetric population. In the absence of a consensus approach, hospitals providing obstetric services must have their own guidelines, appropriate and easily accessible airway equipment, and regular teaching and training in the management of airway problems (Fig. 2).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Pregnancy-related features that may contribute to airway difficulties</th>
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<tr>
<td>Problem</td>
<td>Cause</td>
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<tr>
<td>High risk of regurgitation of gastric contents and acid aspiration syndrome</td>
<td>Reduced lower oesophageal sphincter tone and increased intra-gastric pressures</td>
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<td>Gastric emptying delayed by labour and opioids</td>
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<td>Increased gastric acid volume and acidity</td>
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<td>Rapid onset of hypoxaemia after induction</td>
<td>FRC reduced by 20% (more when supine)</td>
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<td>Difficulty inserting the laryngoscope blade</td>
<td>Oxygen consumption increased by 25% (up to 60% during labour)</td>
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<td>Enlarged breasts</td>
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<td>Weight gain/obesity</td>
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<td>Poor view at laryngoscopy</td>
<td>Misplaced cricoid pressure and/or misaligned laryngoscopy due to lateral tilt to reduce aorto-caval compression</td>
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<td>Airway oedema due to increased total body water and reduced colloid oncotic pressure</td>
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<td>Exacerbated by pre-eclampsia</td>
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<td>Risk of bleeding from airway manipulation</td>
<td>Capillary engorgement of nasal and oropharyngeal mucosa</td>
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<td>Coagulopathy in pre-eclampsia</td>
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Fig 1  Head elevated (ramped position).
Improving a poor view of the glottis

With correct patient positioning and optimal pre-oxygenation, the first attempt at intubation should be the best and repositioning unnecessary if intubation is difficult.

The tracheal tube introducer (bougie) has a long history of aiding intubation and is often the only adjunct required when the view at laryngoscopy is poor. Even if the glottic opening can be seen, it may be sensible to elect to use an introducer if passage of the tracheal tube is considered potentially awkward. Rotating the tube anti-clockwise may reduce the likelihood of hold-up as it passes through the glottis when rail-roaded over an introducer.

Cases of serious airway injury have been reported especially with the single-use introducer which is now more commonly provided. Injury is more likely if the introducer is repeatedly inserted when the view of the glottis is poor and multiple insertions must be avoided.

Alternative laryngoscopes and the role of videolaryngoscopy

A short-handled laryngoscope or polio blade may be helpful if insertion of the laryngoscope is prevented by the patient’s chest or breasts. A McCoy blade may lift the epiglottis forward to expose the glottis and should be close at hand.
Over the last decade, several rigid indirect laryngoscopes and optical styles have been developed. These devices often referred to as video laryngoscopes, differ in design, method, and ease of use. Unlike a traditional Macintosh laryngoscope, which requires a direct line of sight from the eye of the anaesthetist to the glottis, video laryngoscopes acquire the view of the glottis from the distal end of the device. Videolaryngoscopy may improve the view in some patients; however, disadvantages have been described, including unfamiliarity of use, difficulty with insertion, and problems passing the tracheal tube into the trachea which may result in airway injury. Videolaryngoscopy is an exciting development, but there is limited evidence to recommend one device over another, and the precise effectiveness and role in obstetric airway management remains, for the time being, unclear. If the anaesthetist is experienced with videolaryngoscopy, it appears reasonable to use this technique in obstetric general anaesthesia.

Failed intubation: can I ventilate?

Failed intubation should be clearly declared to the whole theatre team, help summoned, and the anaesthetist should focus on the immediate priority of oxygenation and ventilation. First attempts should be by face mask, using a two-handed technique with cricoid pressure maintained. Communication to the whole theatre team is vital since a second pair of hands may immediately be required to squeeze the bag while the assistant maintains cricoid pressure. Cricoid pressure should be reduced and if necessary released if ventilation remains inadequate. An oropharyngeal airway may assist ventilation but care should be taken with inserting a nasopharyngeal airway due to the increased risk of bleeding from the nose. If ventilation is now possible, the decision whether to proceed with surgery must be made. If ventilation remains ineffective, a supraglottic airway device must now be inserted.

Which supraglottic airway device to use?

The laryngeal mask airway (LMA) is familiar to many anaesthetists and there are several reports of its successful use in the management of the difficult obstetric airway. A range of LMAs now exist, including devices that aim to reduce the risk and harm of regurgitated gastric contents (LMA Supreme™, LMA ProSeal™) and devices adapted to facilitate intubation through the LMA itself (LMA Fastrach™, LMA CTrac™).

There is no clear evidence to support which LMA should be inserted, but since oxygenation and ventilation are the prime objectives, inserting the device with which the anaesthetist has most experience and confidence would appear sensible. For many, this is the classic LMA; however, there is an argument for inserting a device which may reduce the risk and harm of regurgitation and provide improved ventilation. The LMA ProSeal™ has been used successfully after failed obstetric intubation and not only provides an improved airway seal but also allows insertion of a gastric tube to aspirate insufflated air or empty stomach contents. The possible advantages of this device must be balanced against its lower first-time insertion rate and the fact that most anaesthetists have more experience with the classic LMA.

Although the LMA may rescue ventilation, there are potential difficulties with its use in this situation. If not already prepared, it will need to be opened and lubricated, insertion may be difficult as depth of anaesthesia lightens and muscle relaxation wears off, and cricoid pressure may impede correct placement and may need to be eased or released during insertion.

If insertion of the LMA allows adequate ventilation, then the decision to proceed or not with surgery must be made. If ventilation remains impossible, then the anaesthetist must progress swiftly to the next step in the failed intubation management plan.

Can’t intubate, can’t ventilate

When both intubation and ventilation have failed, the anaesthetist must cease further attempts at oxygenation by face mask or LMA and proceed rapidly to the neck to access the upper airway.

A number of different devices and methods for providing trans-tracheal ventilation have been described and it is unfortunate that there is no clear consensus on the optimal equipment and technique to use. The Difficult Airway Society recommends following one of two pathways—to access the neck with a cannula and ventilate with oxygen under high pressure, or to perform a surgical cricothyroidotomy and ventilate with oxygen delivered by a low-pressure source. Each method requires different equipment and skills and presents different challenges and complications. In such a difficult situation, every anaesthetist must know the technique they would use and equipment must be readily available.

It has been suggested that anaesthetists may be better suited to performing procedures using a syringe and cannula rather than a scalpel blade, prompting the recommendation that a cannula is the most suitable first-line device to access the neck. Although placement of a cannula cricothyroidotomy has the advantage of reducing the risk of trauma during insertion, its main disadvantage relates to the risks of jet ventilation. Most anaesthetists are unfamiliar with emergency subglottic jet ventilation and there is potential for serious harm through barotrauma and disruption of soft tissues in the neck due to high-pressure ventilation through a misplaced cannula.

Should cannula trans-tracheal ventilation fail, scalpel incision of the cricothyroid membrane and rail-roading of a tracheal tube over a bougie inserted into the trachea have been recommended.

Once oxygenation has improved, the decision to continue with surgery or to wake up must be made. Unless the mother’s life is seriously threatened, she should be woken.

Decision-making: to wake or deliver?

The appropriate action to take when the patient cannot be intubated but can be ventilated is sometimes obvious, but there are occasions when the decision is less clear cut. Unfortunately, guidance is limited probably because each case has its own individual features.
relating to the urgency of the procedure, the condition of the fetus, the condition of the mother, the experience of the anaesthetist, and their confidence in the airway they are maintaining at that time.

In the case of a failed intubation in an elective Caesarean section, the mother should be woken. Conversely, if faced with a life-threatening maternal event, for example, severe ante-partum haemorrhage, or maternal cardiac arrest requiring peri-mortem Caesarean section, there is no option but to proceed with surgery. The correct approach may be less obvious in the case of failed intubation during a non-elective Caesarean section for fetal distress where ventilation by an LMA is adequate but the fetal heart remains compromised. The LMA has been used in many Caesarean sections but most reports are of elective, fasted, non-obese women. Case reports of the LMA rescuing ventilation in emergency situations do not prove the safety of the technique. They do, however, provide reassurance that proceeding with surgery, while maintaining cricoid pressure may be appropriate in some situations. In the absence of clear guidance on what to do in these grey areas, it is likely that the decision made will be based on the circumstances of the case and the experience of the anaesthetist. It is prudent to consider this before commencing general anaesthesia.

**Decision to deliver**

If intubation has failed, ventilation is possible, and the decision to continue surgery has been made, spontaneous ventilation under deep inhalation anaesthesia has traditionally been advocated. This may not be straightforward and high concentrations of volatile agent may adversely affect uterine tone. A non-irritant agent such as sevoflurane is advisable and assisted ventilation may be appropriate if ventilation is straightforward and cricoid pressure maintained.

**Tracheal intubation via the LMA**

If the decision is made to continue surgery after an LMA is inserted but a more secure airway is desired, the LMA can be used as a conduit to intubate the trachea. The LMA Fastrach™ (Intubating LMA) facilitates intubation while maintaining ventilation; however, its insertion and use differ from the classic LMA with which most anaesthetists are more familiar. The Aintree Intubation Catheter (AIC) can be passed under fibreoptic guidance into the trachea using the LMA as a conduit and a tracheal tube railroaded over it after removal of the LMA. The ease of using an AIC may be influenced by the type of LMA acting as the conduit. Inserting an LMA Supreme™ to rescue ventilation may be attractive because of its potential to reduce the risk of gastric regurgitation; however, passage of an AIC may be more difficult through this device than through other LMAs.

**Decision to wake the patient up**

Turning the patient on their side to recover has been advocated; however, if maintaining the airway is difficult in the supine position, it may be prudent to stay supine with cricoid pressure maintained until the patient is awake.

**Recovery**

Serious airway problems have occurred in pregnant women during recovery from general anaesthesia. If there have been multiple intubation attempts or signs of airway oedema at laryngoscopy, there is a potential for airway problems after extubation. The cuff of the tracheal tube should be deflated before extubation and a leak around the tube confirmed before its removal.

**Training**

A recent confidential enquiry into maternal deaths highlighted the need for better training in obstetric airway management and stressed that this is a responsibility of anaesthetic departments. Simulation exercises and teaching using airway manikins and animal models play an important role in supplementing training in the operating theatre.

**Future developments**

There is evidence that significant gastric insufflation is unlikely during positive pressure ventilation if cricoid pressure is correctly applied and gentle bag-mask ventilation has been advocated after induction to prevent desaturation allowing more time should intubation be difficult. This may be particularly relevant if rocuronium rather than succinylcholine is used.

Face mask ventilation may be easier in the presence of adequate muscle relaxation. Avoidance of a second dose of succinylcholine after failed intubation is commonly promoted and this recommendation may avert the temptation to make multiple attempts at intubation when the correct course of action is to abandon intubation attempts and provide ventilation and oxygenation by other means. When intubation has failed, face mask ventilation or LMA insertion may be difficult due to decreasing depth of anaesthesia and incomplete muscle relaxation. In this situation, the patient may not be sufficiently awake to spontaneously ventilate or deep/paralysed enough for ventilation to be effectively provided. Whether muscle relaxation may be beneficial in these circumstances is debatable.

The recent introduction of sugammadex, a drug that can rapidly reverse certain non-depolarizing neuromuscular blocking agents (rocuronium), has the potential to influence established practice in obstetric airway management. The availability of sugammadex may instil confidence to provide longer-acting muscle relaxation at induction of anaesthesia which may have benefits in difficult airway management. If sugammadex is required to reverse neuromuscular block, it will need to be administered rapidly and in the
correct dose. Maintaining a supply on the difficult airway trolley along with clear information on dosage is sensible. It must be remembered that permanent reversal of neuromuscular block does not imply rapid return of spontaneous ventilation if the airway remains obstructed.

**Declaration of interest**

None declared.

**References**


2. Calder I, Yentis SM. Could ‘safe practice’ be compromising safe practice? Should anaesthetists have to demonstrate that face mask ventilation is possible before giving a neuromuscular blocker? *Anaesthesia* 2008; 63: 113–5


Please see multiple choice questions 33–36.