Failed intubation in obstetrics

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Abstract

Failed intubation in obstetrics remains a topical issue, a rare but potentially devastating complication of obstetric general anaesthesia. The 2015 guidelines produced following several years of collaborative work between the Difficult Airway Society (DAS) and Obstetric Anaesthetist's Association (OAA) remain the definitive text. While deaths from failed intubation have declined significantly over 30 years, the incidence of failed intubation remains fairly constant at 1:300, with latest studies showing a rate of 1:224. This reflects the significant decline in the use of general anaesthesia for caesarean section over the last three decades; however it also highlights a decreased exposure for trainees to tracheal intubation in the obstetric population.

Keywords Airway skills; assessment; failed intubation drill; obstetrics; preoperative; simulation

Royal College of Anaesthetists CPD Matrix: 1B02, 1C01, 1C02, 2A01, 2B02, 2B05

Learning objectives

After reading this article you, should be able to:

- describe the factors that contribute to failed intubation in obstetric anaesthesia
- recall the stages required in a safe obstetric general anaesthetic
- discuss the DAS/OAA guidelines on how to manage failed intubation in obstetrics

Incidence

While deaths from failed intubation in the UK have fallen from 16 per triennium (1976–1978) to 2 (2006–2008),[1] the incidence of failed intubation has remained at levels of approximately 1:300, 3–6 times as common as the general population.

The rate of general anaesthesia (GA) for caesarean section (CS) has fallen from 55% (1989–90) to 6% (2016–18). In the same time-frame there has been an increase in the overall CS rate from 11% to 29%.[2] Despite this rise in the CS rate, the number of CS done under GA has fallen three-fold.

There are several possible reasons to explain why there may not have been a fall in failed intubation in obstetrics. A lower incidence of failed intubation has been demonstrated with more senior anaesthetic cover and more frequent use of GA, so it is possible that the decrease in obstetric GAs, combined with less exposure to clinical work caused by the European Working Time Directive (EWTD) has decreased trainee's exposure, leading to less expertise in managing the obstetric airway. The increasing complexity of obstetric patients may be another contributing factor to failed intubation rates not declining.

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Contributing factors

The causes of difficult intubation in obstetrics can be divided into demographic, anaesthetic, pregnancy related and situational factors.

Demographic

The demographics of the obstetric patient group are changing. Levels of obesity, maternal age, and pre-existing maternal morbidity are all increasing.

Anaesthetic

There has been a significant decline in the number of obstetric GAs performed over the last 30 years. Most obstetric GAs are performed by trainee anaesthetists out of hours. Furthermore, trainee anaesthetists may be gaining less exposure to intubation generally, with a combination of factors contributing to this. These include the effect of reduced hours imposed by the EWTD, the advent of the laryngeal mask airway, and, as discussed, the decreasing number of obstetric GAs. The advent of videolaryngoscopy has been shown to reduce the rate of failed intubation.[3] While the central theatre areas in hospitals usually have access to videolarygnoscopes a national survey showed obstetric theatres have been slower to catch up on this advance in technology.[4]

Pregnancy related

Obstetric airways can be challenging due to physiological changes in pregnancy. Venous congestion causes the airway mucosa to become more vascular and oedematous. This increases the risk of bleeding on airway instrumentation, and can also distort normal anatomy making intubation more difficult. This swelling may be exacerbated by pre-eclampsia, IV fluids and oxytocin administered during labour, and Valsalva manoeurvres performed in labour. Desaturation can be rapid due to decreased functional residual capacity (FRC), increased oxygen requirements and difficulties pre-oxygenating in the distressed parturient.

The risk of reflux is increased due to decreased lower oesophageal sphincter tone, and delayed gastric emptying due to pain in labour and opioid medication.

Enlarged breasts can make the insertion of a laryngoscope blade difficult.

Situational factors

Multiple factors may complicate the successful securing of a patent airway. The majority of difficult and failed intubations in obstetric patients occur during emergencies and out of hours.[5]

In an emergency setting, airway assessment may have not been completed satisfactorily. This is associated with failed intubation.

The obstetric theatre can be a different environment to that which the trainee anaesthetist has had previous experience. Excessive noise levels, a distressed patient, fetal considerations, as well as pressure from surgeons with their potential different clinical priorities can all act to compound the stress of the situation for the anaesthetist.

This environment may also result in suboptimal positioning of patients and failure to communicate the airway plan with the anaesthetic team. It has also been shown that pre-oxygenation is done poorly in obstetric GA.[6]

Another significant risk factor for failed intubation is failed regional anaesthesia. The UK Obstetric Surveillance System (UKOSS) showed that 17% of failed intubation was preceded by failed regional anaesthesia. Failed regional anaesthesia has been shown to be three times more likely[7] to occur with epidural top up anaesthesia compared with spinal anaesthesia. This highlights the importance of reviewing women with epidurals regularly. Predictors for failure of epidural top up are an increasing number of anaesthetist top ups in labour, and a high urgency for CS.[8]

Management of failed intubation

Failed intubation is a very rare event. In units similar to ours, with >9000 deliveries per year, a failed intubation rate of 1:224 anaesthetics would give rise to one incident per 12 months.

The Obstetrics Anaesthetist's Association (OAA) and Difficult Airway Society (DAS) formed a Guidelines Group in May 2012, and in 2015 published difficult and failed intubation guidelines.[9] These should now be considered the gold standard for management of failed intubation in obstetrics in the UK, and should be circulated amongst all anaesthetic staff undertaking obstetric work. There should also be simulation drills using the new guidelines in order to ensure familiarity with them amongst all health professionals working on delivery suite. The guidelines will be summarized below. Figure 1 is a composite of three specific algorithms to be discussed below.

Safe obstetric general anaesthesia (Figure 2, Algorithm 1)

Pre-theatre preparation

Airway assessment: All women undergoing obstetric anaesthesia should have an assessment to predict difficult intubation, difficult mask ventilation, supraglottic airway device (SAD) placement and front of neck access.

Fasting status and antacid prophylaxis: Women should be stratified into low and high risk for requiring general anaesthesia. Low-risk women should be allowed a light diet. High-risk women should not eat but may have clear fluids (preferably isotonic). They should also have oral H_2 receptor antagonists every 6 hours. Sodium citrate should be administered before general anaesthesia. Aspiration of gastric contents is a significant cause of morbidity following failed tracheal intubation.[10]

Intrauterine fetal resuscitation: This should be instituted prior to an emergency operative delivery and urgency of surgery reassessed on arrival to the operating theatre.

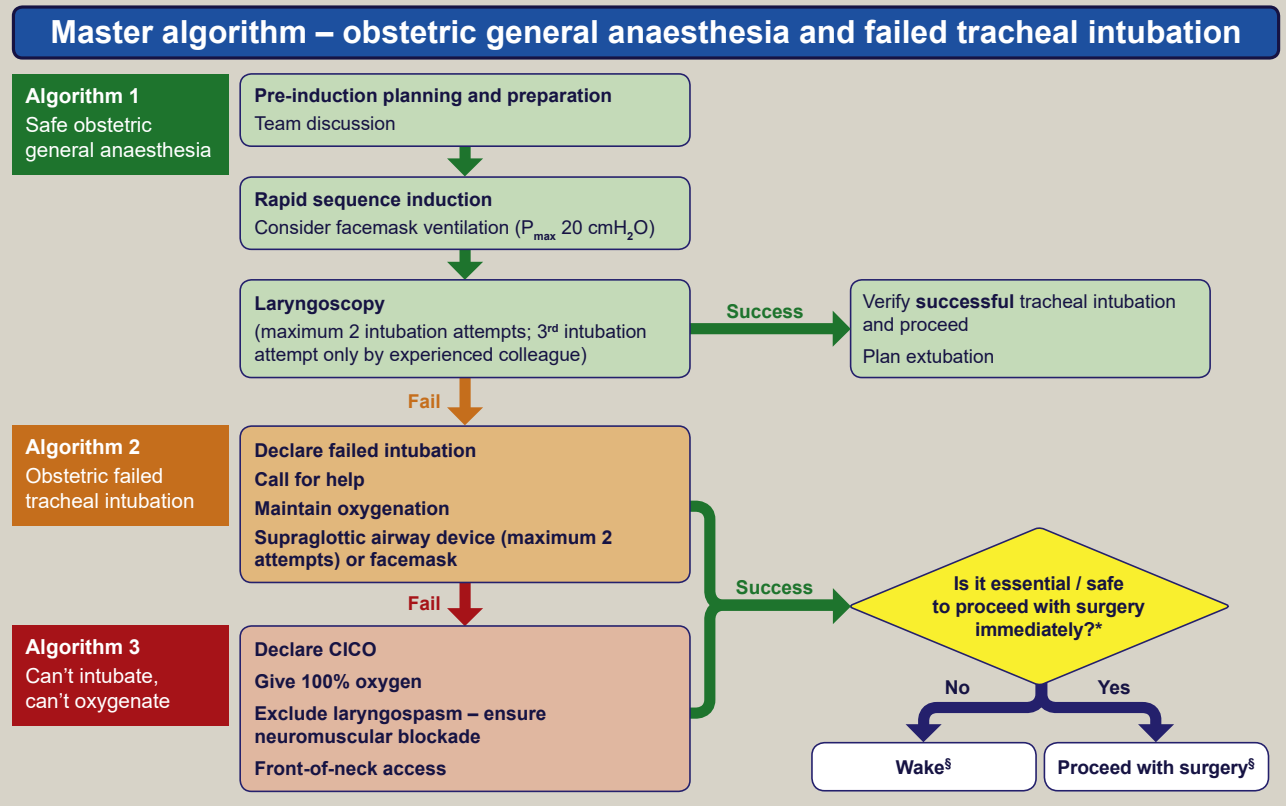

Figure 1

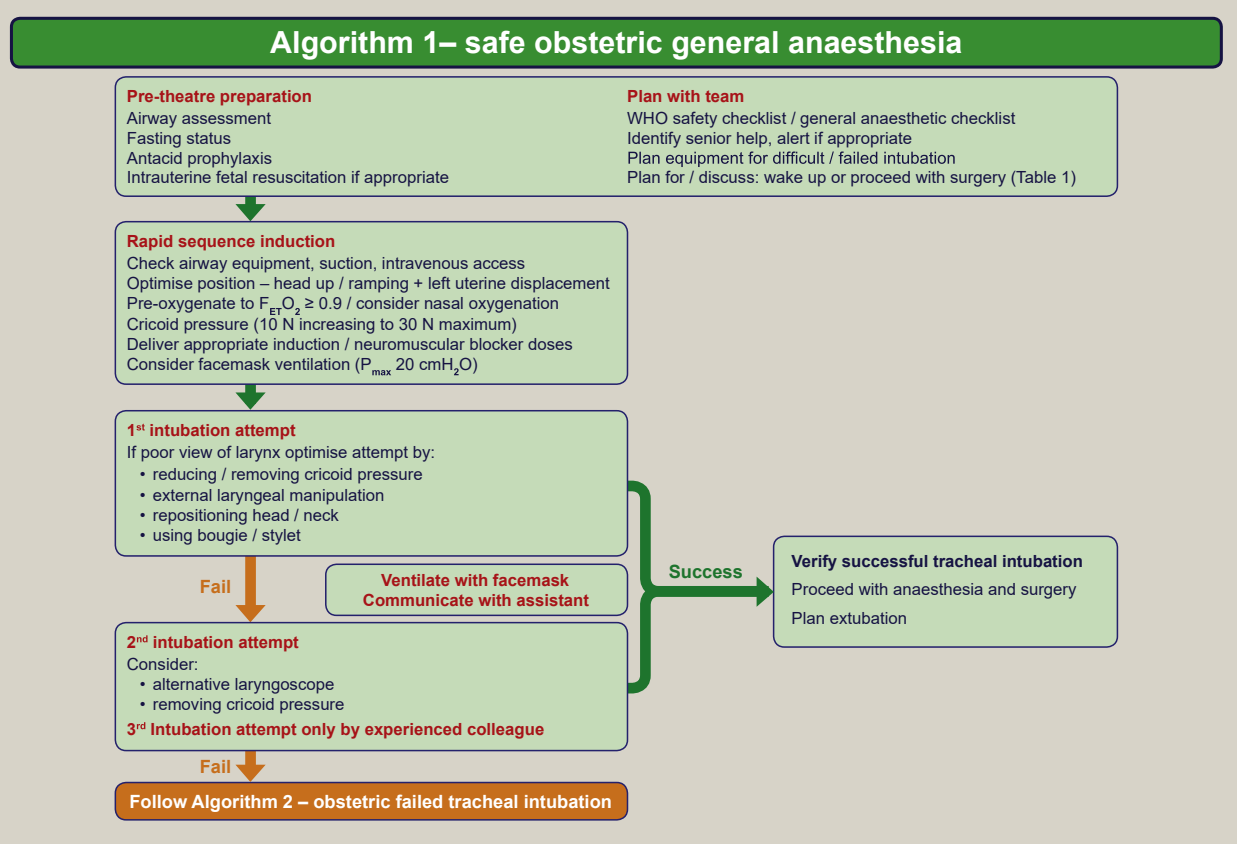

Figure 2

In-theatre preparation

Plan with team: The World Health Organization (WHO) surgical checklist should be used before each theatre procedure. The urgency category should be clearly communicated. There should be a clear procedure for how to contact a second anaesthetist if required. Difficult airway trolleys should be standardized throughout a hospital site. It is vital for all anaesthetists to be aware of the contents of the trolley and be familiar with their use. This should be covered at induction of new staff.

Prior to induction of anaesthesia, the team should discuss whether to wake the woman or continue anaesthesia in the event of failed tracheal intubation. Table 1 highlights the factors that need to be considered, and should be considered prior to every elective and emergency obstetric general anaesthesia.

The main indications to continue with general anaesthesia without a secured airway are maternal compromise not responsive to resuscitation and acute fetal compromise secondary to an irreversible cause. Common causes of irreversible fetal compromise are fetal haemorrhage, ruptured uterine scar with placental/fetal extrusion, major placental abruption, umbilical cord prolapse and failed instrumental delivery. The exact reason for fetal compromise may not be apparent until after delivery.

Strong indications to wake the mother up are poor ventilation with an SAD or facemask despite efforts at optimizing, and periglottic airway swelling.

Several other factors shift the balance in favour of waking the patient, including significant obesity, inexperience of trainee, previous intra-abdominal surgery, and high maternal aspiration risk.

It is worth noting that general anaesthesia is continued after failed intubation in most cases of elective as well as emergency caesarean section in current UK practice.[11]

Optimize patient position: This is essential prior to the first intubation attempt. A 20–30 degree head up position increases FRC and safe apnoea time, and may help laryngoscope insertion, as well as reduce gastro-oesophageal reflux. For some patients an Oxford pillow may be useful for this purpose.

Pre-oxygenation: Previous clinical research and recent computer modelling shows that 2 minutes of pre-oxygenation is sufficient for a pregnant woman at term.

Continued administration of 100% oxygen with a tight-fitting facemask during apnoea delays desaturation by bulk flow. The anaesthetist should also consider attaching nasal cannula with a flow of 5 L/min to maintain bulk flow during intubation attempts. High-flow nasal oxygen systems have shown promise at reducing desaturation during intubation in the non-obstetric population and are likely to be useful in certain patients (e.g. obesity).[12]

Cricoid pressure: Current evidence supports applying 10 N force initially, and increasing it to 30 N (20 N if head up position used) after loss of consciousness. Incorrectly applied cricoid pressure can cause difficulties with laryngoscopy, tracheal tube and SAD insertion, and mask ventilation, so there should be a low threshold to reduce or remove cricoid pressure if difficulties are

Proceed with surgery?

Factors to consider		Wake ⟷			Proceed
Before induction	Maternal condition	• No compromise	• Mild acute compromise	• Haemorrhage responsive to resuscitation	• Hypovolemia requiring corrective surgery • Critical cardiac or respiratory compromise, cardiac arrest
	Fetal condition	• No compromise	• Compromise corrected with intrauterine resuscitation, pH < 7.2 but >7.16	• Continuing fetal heart rate abnormality despite intrauterine resuscitation, pH < 7.15	• Sustained bradycardia • Fetal haemorrhage • Suspected uterine rupture
	Anaesthetist	• Novice	• Junior trainee	• Senior trainee	• Consultant / specialist
	Obesity	• Supermorbid	• Morbid	• Obese	• Normal
	Surgical factors	• Complex surgery or major haemorrhage anticipated	• Multiple uterine scars • Some surgical difficulties expected	• Single uterine scar	• No risk factors
	Aspiration risk	• Recent food	• No recent food • In labour • Opioids given • Antacids not given	• No recent food • In labour • Opioids not giver • Antacids given	• Fasted • Not in labour • Antacids given
	Alternative anaesthesia • regional • securing airway awake	• No anticipated difficulty	• Predicted difficulty	• Relatively contraindicated	• Absolutely contraindicated or has failed • Surgery started
After failed intubation	Airway device /ventilation	• Difficult facemask ventilation • Front-of-neck	• Adequate facemask ventilation	• First generation supraglottic airway device	• Second generation supraglottic airway device
	Airway hazards	• Laryngeal oedema • Stridor	• Bleeding • Trauma	• Secretions	• None evident

Table 1

encountered. If cricoid pressure is removed there is an increased risk of regurgitation and aspiration, so the anaesthetic team should be prepared to reapply cricoid pressure, introduce head down tilt and administer oropharyngeal suction.

Appropriate doses of induction agent/neuromuscular blocking drug: Thiopentone is the most commonly used induction agent for obstetric RSI in the UK. There is strong support for a change of induction agent due to familiarity, ease of drawing up, fewer drug errors and suppression of laryngeal reflexes. NAP5 showed a high incidence of overdosing and underdosing of thiopentone which led to awareness in obstetrics or cardiovascular collapse. This emphasized that whatever induction agent is used, an adequate dose should be administered with further doses available in case difficulty with intubation is encountered.[13]

Suxamethonium has historically been the muscle relaxant of choice in obstetric GA. It is commonly taught that it will wear off before significant hypoxia occurs, although often hypoxia occurs before return of neuromuscular function. The introduction of sugammadex has meant rocuronium has become a suitable alternative to suxamethonium at a dose of 1–1.2 mg/kg. If rocuronium is used, sugammadex should be immediately available and dose pre-calculated.

Consider facemask ventilation: This has been traditionally avoided, but is now recommended after induction, provided pressures are kept below 20 cmH_2O. This may help reduce the risk of significant desaturation, and also may give an indication as to the ease of mask ventilation in the event of a failed intubation attempt. As previously mentioned, high-flow nasal oxygen may also be of benefit.

Intubation: A range of laryngoscopes should be available (Macintosh, McCoy, videolaryngoscope). Caution should be taken with repeated attempts with a bougie or stylet due to the risk of airway trauma. The second attempt should be by the most senior anaesthetist present, and cricoid pressure should be released. A third attempt should only be made by an experienced anaesthetist. During repeated attempts at intubation it is important to maintain anaesthesia with either a volatile agent or further dose of intravenous agent. The likelihood of muscle relaxation wearing off if suxamethonium has been used should be remembered, with consideration of a further dose of a neuromuscular blocking agent.

Verification of tracheal intubation: The most reliable method of confirming successful tracheal intubation remains capnography.

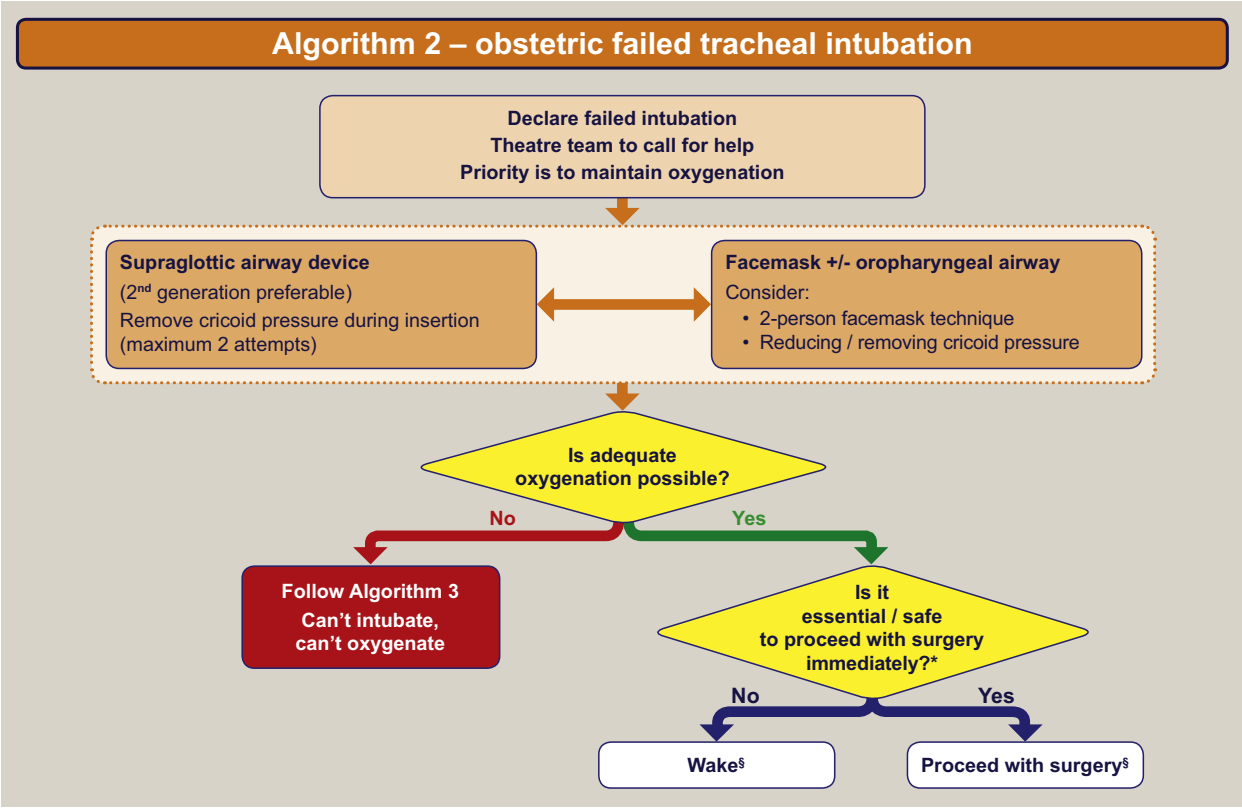

Figure 3

Rarely severe bronchospasm may cause a false negative reading of the capnography, but a flat trace on the capnograph should be treated as an oesophageal intubation until proven otherwise.

Obstetric failed tracheal intubation

At this point Algorithm 2 (Figure 3) should be followed.

Failed intubation should be declared to the theatre team and a senior anaesthetist sought. The focus is to maintain oxygenation via a facemark or SAD, and prevent aspiration and awareness.

If mask ventilation is difficult, or the pre induction decision was to proceed to surgery, immediate insertion of an SAD is the preferred option. Cricoid pressure has been shown to impair insertion of an SAD, so cricoid pressure should be released temporarily during insertion of an SAD. A second-generation SAD with a gastric drain is recommended as it allows passage of a gastric drain and higher ventilation pressures. If the first SAD does not provide an alternative airway should be considered, with care to minimize airway trauma.

The recommendation by DAS/OAA of the use of a second-generation SAD means clinicians should be familiar with their use. Clinicians will not gain experience with them in the elective setting on the obstetric unit, so should seek out opportunities to become familiar with them in other clinical settings.

Can't intubate, Can't oxygenate (CICO)

At this point Algorithm 3 (Figure 4) is followed.

This may be due to laryngeal spasm and poor chest wall compliance, so full relaxation should be achieved with rocuronium with sugammadex back up.

On recognition of CICO, an emergency should be declared to the theatre team, and specialist help from an ENT surgeon or intensivist.

Front of neck procedure

Access should be sought using scalpel cricothyroidotomy which has a higher success rate than other methods and provides a definitive airway. It is suggested that current DAS guidelines for emergency front-of-neck access in the non-obstetric patient are followed.

If this fails to restore oxygenation, a cardiac arrest protocol should be initiated, including caesarean delivery if the fetus is >20 weeks' gestation.

Management after failed tracheal intubation

After failed tracheal intubation, a decision will be made as to whether to proceed with surgery or wake the patient. The DAS/OAA guidelines provide a structure on how to manage the two scenarios (Table 2).

Wake

If the decision is made to wake the patient, the priorities are to maintain oxygenation, and avoid aspiration and awareness. The lateral head-down position ensures least risk of aspiration, but may make maintenance of the airway more complicated. If there is residual paralysis from suxamethonium, consideration of administration of further anaesthetic agents, either volatile or intravenous, should be considered. Paralysis with rocuronium should be reversed with an appropriate dose of sugammadex.

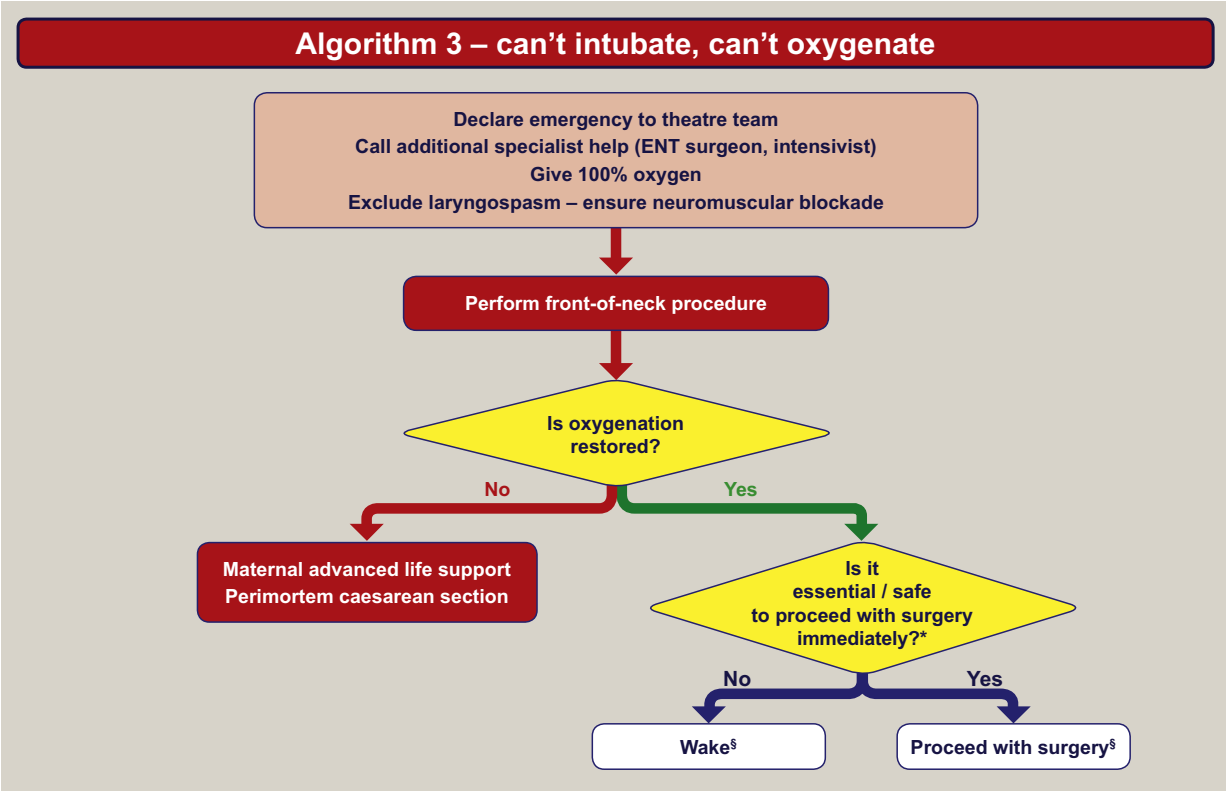

Figure 4

Management after failed tracheal intubation

Wake

- Maintain oxygenation
- Maintain cricoid pressure if not impeding ventilation
- Either maintain head-up position or turn left lateral recumbent
- If rocuronium used, reverse with sugammadex
- Assess neuromuscular blockade and manage awareness if paralysis is prolonged
- Anticipate laryngospasm / can't intubate, can't oxygenate

After waking

- Review urgency of surgery with obstetric team
- Intrauterine fetal resuscitation as appropriate
- For repeat anaesthesia, manage with two anaesthetists
- Anaesthetic options:
  - Regional anaesthesia preferably inserted in lateral position
  - Secure airway awake before repeat general anaesthesia

Proceed with surgery

- Maintain anaesthesia
- Maintain ventilation - consider merits of:
  - controlled or spontaneous ventilation
  - paralysis with rocuronium if sugammadex available
- Anticipate laryngospasm / can't intubate, can't oxygenate
- Minimise aspiration risk:
  - maintain cricoid pressure until delivery (if not impeding ventilation)
  - after delivery maintain vigilance and reapply cricoid pressure if signs of regurgitation
  - empty stomach with gastric drain tube if using second-generation supraglottic airway device
  - minimise fundal pressure
  - administer H2 receptor blocker i.v. if not already given
- Senior obstetrician to operate
- Inform neonatal team about failed intubation
- Consider total intravenous anaesthesia

Table 2

Upon waking, the urgency of delivery should be reassessed. The preferred anaesthetic options are a regional technique, or awake intubation followed by general anaesthesia.

Proceed

If it has been decided to continue with anaesthesia, the key points to consider are selection of airway device, use of cricoid pressure, ventilation strategy, drainage of gastric contents.

Caution should be taken with a change of airway device, as further manipulation may cause deterioration as well as improvement. It should be remembered that ventilation and ventilation/perfusion mismatch may improve after delivery.

The decision between spontaneous ventilation versus controlled ventilation needs to be taken on a case-by-case basis having assessed the respiratory sufficiency. A further decision has to be made, as positive pressure ventilation can be achieved without a neuromuscular blocking drug. A neuromuscular blocking agent confers the advantages of reduction in peak airway pressures, avoidance of laryngospasm and facilitation of surgery by abdominal muscular relaxation.

Ideally cricoid pressure should be maintained provided it doesn't interfere with ventilation. A high vigilance for aspiration should be continued until the patient is able to maintain their own airway.

Follow-up

It is important to remember that failed intubation can be a traumatic episode for both parturients and clinicians. It is good practice to follow-up all obstetric patients who have undergone anaesthetic intervention on the delivery unit. After a failed intubation a more formal debrief explaining the events in the peripartum period may help reduce psychological morbidity for the mother. Direct enquiry should be made regarding accidental awareness during anaesthesia.

Physical as well as psychological morbidity should also be excluded following failed intubation. Minor injuries, such as mucosal abrasions, are common. More serious injuries such as laryngeal, pharyngeal and oesophageal trauma should be sought and excluded.

Full documentation should be completed to facilitate future airway management.

Extubation

NAP4 showed that almost 30% of all adverse events associated with anaesthesia occurred at the end of anaesthesia or in recovery. The key issues are planning and preparation; consider options for reintubation. In the past, a left lateral/head down position was preferred for extubation following rapid sequence induction. There has been a trend towards extubation in the head up position, which may increase airway patency, respiratory function and airway access.

Summary

Failed intubation remains an important cause of maternal morbidity and mortality. It is important for obstetric units to ensure familiarity with new guidelines by cascading them to medical staff working on delivery units. The guidelines can be reinforced by teaching and simulation sessions that familiarize staff with the changes recommended. ◆

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