Obstetric Anaesthetists’ Association/Difficult Airway Society difficult and failed tracheal intubation guidelines – the way forward for the obstetric airway

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The Difficult Airway Society (DAS) has been producing airway guidelines for more than a decade. The original 2004 DAS guidelines for management of the unanticipated difficult intubation1 were followed by those on extubation2 and specialized intubation techniques.3 More recently it has collaborated with the Association of Paediatric Anaesthetists to produce guidelines for management of the difficult airway in children up to eight years of age.4 And now, after a three-year development period, a joint working group from the Obstetric Anaesthetists’ Association (OAA) and the DAS has written the first national obstetric-specific difficult airway guidelines, published this month.4

The original 2004 DAS guidelines specifically excluded obstetric patients, as this was seen to be a particularly complex area.1 The pregnant woman presents many unique challenges for airway management, both because of differences in physiology and the particular surgical situation. The former has possibly been over emphasized in the past; in the healthy non-labouring woman gastrointestinal changes are mainly confined to reduced lower oesophageal sphincter tone, and airway swelling (reflected by the Mallampati score) is also not prominent. Other than a higher risk of mucosal swelling and bleeding from repeated attempts at airway device insertion, women in early pregnancy, women having elective surgery in mid- to late pregnancy, and post-partum women do not present major additional challenges for airway management. However the unique aspect when providing general anaesthesia for operative delivery is the potential conflict between the needs of the mother and the fetus.5 General anaesthesia for Caesarean section is also now often provided because of contraindication or failure of regional anaesthesia, or extreme urgency.

These OAA/DAS guidelines follow extensive preparatory work including a comprehensive literature review of case reports and case series of failed intubation in obstetrics,6 an OAA-approved national survey of UK lead obstetric anaesthetic consultants on the management of failed intubation,7 and a secondary analysis of neonatal outcome from the UK Obstetric Surveillance System obstetric failed intubation database.8 Although more than 60 detailed case reports of failed intubation at Caesarean section were identified,9 there is little systematic airway-related research in pregnant women; hence the recommendations are largely Level C evidence, except for areas where it was felt justified to extrapolate from non-obstetric studies. After the drafting of the algorithms by expert consensus within the guidelines group, they were opened to consultation and comment from DAS and OAA members and relevant specialist societies.

The underlying principles in writing the guidelines were that they should take account of ‘real world’ current practice,6–8 and also align general anaesthesia for obstetric patients with non-obstetric practice wherever appropriate (such as the use of propofol for induction) (Box 1). The guidelines are based around four algorithms and two tables. The algorithms and tables are available in pdf and Powerpoint formats on the websites of the OAA (http://www.oaa-anaes.ac.uk/ui/content/content.aspx?id=179) and DAS (http://www.das.uk.com/guidelines/downloads.html) for download and use by readers subject to permission. The Master algorithm (Obstetric general anaesthetic and failed intubation) gives a composite overview of three specific algorithms that deal with induction of general anaesthesia, failed intubation and front-of-neck airway access. Algorithm 1 (Safe obstetric general anaesthesia) emphasizes good practice in planning, preparation and performance of rapid sequence induction. ‘Airway assessment’ as commonly understood refers to the attempt to predict a poor view of the glottis at direct laryngoscopy, and by implication difficult intubation. However such assessment is neither sensitive nor specific.10 Furthermore it is arguably less relevant with the introduction of the videolaryngoscope into routine practice,11 as these devices disconnect good glottic visualization from easy passage of the tracheal tube. A wider aim of airway assessment should be to alert the anaesthetist to possible difficulties with facemask ventilation, supraglottic airway device (SAD) insertion and front-of-neck airway access in addition to tracheal intubation; there are a number of common features that predict problems with some or all of these management options.

The World Health Organisation checklists for safer surgery have been introduced into NHS hospitals in the past five years.12 These emphasize the collective responsibility of the whole operating theatre team in promoting a culture of safety, with open discussion and detailed planning now becoming ingrained. The ‘Sign in’ and/or ‘Time out’ steps are valuable opportunities to discuss the urgency of the case, especially in terms of the obstetrician’s appreciation of the severity of any fetal compromise at Caesarean section, as this is a key point where the obstetrician and anaesthetist may have different concerns. A provisional plan on whether to awaken or continue general anaesthesia should be formulated during these safety steps,
considering factors listed in Table 1 (Wake or proceed to surgery?). Harmer suggested a 5-point scale to support this decision, based on the extent of maternal and fetal compromise. The default management was awakening, unless severe compromise dictated the need to continue. However, this unidimensional approach does not fully encompass the different, potentially competing, factors involved. The concept that general anaesthesia for Caesarean section without a tracheal tube in place is unacceptable has been questioned by large case series, demonstrating the safety of anaesthesia using a laryngeal mask in carefully selected patients at Caesarean section. Factors related to the patient, surgery, anaesthetist and background situation will influence the safety of continuing general anaesthesia with a SAD after failed intubation. On the other hand, management after awakening is unlikely to be easy: regional anaesthesia may already have been explored and declined, and skills in awake intubation in the UK are not widespread. In current practice anaesthesia is continued in the majority of patients, including elective, after failed obstetric intubation.

Other aspects of preparation and performance of general anaesthesia are designed to improve the view at laryngoscopy (head up position, reduce/remove cricoid pressure), extend the time until desaturation occurs (head up position, nasal oxygenation, facemask ventilation after induction) and forewarn of potential oxygenation problems if intubation fails (facemask ventilation after induction). Most anaesthetists do not perform facemask ventilation after induction because of the teaching that this might cause gastric insufflation, raise intragastric pressure and hence make regurgitation more likely. However ventilation with low insufflation pressure should not overcome correctly applied cricoid pressure. Capnography is the best method to check tracheal tube position, but in the rare circumstances where there is a conflicting clinical picture, a fibrescope may be required to visualize the trachea and carina.

Algorithm 2 (Obstetric failed tracheal intubation) suggests that a failed intubation should be declared if correct placement of the tracheal tube cannot be verified after two attempts. An early switch to alternative airway management options should reduce the risk of hypoxaemia, trauma and anaesthetic decision-making impaired by stress. The necessity of optimized facemask ventilation using an oropharyngeal airway and four-handed technique may to a certain extent be predicted by prior trials of facemask ventilation.

The guidelines specify immediate use of a SAD after failed intubation as an option to facemask ventilation. The 1985–87 Confidential Enquiries into Maternal Deaths report suggested that laryngeal masks should be available for management of the difficult obstetric intubation. The laryngeal mask was gradually introduced into failed intubation algorithms, sometimes only as a rescue device after facemask ventilation had failed. However the arguments for early recourse to inserting a SAD after failed intubation include better airway control and benefitting from the full effect of the induction agent and neuromuscular blocking agent (if using suxamethonium) during device insertion. A second generation SAD with drain tube is recommended to allow suctioning of gastric contents; these devices also provide a better airway seal for positive pressure ventilation.

In the majority of patients, ventilation will be possible. The original plan to awaken or continue must now be reviewed, taking into account the stability of airway management (airway device, glottic/subglottic pathology) and any change in maternal or fetal compromise. Unless it is considered essential or safe to proceed, the woman should be awakened. It is acknowledged that the judgement on what constitutes an acceptable degree of safety will vary from one clinician to another; it would be appropriate for different individuals to make different decisions if presented with an identical patient, based on their own skills and experience and local practice within their hospital.

Box 1 Summary of important points and changes in obstetric airway management

- ‘Worst case’ is category 1 Caesarean section.
- Use airway assessment to predict global airway management difficulty, not just laryngoscopy and intubation problems.
- Before induction, make provisional plan should intubation fail – either awaken or proceed with surgery - communicate this with the team.
- Head up position and apnoeic oxygenation can prolong safe apnoea time.
- Gentle mask ventilation with cricoid pressure after administering induction agents is recommended.
- Cricoid pressure should be reduced or released if there is a poor view at laryngoscopy.
- Supraglottic airway device or facemask ventilation are valid first options after failed tracheal intubation. A second-generation supraglottic airway device is recommended.
- After failed intubation, the immediate situation will determine the decision to awakening or proceed with surgery. Unless it is safe or essential to proceed, the patient should be awakened.
- Safety - strong indications for waking the patient after failed intubation include one or more of: obstructed airway, inadequate capnogram, hypoxaemia secondary to hyperventilation; a relative indication is if the patient has eaten recently.
- Essential to proceed - strong indications to proceed are maternal compromise or fetal indications with an identified sentinel event (review current status), difficulty with providing alternatives (general anaesthesia, awake securement of the airway).
- Awakening - during failed intubation at category 1 Caesarean section for fetal indications without an identified sentinel event, there is a high chance that fetal condition will remain the same or even improve.
- Proceed with surgery - if there is adequate airway/ventilation, further intubation attempts are discouraged unless a new factor presents that significantly increases the chance of success, or there is an indication for prolonged airway control.
- Can’t intubate can’t oxygenate – if this occurs, ensure muscle paralysis before performing front-of-neck access procedure.
- After failed intubation at Caesarean section, there is increased risk of neonatal admission to the neonatal intensive care unit; the neonatologist should be informed about the problem.

In previous failed intubation guidelines, there has been little detailed advice on how to manage the patient if ventilation is possible; Table 2 (Management after failed tracheal intubation) provides information on positioning, mode of anaesthesia and ventilation, prevention of awareness and anticipation of a ‘can’t intubate, can’t oxygenate’ situation, whether the anaesthetist is awakening the patient or continuing general anaesthesia.
Algorithm 3 (Can’t intubate, can’t oxygenate) addresses the situation where oxygenation cannot be established with SAD or facemask, and therefore front-of-neck airway access is required. The guidelines introduce a considerable paradigm shift here from a commonly-taught dictum that a second dose of suxamethonium should not be given after failed intubation, in order to allow either awakening or continuation of anaesthesia with spontaneous ventilation. This may be appropriate if lung ventilation is possible. However partial muscle paralysis may permit laryngeal spasm and make a front-of-neck procedure more difficult and so, in this desperate situation, the balance of benefit/risk favours administration of further neuromuscular blocker. If suxamethonium was used at induction, then rocuronium (with sugammadex back-up) is the preferred agent.

It is suggested that details of the front-of-neck procedure follow the DAS guidelines, as there should not be technical differences between a pregnant and non-pregnant patient. It is likely that surgical cricothyroidotomy will be recommended in the pending update of the DAS failed intubation guidelines, in view of the high failure rate of cannula cricothyroidotomy.

If front-of-neck access and oxygenation fail and cardiac arrest ensues in the pregnant woman of more than 20 weeks gestation, perimortem Caesarean section will be required, besides any considerations of fetal survival, Caesarean section should reduce cardiorespiratory compromise caused by the uterus.

It is routine for all patients who have an obstetric general anaesthetic to be followed up. After difficult or failed intubation, the problem should be explained verbally and enquiries made about the possibility of accidental awareness where appropriate. As technical details will not be remembered by the patient, she should be given a letter (copied to her general practitioner) detailing the management and including the Read code SP2y3 if failed intubation has occurred.

All anaesthetists need to be familiar and aim to achieve competency with the basic and advanced airway equipment available in their own hospitals. However the guidelines emphasize that the anaesthetist is not a solo operator during management of failed intubation. The anaesthetic assistant should know what the anaesthetist may require in the event of difficult facemask ventilation, SAD insertion, regurgitation and ‘can’t intubate, can’t oxygenate’ situations. Others in the team may also have to assist; multidisciplinary simulation should be used to teach human factors and communication skills during airway crises. Simulations and patient-based discussion can explore the interaction of the factors involved in the safety of decision-making immediately after failed intubation (Table 3).

We believe that the basic algorithms of the new guidelines provide a simple approach, the essential ‘decision points’ of which can be memorized, and the full guidelines provide important background information to improve maternal safety in this rare but feared complication of anaesthesia.

Declaration of interest
M.C.M. is chair and S.M.K. is a member of the OAA/DAS obstetric anaesthetic difficult airway guidelines group.

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Succinylcholine resistance

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Succinylcholine has a rapid onset and a short duration of action in most patients. It is therefore considered the drug of choice for rapid sequence tracheal intubation.¹ On rare occasions succinylcholine does not have the expected clinical effect. The patient seems resistant to the drug resulting in an unanticipated difficult airway management situation with potential morbidity or mortality. The primary aim of this paper is to discuss the possible aetiologies for succinylcholine resistance (Table 1), but also to discuss the diagnosis, the potential clinical consequences and postoperative measurements.

Increased butyrylcholinesterase (BChE, plasma cholinesterase) activity

Succinylcholine is normally rapidly hydrolysed by butyrylcholinesterase in plasma.¹² The homozygous wild type butyrylcholinesterase gene (BCHE) is the normal variant, and the consequent BChE enzyme has a large capacity to hydrolyze succinylcholine. Only about 10% of the i.v. injected drug reaches the effect site at the neuromuscular endplate. Some apparent genotypically normal patients have a mild to moderate increase in enzyme activity. Thus, increased BChE activity has been described in patients with hyperlipidaemia, nodular goiter, obesity, diabetes mellitus, psoriasis, essential hypertension, thyrotoxicosis, nephrosis, bronchial asthma, alcoholism, anxiety states and schizophrenia.¹⁶ The reasons for this increased enzyme activity remains unknown or at best speculative. The presence of the C5+ gene may, at least in some patients, be responsible for the increased enzyme activity. In many of the published cases, the patients were not checked for the presence of this gene variant, which causes an increased enzyme activity of about 30% (see below).²⁰

In patients with mutations in the BCHE the quality and the quantity of active enzyme are often changed. Most common and best known among anaesthetists, are probably the BCHE variants associated with decreased or impaired activity of the active enzyme, causing prolonged duration of action of succinylcholine and mivacurium.²¹ However, some mutations in BCHE may result in an increased enzyme activity, potentially decreasing the effect of injected succinylcholine, clinically showing as resistance to the drug.

Determination of butyrylcholinesterase activity

In a laboratory assay, BChE catalyses the breakdown of an appropriate substrate and the BChE activity is measured using spectrophotometry. As the rapid enzymatic hydrolysis of succinylcholine by BChE is difficult to measure with sufficient accuracy, several other substrates have been – and are – used for measuring BChE activity. It should be acknowledged that the measured enzyme activity varies with the substrate used and that there is not necessarily a correlation between the measured enzyme activity and the clinical response to succinylcholine. Thus, a BChE activity found when using, for example, the traditionally most often used substrate, benzoylcholine, does not always correlate with the activity found when using succinylcholine. Another consequence of the above is that the reference values for normal, decreased or increased BChE activity varies among different laboratories, simply because they use different substrates for measuring the enzyme activity.

Significance of increased butyrylcholinesterase activity

In patients with genetically normal BChE activity a neuromuscular block induced by succinylcholine 1 mg kg⁻¹ recovers within 4–8 min, measured as the time from injection of succinylcholine...