



AIRWAY MANAGEMENT GUIDELINES IN OBSTETRICS

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SUMMARY – Anatomic and physiologic changes during pregnancy make it more difficult to establish a safe airway in pregnant women in case of the need for surgery under general anesthesia than in the non-obstetric population. The inability to ventilate and oxygenate is one of the most common causes of morbidity and mortality associated with general anesthesia for cesarean section. The aim of this paper is to present and analyze modern guidelines and algorithms for the management of difficult airway in obstetrics as an important segment of anesthesiology practice. Modern difficult airway management guidelines for pregnant women describe the procedure of difficult facemask ventilation, difficult airway management by using supraglottic devices, difficult endotracheal intubation, and emergency cricothyrotomy or tracheotomy in a situation where oxygenation and ventilation are impossible. Algorithms describe the procedures and equipment for each variant of difficult airway and decision-making strategies in situations when neither airway nor adequate oxygenation can be provided. Croatian anesthesiologists in most obstetric departments have appropriate equipment, as well as necessary experience in difficult airway management for pregnant women, and modern algorithms from the most developed countries can be adopted and accommodated to our daily practice, as well as incorporated into the training curricula of residents.

Key words: *Pregnancy; Difficult airway; Cesarean section; Obstetrics; Guidelines; Algorithms*

Introduction

Airway management of pregnant women is one of the biggest challenges of anesthesia practice in obstetrics. One of the reasons for this is the increase in body weight and anatomic changes that affect the airway during pregnancy, making it more difficult to pass and vulnerable to mechanical manipulations. Another

reason is that the operations are usually urgent, and patients have full stomachs and reduced functional residual capacity, which is why the anesthesiology team works under the imperative to establish a safe airway as quickly as possible with suboptimal conditions for endotracheal intubation¹. In recent times, we are also faced with the lack of experience in airway management in obstetric patients since general anesthesia for cesarean section is used less often due to the predominance of regional anesthesia². An unsuccessfully managed upper airway in a pregnant woman is associated with serious maternal and/or fetal morbidity and mortality. A closed claim analysis due to damages caused

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by inadequate ventilation does not show a tendency to decrease the number of cases despite the development of increasingly sophisticated methods of airway management. Moreover, there is a trend of worse outcomes, which is attributed to inappropriate airway planning and judgment errors as contributors to patient harm³. All this points to the need for strict adherence to the latest algorithms for airway management in obstetric practice. Epidemiologic data show that difficult face-mask ventilation can be expected in 1.4%-5% and impossible mask ventilation in 0.07%-0.16% of cases. Difficult tracheal intubation occurs in 5-7%, and failed intubation can be expected in 0.05%-0.35% of cases in the general population and 0.15%-0.6% of those in the obstetric population⁴. The aim of this article is to present the basic recommendations of new guidelines and algorithms for airway management in obstetrics with an emphasis on difficult airway.

Materials and Methods

In order to present a summary of modern guidelines for airway management in obstetrics, the avail-

able literature published in English in the last 20 years, from 2002 to 2022, was searched. Scopus, Medline, Embase, Web of Science and Cochrane Library databases were searched. The search was conducted according to these key terms: difficult airway, cesarean section, obstetrics, guidelines, algorithms. Although there is no precise definition of difficult airway, the literature describes difficult airway as an airway for which an experienced practitioner anticipates or encounters difficulty with facemask ventilation, tracheal intubation, or supraglottic airway use, or recognizes the need for an emergency front-of-neck airway access (eFONA)^{4,5}. Four papers dealing with guidelines and algorithms for airway management, especially difficult airway in obstetrics, have been singled out, discussed, and cited.

Results

Four articles describing airway management guidelines in obstetrics are chronologically attached in Table 1. Basic recommendations from these four guidelines are described and discussed in the next section.

Table 1. Results of literature search describing airway management guidelines in obstetrics

Article title	Journal and year	Authors/organization	Specificity
American Society of Anesthesiologists Task Force on Obstetric Anesthesia. Practice guidelines for obstetric anesthesia: an updated report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia	Anesthesiology 2007;106:843-63 (ref. 8)	American Society of Anesthesiologists Task Force on Obstetric Anesthesia	Obstetric specific
Obstetric Anaesthetists' Association and Difficult Airway Society guidelines for the management of difficult and failed tracheal intubation in obstetrics	Anaesthesia 2015;70:1286-306 (ref. 1)	Mushambi MC, Kinsella SM, Popat M, <i>et al.</i> / Obstetric Anaesthetists' Association and Difficult Airway Society	Obstetric specific
All India Difficult Airway Association 2016 guidelines for the management of unanticipated difficult tracheal intubation in obstetrics	Indian J Anaesth 2016;60:899-905 (ref. 13)	Ramkumar V, Dinesh E, Shetty SR, <i>et al.</i> /All India Difficult Airway Association	Obstetric specific
Canadian Airway Focus Group updated consensus-based recommendations for management of the difficult airway: Part 1. Difficult airway management encountered in an unconscious patient	Can J Anaesth. 2021;68(9):1373-404 (ref. 4)	Law JA, Duggan LV, Asselin M, <i>et al.</i> /Canadian Airway Focus Group	General guidelines + Obstetric specific chapter

Discussion

Difficult airway guidelines

Although most of the guidelines refer to the problems of difficult airway in the general population of adults or children, the need for specific guidelines for the management of difficult airway in pregnant women was noticed as early as the 1970s. The first papers on the subject dealt with the assessment of difficult airways with recommendations for the most optimal technique of endotracheal intubation using existing equipment^{6,7}. Cormack and Lehane describe 4 categories of airways according to visualization by direct laryngoscopy, which are still used today⁷. The guidelines for obstetric anesthesia of the American Society of Anesthesiologists especially emphasize the importance of equipment for difficult intubation in the operating room for cesarean section, and the importance of preoperative examination of the airway in order to anticipate a difficult airway and take appropriate preoperative measures⁸. A difficult airway can be expected if the examination determines anatomic type 3 or 4 according to Mallampati, a shortened thyromental or sternomental distance, or by applying the Wilson risk score, the mouth opening test, and the upper lip bite test⁹. However, all the above tests had relatively low sensitivities with high variability, whereby the upper lip bite test showed the most favorable diagnostic and accuracy properties⁹. Among the biggest risk factors for a difficult airway is obesity, which is associated with both anatomic (neck circumference of more than 40 cm) and physiologic (reduced functional residual capacity) risk factors^{4,10}. Obstetric anesthesiologists meet morbidly obese pregnant women more and more often, in which all components of airway management from facemask ventilation, supraglottic airway device (SAD) insertion, endotracheal intubation, and finely difficult identification of the landmarks for cricothyrotomy (FONA) are made difficult¹¹. In addition to the described predictors of difficult intubation, in a significant number of cases, a difficult airway is determined only during induction of anesthesia when the patient is unconscious and relaxed, i.e., unanticipated difficult airway¹². If a difficult airway is anticipated, the algorithms recommend providing, in addition to direct laryngoscopy and video-laryngoscope which should always be available, the availability of an experienced anesthesiologist, as well as a fiberoptic bronchoscope

and equipment for emergency cricothyrotomy^{1,5,13}. Unfortunately, a difficult airway can also be encountered when it is not anticipated and when the help of other anesthesiologists is not available, therefore it is desirable to always have all drugs and equipment ready for the case of anticipated difficult airway, and all anesthesiologists who perform obstetric anesthesia must undergo quality education^{1,13}. Difficult airway management can already be manifested during ventilation *via* a facemask or *via* supraglottic airway device (SAD) insertion, and finally by difficult or impossible insertion of the endotracheal tube. For each of the mentioned situations, algorithms predict appropriate procedures^{1,5,13}.

Algorithm for safe obstetric general anesthesia

In order to make general anesthesia in obstetrics as safe as possible, modern algorithms emphasize the importance of preoperative assessment of the airway, checking of fasting status and antacid prophylaxis, and intrauterine assessment of the condition of the fetus in cooperation with the obstetrician team^{1,5}. Good cooperation between the teams is especially important in case of unsuccessful endotracheal intubation when it is necessary to decide whether to wake up the patient or continue the operation with alternative forms of ventilation. During induction of anesthesia, rapid sequence induction with 2 minutes of preoxygenation with 100% oxygen flow rate of ≥ 10 L/min and a tight mask-to-face seal, which is enough to achieve end-tidal oxygen fraction (FETO₂) ≥ 0.9 , is recommended^{1,14}. Head-up position of 20-30° is recommended to increase functional residual capacity, to improve the view at laryngoscopy and to reduce gastro-esophageal reflux. Cricoid pressure should also be applied to prevent lung aspiration¹. In case of difficult intubation, cricoid pressure must be reduced or removed. Induction with thiopental and suxamethonium still prevails in anesthesiology practice, but new research favors propofol with high-dose rocuronium (1.0-1.2 mg/kg) with sugammadex backup for rapid reversal of neuromuscular block in case of the need for awakening^{1,15,16}. After administration of induction drugs, bag/facemask ventilation with inflation pressure up to 20 cm H₂O is now recommended to reduce oxygen desaturation during intubation^{1,17}. Insufflation of 15 L/min oxygen *via* a nasopharyngeal catheter during laryngoscopy increases the time to desaturation and it is recommended

in obese patients^{1,18}. New algorithms recommend intubation of pregnant women with a video-laryngoscope, especially in morbidly obese patients and during failed intubation^{1,5,19}. If the first attempt at intubation fails, the next attempt should be made to improve the view by reducing or removing cricoid pressure and repositioning the head and neck, and using a tracheal tube introducer (bougie) or a stylet to facilitate the tracheal tube insertion¹. The second attempt should be made by the most experienced anesthetist present and if it is unsuccessful, a failed intubation must be declared with focus to maintain oxygenation *via* a facemask or SAD. Third attempt at intubation should only be performed by an experienced anesthesiologist¹.

Algorithm in case of obstetric failed tracheal intubation with exit strategy options

After the second or third failed intubation, the team should decide to wake the patient or to proceed with surgery. If the decision is made to wake the patient, oxygenation needs to be maintained by facemask ventilation and measures to avoid regurgitation or vomiting. Following waking, in agreement with the obstetrician, it should be decided whether to perform the operation under regional anesthesia or under general anesthesia after awake intubation *via* the oral route^{1,5}.

If decision is to proceed with surgery, SAD placement is the preferred choice and preferably a second-generation SAD with a gastric drain tube and the ability to generate higher inflation pressures. If the first SAD does not provide an effective ventilation, only one more attempt is recommended by using an alternative size SAD and a laryngoscope^{1,20}.

'Cannot ventilate, cannot oxygenate' algorithm

In case of failed endotracheal intubation and impossibility of ventilation and oxygenation of the patient by facemask or SAD, it is necessary to prepare the patient for urgent FONA access while simultaneously trying to remove the possible reversible causes such as laryngospasm or insufficient muscle relaxation^{1,5}. As a small-bore cannula technique has a high failure rate, especially in obese patients, a surgical airway provides more accurate ventilation^{1,21}. Maternal and fetal status are crucial for the decision whether to continue the operation or wake the patient after tracheotomy. In the case of a prolonged state of 'cannot ventilate, cannot oxygenate', the cardiac arrest algorithm is ini-

tiated, and in the case of a pregnancy over 20 weeks of gestation, a 'perimortem cesarean section' should be performed^{1,13}.

Tracheal extubation and postpartum period

Extubation after difficult intubation must be approached with caution in order to avoid a situation that would require reintubation. Emphasis is on the extubation of the patient who is fully awake, without residual muscle blockade and with satisfactory spontaneous respiration and oxygenation. If necessary, the patient should be transferred to the intensive care unit for controlled ventilation and delayed extubation^{1,4,22}.

Conclusion

Practice guidelines are not absolute requirements since they are subject to revision by emerging medical knowledge, technology, and practice but recommendations provided by guidelines and algorithms are a valuable guide in everyday practice, making our work safer and aligned with evidence-based medicine. In the absence of national guidelines for the work of anesthesiologists in certain special circumstances such as obstetric anesthesia, it is justified to follow the guidelines of eminent world and national societies and adopt them in whole or in parts that are appropriate for one's own environment. The basic elements of the guidelines for the management of difficult and failed tracheal intubation in obstetrics published by several national societies presented in this article can, for the most part, be successfully implemented in the practice of obstetric anesthesiologists worldwide and incorporated into the curricula of residency in anesthesiology.

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Sažetak

SMJERNICE ZBRINJAVANJA DIŠNOG PUTA U PORODILJSTVU

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Anatomske i fiziološke promjene tijekom trudnoće čine uspostavu sigurnoga dišnog puta u trudnica u slučaju potrebe operativnog zahvata u općoj anesteziji težim nego što je to u neopstetričkoj populaciji. Nemogućnost ventilacije i oksigenacije jedan je od najčešćih uzroka pobola i smrtnosti povezanih s općom anestezijom za carski rez. Cilj ovoga rada je prikazati i analizirati suvremene smjernice i algoritme uspostave otežanoga dišnog puta u porodiljstvu kao važnom segmentu anesteziološke prakse. Suvremene smjernice zbrinjavanja dišnog puta u trudnica opisuju postupak otežane ventilacije na masku, otežanog zbrinjavanja dišnog puta primjenom supraglotičkih pomagala, otežanu endotrahealnu intubaciju te hitnu krikotirotomiju ili traheotomiju u situaciji nemoguće oksigenacije i ventilacije. Algoritmi opisuju postupke i opremu za svaku varijantu otežanog dišnog puta te strategije odlučivanja i situacije kada se dišni put, kao ni dostatna oksigenacija, ne uspijevaju osigurati. Hrvatski anesteziolozi u većini opstetričkih odjela raspolažu odgovarajućom opremom, kao i potrebnim iskustvom u zbrinjavanju otežanoga dišnog puta u trudnica te se suvremeni algoritmi najrazvijenijih zemalja mogu usvojiti i prilagoditi našoj dnevnoj praksi te ugraditi u kurikule izobrazbe specijalizanata.

Ključne riječi: *Trudnoća; Otežani dišni put; Carski rez; Porodiljstvo; Smjernice; Algoritmi*