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Pre-hospital airway management: guidelines from a task force from the Scandinavian Society for Anaesthesiology and Intensive Care Medicine

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This article is intended as a generic guide to evidence-based airway management for all categories of pre-hospital personnel. It is based on a review of relevant literature but the majority of the studies have not been performed under realistic, pre-hospital conditions and the recommendations are therefore based on a low level of evidence (D). The advice given depends on the qualifications of the personnel available in a given emergency medical service (EMS). Anaesthetic training and routine in anaesthesia and neuromuscular blockade is necessary for the use of most techniques in the treatment of patients with airway reflexes. For anaesthesiologists, the Task Force commissioned by the Scandinavian Society of Anaesthesia and Intensive Care Medicine recommends endotracheal intubation (ETI) following rapid sequence induction when securing the pre-hospital airway, although repeated unsuccessful intubation attempts should be avoided independent of formal qualifications. Other physicians, as well as paramedics and other EMS personnel, are recommended the lateral trauma recovery position as a basic intervention combined with assisted mask-ventilation in trauma patients. When performing advanced cardiopulmonary resuscitation, we recommend that non-anaesthesiologists primarily use a supraglottic airway device. A supraglottic device such as the laryngeal tube or the intubation laryngeal mask should also be available as a backup device for anaesthesiologists in failed ETI.

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Purpose

THIS article is intended as a guide to evidence-based pre-hospital airway management. The available litterature on pre-hospital airway management reflects vast differences in pre-hospital emergency medicine service (EMS) organisation, qualification levels, training programmes and even terminology. These differences make comparisons between systems and treatment protocols difficult at best. The conduct of clinical trials in pre-hospital airway management is hampered by the 2001/20/EC directive of the European Parliament concerning informed consent.

This paper describes selected equipment and techniques available for pre-hospital airway management. Advice given differs, depending on which category of personnel is available in a given EMS. Our baseline assumption is that a certain level of education and training is necessary for the safe use of a specific technique. Distinction must be made between personnel trained and experienced in providing and monitoring anaesthesia and other groups of personnel with limited or no anaesthetic skills. This distinction dictates which drugs and equipment that should be available in the pre-hospital setting.

Differences between regions and systems

Paramedic-based systems are the rule in the United States, whereas physician-based pre-hospital systems are common in Europe. Ideally, the best person to manage the pre-hospital airway should

be a dedicated specialist, trained for the pre-hospital environment, experienced in medical emergencies and critical care, with daily routine in the induction of anaesthesia and advanced airway management. The pre-hospital environment in Scandinavia is unique, with consultants or senior trainee anaesthetists providing advanced emergency care as well as support for paramedics in the field. A review of the similarities and differences between the Nordic EMS systems, as well as their main problems and challenges, has previously been published (1). Emergency medicine is a cornerstone of Scandinavian anaesthesiology, and anaesthesiologists predominate as pre-hospital emergency physicians. Advanced pre-hospital airway management is almost exclusively performed by anaesthesiologists, although in some countries paramedics have authorisation to intubate the trachea under certain conditions. Paramedic training requirements and qualifications vary between the five Nordic countries.

In recognition of the central role anaesthesiologists play in the pre-hospital setting, the Scandinavian Society of Anaesthesiology and Intensive Care Medicine (SSAI) commissioned a Task Force to formulate guidelines for pre-hospital airway management, specifically taking into account the professional culture and level of pre-hospital expertise available in the Nordic countries. The Task Force aimed at providing one combined, but not too detailed, set of practice guidelines for pre-hospital airway management, applicable to pre-hospital health care providers at all levels. The guidelines are based on a comprehensive review of the literature (ultimo 2007) supported by the Task Force's clinical experience. Systematic searches in Medline, EMBASE and Cochrane Library were performed with the search terms 'airway device', 'airway management' 'airway success rate', 'pre-hospital airway', 'resuscitation airway' and 'trauma airway'. The resulting literature and related articles were manually scanned to identify relevant literature. The guidelines provide a differentiated approach to airway management, acknowledging that level of training and experience influence outcome, and that 'the right tool in the wrong hands' may be harmful to the patient. The Task Force's overall goal is to ensure patients the same standard of care in the pre-hospital environment as in the hospital setting.

In evidence-based medicine, the hierarchy of study types described by the Agency for Health Care Policy and Research is widely used (2). Weaknesses of this system have been pointed out and a new system for grading recommendations in evidence-based guidelines has been published (3). In the latter system, the level of evidence is graded from 1++ (high-quality meta-analyses, systematic reviews of randomised clinical trials or randomised clinical trials with a very low risk of bias) via several levels to level 4 (expert opinion). Based on the level of evidence, a grade of recommendation is assigned, where A is the highest level (at least one meta-analysis, systematic review or randomised clinical trial rated as 1++ and directly applicable to the target population or a systematic review of randomised clinical trials or a body of evidence consisting principally of studies rated as 1+ directly applicable to the target population and demonstrating overall consistency of results) and D is the lowest level (extrapolated evidence rated as 2++ or 2+ or evidence level 3 or 4).

However, in many areas of medical practise, randomised trials may not be practical or ethical to undertake, and for many questions other types of study design may provide the best evidence. Pre-hospital airway management is an example of such an area. Many of the references referred to in this paper are actually well-performed studies on airway management performed in a laboratory setting on manikins or anaesthetised patients by personnel usually working pre-hospitally. The studies are well performed and the level of evidence is 1+ or 1++ and can be used to predict for instance whether paramedics should use the bag-valve-mask (BVM) technique or use a laryngeal mask to secure the airway in anaesthetised patients in the operating theatre. But can the results – and evidence level – from such laboratory studies be used to develop recommendations about pre-hospital airway management? Yes, they can for lack of better studies performed in the pre-hospital setting, but subjective judgment must be applied by the group developing the recommendations. The grades of recommendations presented in this paper will be on D level because the evidence is extrapolated and the majority of the studies have not been performed under realistic, pre-hospital conditions.

Lateral recovery position and cervical spine control

The dogma in Prehospital Trauma Life Support (PHTLS) (National Association of Emergency

Medical Technicians, Clinton, MS) (4) and Advanced Trauma Life Support (ATLS) (Committee on Trauma, American College of Surgeons, Chicago, IL) (5) is to always secure the patient's airways first. In addition, much emphasis in pre-hospital emergency care in the last decade has been put on protecting a possible or suspected spinal injury as reflected in the manuals of the aforementioned courses. Personnel not qualified in performing endotracheal intubation (ETI) may therefore choose to transport the unconscious patient strapped in the supine position. However, the International Liaison Committee on Resuscitation (ILCOR) states that it is reasonable to position an unconscious adult with normal breathing on the side (6), which is also in accordance with the current European Resuscitation Council (ERC) guidelines regarding paediatric and adult patients (7–9). These two treatment modalities can be combined if, after checking the airways and applying a stiff neck collar, the patient is log-rolled with manual inline stabilisation to a position similar to the recovery position. Caution must be taken to maintain normal alignment of the spine at all times, and the head is supported in a neutral position. The patient can be strapped to the stretcher with a modification of the standard three-belt technique. This enables the health care provider to sit and observe at the patient's head, supporting it while administering oxygen and performing suction when needed (7).

BVM ventilation (BVMV)

This basic skill, using a self-inflating bag and a non-return valve attached to a mask, is the platform for all other airway procedures. Several studies have been performed to evaluate the skill of use of this technique in various groups of health care providers (8, 10, 11). This skill is mandatory for all health care professionals and must be subjected to repeated training. Studies show, however, that BVMV – even in conjunction with jaw thrust and chin lift – is demanding and that the use of alternative airways such as the laryngeal mask and the laryngeal tube result in significantly higher tidal volumes than BVMV. The self-inflating bag may provide a false sense of security, in so much as the bag always expands independent of the amount of lung (or gastric) inflation. The complexity of performing adequate BVMV may necessitate the use of adjunct devices in order to ensure sufficient ventilation in patients in need of ventilatory support. The major disadvantages of BVMV include increased risk of gastric inflation and of aspiration of gastric content (12). The optimal tidal and minute volume during BVMV will depend upon the clinical setting. During CPR, a tidal volume of 10 ml/kg has been suggested to achieve normocapnia (13). It seems likely that high tidal volumes will increase the risk of gastric inflation.

Supraglottic airway devices (SADs)

SADs are not inserted past the vocal cords into the trachea and an attractive feature is that laryngoscopy or direct visualisation of the cords is not necessary for their insertion. These devices may be easier to insert and suitable for users with limited experience. A number of such devices have been introduced, including the oesophago-tracheal combitube (ETC), the laryngeal tube (LT) and various kinds of laryngeal masks [laryngeal mask airway (LMA)]. This paper will focus on the three most commonly described of these devices because they have been used quite extensively in the pre-hospital setting. Many other SADs are available commercially, such as the Airway Management Device (AMD), Pharyngeal Airway xpress (PAx), Cobra Perilaryngeal Airway (CobraPLA), Streamlined Liner of the Pharynx Airway (SLIPA), iGel and the Elisha Airway Device, (14–19) and new SADs are introduced regularly. Comparably few pre-hospital studies employing these devices have been performed until now, and they will therefore not be discussed further in this paper.

Primarily designed for use in conjunction with elective anaesthesia, SADs have in recent years received increasing interest from the pre-hospital area. SADs have mainly been used as alternative devices for airway management during resuscitation, but they have also been used as backup measures in the treatment of trauma patients when intubation has proven difficult. The ETC was originally designed as a simpler primary alternative to ETI in emergencies, but has mainly been employed as a backup device. The LT was intended as both a primary and secondary airway device for emergency situations, and its variants LT-D and LT-Sonda II with a suction channel have been used pre-hospitally. The LMA and its variants have become a very popular airway management device for anaesthesia [see (20) and references therein].

With the exception of the ETC, the available devices are genuinely supraglottic because they are not inserted into the trachea. This makes

inadvertent oesophageal intubation impossible. The ETC can be blindly inserted to the trachea, which should be noted. Furthermore, it seems that SADs have a shorter learning curve and better skill maintenance when compared with ETI. Although some of these devices require minimal practice, training is still essential for safe use. Whether manikin training alone is sufficient has not been demonstrated.

The major concern regarding SADs is the fact that the trachea is not sealed from the GI-tract and aspiration of stomach contents may occur. In emergency cases, patients must be assumed to have a full stomach and thus an increased risk of regurgitation (21). SADs also do not fully seal the lower airways from blood and debris associated with maxillo-facial trauma.

Each SAD has its own special features, described in the text below.

ETC

The ETC is a double lumen airway allowing ventilation in either the oesophageal or tracheal position. One lumen resembles an endotracheal airway with an open distal end. The second lumen resembles an oesophageal obturator type airway, with a blocked distal end and perforations for air passage at pharyngeal level. The ETC is inserted blindly along the surface of the tongue with a gentle downward, caudal movement until the printed marking lies between teeth. After insertion, the proximal and distal cuffs are inflated with air. Blind insertion places the ETC in the oesophagus in more than 95% of cases (22). The ETC has been studied extensively among inexperienced pre-hospital care providers. The success rate for insertion and successful ventilation varies from 79% to 82.4% (23, 24). The ERC has included the ETC as an alternative airway in advanced cardiovascular life support (6).

A major concern regarding the ETC is the fact that it has a double lumen, and the user must verify the correct lumen through which ventilation is possible. This problem has been described in a study involving EMS personnel (25). Another potential cause for concern is trauma of the upper oesophagus inflicted by the large distal balloon. Several reports describe such injuries (26–29).

The ETC has never gained widespread use among anaesthetists and pre-hospital systems in Scandinavia. It is the view of the Task Force that this lack of popularity, combined with its relative complexity and potential for injury, makes the ETC unsuitable as first choice as SAD for EMS care providers in Scandinavia.

LMA

The LMA is probably the most widespread and commonly used SAD. It has three major variants: the classic LMA (cLMA), the intubating LMA (ILMA) and the ProSeal™ LMA (PLMA) [see (20) and references therein]. Although originally designed for elective anaesthesia, it has rapidly gained success in emergency care. Successful insertion rates ranging from 64% to 100% (30, 31) have been demonstrated among inexperienced EMS care providers, nurses and respiratory therapists. Training in the placement and use of cLMA seems to be simpler than ETI (32–35). Inexperienced health care workers provide more secure and reliable ventilation in cardiac arrest cases with LMA than with BVMV (11, 36). The cLMA is recommended for ventilation in cardiac arrest by the ERC in the resuscitation guidelines (24, 37). The ILMA has been proposed for emergency airway management because its insertion technique is somewhat simpler than that for the cLMA with no need for digital manoeuvres. Insertion success rates up to 97% on manikins have been reported and it seems that users prefer the ILMA to the cLMA (15). ILMA provides a feature for blind intubation, but limited data regarding intubation by inexperienced users is available and this procedure can therefore not be recommended.

The use of ILMA and cLMA as primary devices should be reserved for anaesthetised patients and patients in cardiac arrest because limited data is available about their use in patients with airway reflexes. The use of PLMA is not recommended by the Task Force because there is some evidence that its insertion is more difficult than with cLMA.

LT

The LT is a single-lumen, silicon tube with two cuffs. The distal cuff lies at the end of the tube and is somewhat cone shaped. The second cuff is larger and formed to fit the patient's oropharynx. Both cuffs are low-pressure cuffs and inflated via the same pilot balloon–valve system. Two ventilation outlets are located between the cuffs, and the distal opening is large enough to allow suction of the airway. The LT is inserted with the patient's head in the neutral position. The tube is inserted along the

hard palate with a curved, downward motion, until a distinct resistance is felt at the recommended depth.

The new laryngeal tube-Sonda (LTS-II) has a suction channel posterior to the airway tube and offers the advantage of gastric suctioning, but limited data is available regarding the modified LTS-II model.

Anaesthesiologists have inserted LT in anaesthetised patients with a success rate of up to 100% (38–40). Inexperienced pre-hospital care providers insertion success rates on anaesthetised patients vary from 78% to 100% (8, 36). Pre-hospital care providers have demonstrated an insertion success rate of 83% in cardiac arrest cases (41).

A steep learning curve, easy insertion and minimal harmful effects are advocated, although prospective studies regarding the use of LT are missing. The LTS-II is an option as a pre-hospital SAD and is increasingly used in Scandinavia for airway management during resuscitation performed by paramedics. There is no literature describing its use in patients retaining some degree of airway reflexes, but insertion will most likely increase the risk of gagging, vomiting and aspiration.

ETI

ETI has for decades been regarded as the gold standard in airway management in both the hospital and pre-hospital setting. The support in the literature for this notion is weak, however, because two major points frequently are not taken into consideration: the education and experience level of the personnel performing the procedure, and whether or not neuromuscular blocking agents are being used (42). ETI is a potentially harmful procedure and undetected oesophageal intubation is disastrous for the patient. A severe disadvantage for the ETI is that the patient often has to be moved several times pre-hospitally, which could change the position of the tube in trachea so that dislocation occurs during pre-hospital rescuing or transportation without immediate observation, especially in children and also more often for patients with cardiac arrest. Health care providers lacking expertise and day-to-day routine in drug-assisted ETI should use alternative methods to secure the airways of critically ill or injured patients, independent of their formal education. A possible exception may be patients in cardiac arrest or deeply comatose patients lacking protective airway reflexes.

ETI is traditionally regarded as the preferred method of airway management, because a cuffed tracheal tube protects the lungs from aspiration of blood and gastric contents (43).

Outcome

In many countries, paramedics are taught how to perform ETI on the assumption that pre-hospital ETI improves outcome for comatose patients. Several recent studies contradict this assumption, however, showing worse outcomes for patients intubated in the field compared with patients intubated in the hospital (44–48). Most of these studies are from the United States, where the majority of pre-hospital ETIs are performed by paramedics from the ground ambulance system. In similar studies from the air ambulance system, where ETI is performed by flight nurses, the difference between field and hospital outcome is less pronounced (49). A recent article reports decreased mortality in trauma patients offered advanced life support with rapid sequence intubation by emergency physicians (50).

Complications

In the absence of neuromuscular blockers, ETI success rates in emergency settings are generally poor. Some studies report success rates varying from 53% to 63% when paramedics attempt intubation of traumatised patients without neuromuscular blocking agents (51–53). Not surprisingly, success rates are much better for patients in cardio-respiratory arrest (54).

Intubation attempts – whether they are successful or not – may delay transfer of the patient from the scene of the accident to the hospital. Intubation attempts without sufficient sedation may result in a detrimental increase of intracranial pressure in patients with closed head injury. Unrecognised oesophageal intubation is by far the most harmful potential complication of ETI. The incidence of unrecognised oesophageal intubation is dependent on whether neuromuscular blocking agents have been used or not. In two studies of drug-assisted field intubation performed by paramedics, the reported rate was as low as 0.4% (55, 56). Conversely, in other studies of paramedic field intubation where drugs were not used, the rate of unrecognised oesophageal intubation was 6% (57)

and 16.7% (58), respectively. In the latter study, 37% of trauma patients had a misplaced endotracheal tube (ET) (the majority in the oesophagus, the remainder in the hypopharynx above the vocal cords).

Use of neuromuscular blocking agents

Paramedics in the Nordic countries are traditionally not permitted to use neuromuscular blocking agents in connection with ETI, because of concerns regarding unrecognised oesophageal intubation and 'cannot intubate–cannot ventilate' situations in the paralysed patient. Reports from the State of Washington, however, where paramedics have undertaken succinylcholine-assisted intubations for at least two decades, are encouraging with a success rate of 95.5% (55). Another group has reported a success rate of 92% (59). In EMS systems where the paramedics are permitted to use sedatives, but not neuromuscular blocking agents, the reported success rates are lower (62.5–85%) (60, 61). Unfortunately, almost all studies of field ETI performed by paramedics are retrospective in nature.

Most pre-hospital ETIs in traumatised patients in the Nordic countries are performed by anaesthetists using sedatives and/or neuromuscular blocking agents when necessary. The reported success rates are significantly higher. In a French study, 685 of 691 (99.1%) consecutive pre-hospital intubations were successful (62). Approximately half of these ETIs were non-cardiac arrests, but neuromuscular blocking agents were used only in 8.8% of the cases, while sedation was performed in 2/3 of the patients not suffering from cardiac arrest. In a study from Paris, 147 children were intubated by physicians in the field (63). No failures were reported in sharp contrast to the 57% success rate in a study where paramedics were responsible for the airway management (44).

Detailed information about choice of drugs, doses and side effects falls outside the scope of this paper and has not been included.

Training and simulation techniques

The low success rates among paramedics may reflect inadequate training. Studies indicate that training in the operating theatre is essential to acquire the necessary skills (8). Manikin training alone is not sufficient. There is no consensus regarding the number of ETIs required for achieving and retaining intubation skills. In a Swiss study, the learning curve for residents in anaesthesiology for various skills was studied (64). For ETI, a 90% success rate was achieved after a mean of 57 attempts. There is no reason to believe that paramedics or other pre-hospital personnel should have a steeper learning curve, especially considering the harsher working conditions compared with the operating theatre. The annual requirement of intubations to maintain the skills of ETI is not well documented, but the number 10 is often cited.

In-hospital ETI rates are declining because of the development and success of alternative SADs and regional anaesthesia for patients undergoing elective surgery. Consequently, fewer patients are available for paramedic ETI training, rendering it more or less impossible to achieve and maintain skill levels acceptable for pre-hospital use.

It is important to take note of differences in terminology in the literature. 'Advanced' airway skills for the paramedic are basic core skills for the experienced anaesthetist. The abbreviation RSI refers in the literature both to rapid sequence intubation and to rapid sequence induction, a subtle but important distinction. The knowledge and ability to correct changes in cardiopulmonary function after the use of sedatives and muscle relaxants is rarely commented on in studies.

Advanced airway management is potentially harmful in unskilled hands. Based on recent literature, the SSAI Task Force recommends that pre-hospital ETI in traumatised patients or medical patients is restricted to anaesthesiologists routined in drug-assisted ETI. Experienced EMS personnel may attempt ETI during cardiopulmonary resuscitation but repeated attempts should be avoided.

Pre-hospital end-tidal carbon dioxide monitoring for the ETI

Unrecognised misplacement or dislodgement of an ET can be fatal. Primary methods of confirmation of ET placement – direct visualisation of the ET passing through the vocal cords, inspection of chest excursions and auscultation of the epigastrium and anterior and lateral chest walls – can be unreliable also in the pre-hospital environment.

End-tidal carbon dioxide ($ETCO_2$) monitoring is a standard, obligatory adjunct in the modern anaesthetic and critical care setting. $ETCO_2$ monitoring provides non-invasive information regarding CO_2 production, pulmonary perfusion, alveolar ventilation and respiratory patterns. The absence of

$ETCO_2$ indicates either a misplaced or dislodged ET (oesophageal intubation or accidental extubation) or absent/decreased CO_2 production as in cardiac arrest. $ETCO_2$ can be detected or measured by the following methods – colorimetry, capnometry and capnography (65). None of the methods can distinguish between tracheal or main-stem bronchial intubation.

Colorimetry

The colorimetric, single-use device consists of a pH-sensitive chemical indicator enclosed in a plastic housing that may be attached between the ET and the ventilation device. The indicator changes colour when exposed to CO_2. The colour varies according to breath-to-breath changes in $ETCO_2$ levels, providing an estimate within a range of CO_2 concentrations. As such, the device only functions as a qualitative detector and not a monitor. The device is unreliable in confirming ET placement in situations with absent or minimal levels of expired CO_2 (cardiac arrest, pulmonary oedema, extremely low cardiac output). Several breaths are recommended before interpreting a colour change. This may not be feasible in an emergency situation, especially when rapid differentiation between oesophageal intubation and profound shock or cardiac arrest is vital (66). Colorimetric devices provide false-positive readings when exposed to acidic substances such as gastric contents, lidocaine or epinephrine, which are not uncommon in the resuscitation setting. The device is vulnerable to clogging by secretions and subsequently unable to provide a reading. The device has no audible alarm or backlighting, limiting its value in hostile pre-hospital settings (67).

Capnography

Capnography combines a quantitative measurement of exhaled CO_2, displayed as a numeric $ETCO_2$ value (capnometry), with a graphic display of $ETCO_2$ over time (capnogram). Capnographs display the respiratory rate and are equipped with audible alarms and illuminated displays. The method enables tight control of ventilation, reducing the risk of inadvertant hypo- or hyperventilation (68). The dynamic waveform of the capnogram provides invaluable information regarding ventilation and circulatory status as well as monitoring airway and breathing-circuit integrity. Critical situations may be diagnosed or alerted by the waveform alone (e.g. tube disconnection, cardiac arrest, bronchospasm). In situations with CO_2-rich gastric contents (carbonated beverages, mouth-to-mouth resuscitation attempts), confusion may arise after oesophageal intubation. The trend and waveform of the capnogram aids in differentiating ET placement under these circumstances. Capnography is also of value in the monitoring of non-intubated patients but have a risk of false-negative interpretation for patients with low cardiac output, similar to the colorimetric method (69).

Recommendations

Colorimetric devices are unreliable in certain clinical settings and have potentially serious functional drawbacks, which limit their use in the pre-hospital environment. For this reason, colorimetric CO_2 detectors are not recommended by the Task Force for pre-hospital use in Scandinavia. Capnography, with the advantages stated above, also fulfils the criterium of providing the same level of care in the pre-hospital setting as in hospital. Verification of correct ET placement is only one of several benefits provided by capnography. The Task Force recommends that the use of capnography should be mandatory in connection with pre-hospital advanced airway management.

Discussion

Many guidelines for airway management have been published, but none to our knowledge encompassing all skill levels of pre-hospital health care providers [see (70) and references therein]. In recognition of the organisational culture of pre-hospital emergency medicine common to the Nordic countries, SSAI felt the need for the development of common guidelines and appointed a Task Force with representatives from all Nordic countries. Health care providers with vastly different skill levels and educational backgrounds made it necessary to design an algorithm that accordingly differentiates between recommended actions (Fig. 1). Whether health care providers belong in the basic or intermediate group will vary across Scandinavia, but in the foreseeable future, advanced airway management in the field will universally be provided by anaesthesiologists. Specially trained anaesthetic nurses can employ advanced techniques, but consultation with the anaesthesiologist in charge is mandatory in each case.

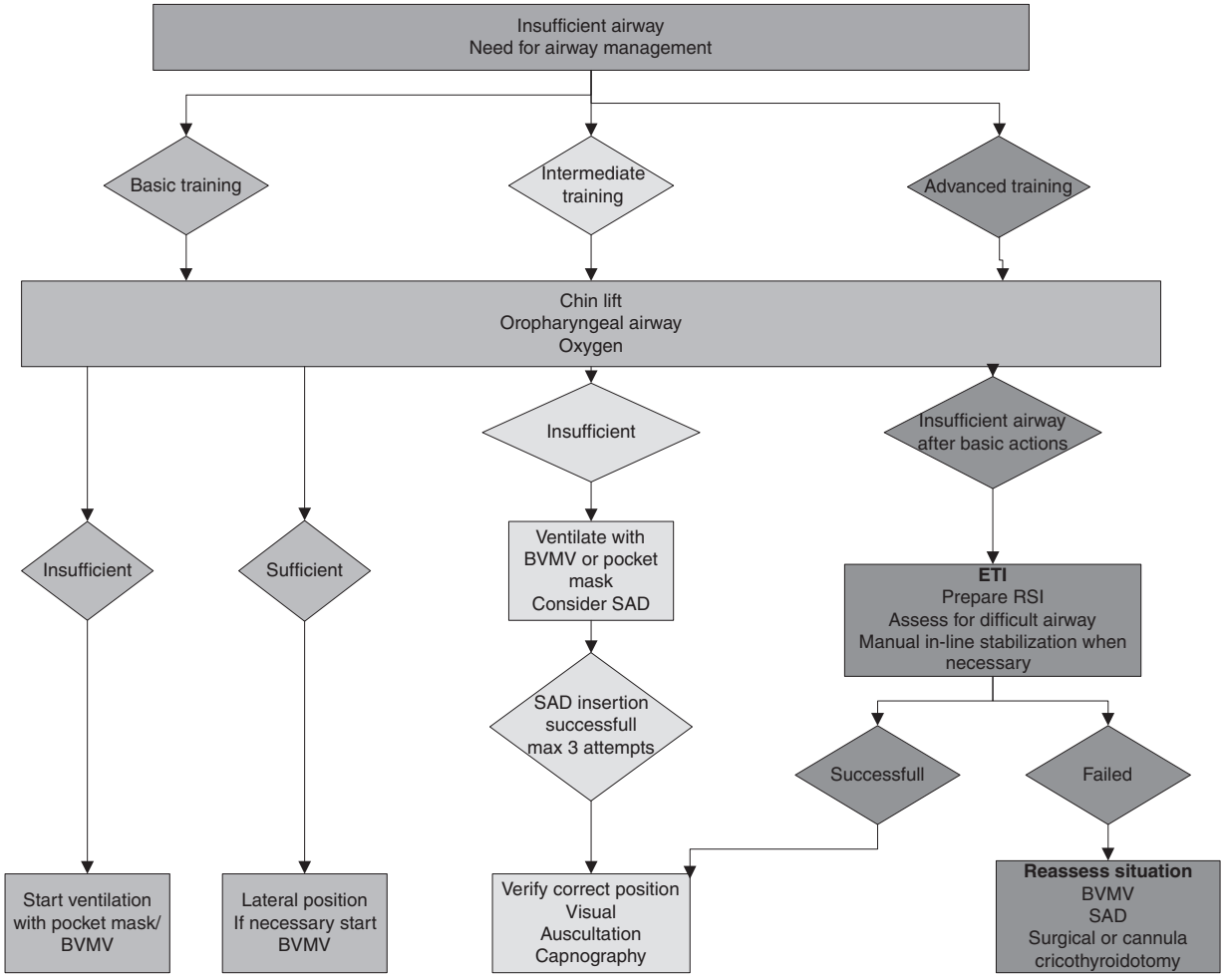

Fig. 1. Flow chart for pre-hospital airway management. The recommended actions depend on the skill level of the health care provider. Three levels are indicated: basic, intermediate and advanced. See text for details.

It must be emphasised that arrows in the algorithm may point in both directions, because an improvement in the patient's condition after an action has successfully been performed may be temporary in nature, forcing new actions to be taken.

Based on current literature and clinical and educational experience, the Task Force recommends that pre-hospital airway management performed by EMTs and paramedics is based on the lateral recovery position and assisted BVMV in all patients retaining some degree of airway reflexes. During cardio-pulmonary resuscitation, this group of personnel may try ETI if locally authorised, but repeated attempts should be avoided. A SAD should then be used if BVMV does not result in adequate oxygenation. Actions more complex than necessary should generally be avoided.

The Task Force acknowledges the fact that it is unrealistic for many EMS – especially in rural areas with scattered populations – to implement more advanced airway devices, but in these EMS it is all the more important to be focused on drilling the basic skills instead.

Anaesthesiologists have anaesthetic training warranting a wider instrumental and pharmacological repertoire. This group could primarily secure the patient's airway with ETI – drug assisted when necessary – or secondarily with a SAD if intubation proves difficult. However, even for maximally skilled personnel, it should always be considered whether intubation attempts should be performed pre-hospitally or be postponed till more advanced in-hospital techniques are available. The clinical situation as well as the distance from the hospital will decide the correct treatment in a given case.

For all groups of health care providers, the skill and training of the individual as well as local protocols must govern which SAD is to be employed. No literature is available comparing the

use of LMA and LT in anaesthetised trauma or medical patients; thus preference of SAD depends on the skill and training of the individual health care provider as well as the local organisation. The use of emergency airway techniques is rare and no literature supports recommendations on what kind of technique or equipment is superior. However, for health care providers without prior experience with SADs, it seems reasonable to recommend the LT because studies indicate that the insertion of this device is easiest to learn and to maintain skill with suitable realistic training in hospital.

These guidelines for pre-hospital airway management must be updated on a regular and frequent basis in order to keep abreast with the rapid development in this field. Anaesthesiological competencies are needed in the pre-hospital setting and it is the health authorities' responsibility to ensure public access to this expertise when the need arises. SSAI is taking its part of the responsibility by providing Nordic anaesthesiologists with a course in advanced airway management. In addition, a 2-year SSAI post-specialist training programme in advanced emergency medicine is to be launched soon.

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