Cardiopulmonary resuscitation: the laryngeal mask airway

Helen Hand looks at the use of the laryngeal mask airway by nursing staff, as a means of advanced airway management during cardiopulmonary arrest.

Aims and intended learning outcomes

The aim of this article is to discuss issues relating to the successful training of nurses in the insertion of the laryngeal mask airway (LMA) by nursing staff during cardiopulmonary resuscitation (CPR). After reading the article, you should be able to:

- Outline the issues that must be considered before deciding to expand your own nursing practice.
- Name the anatomical structures of the upper respiratory tract.
- Describe in detail the steps to successful LMA insertion.
- Compare and contrast the LMA with other forms of airway management used in cardiopulmonary arrest.
- State any advantages/disadvantages for the patient resulting from nurses undertaking LMA insertion training.
- State the rationale for undertaking the practice by summarising the research evidence presented in the article.

Introduction

Successful airway management is of fundamental importance in the performance of cardiopulmonary resuscitation (CPR). There is a recognised need to protect the airway, ensure adequate oxygenation and effective ventilation, without risking regurgitation and pulmonary aspiration of gastric contents. While endotracheal intubation remains the 'gold standard' for airway management, it is a difficult skill to acquire and maintain, and is therefore a skill not usually possessed by nursing staff.

Current teaching advocates the use of a face mask or bag-valve-mask system during initial resuscitation. Research suggests, however, that both systems are often used inadequately (Bailey and Hett 1994). The use of the LMA is receiving increasing support in the literature as an effective, efficient means of providing airway maintenance and protection during cardiopulmonary resuscitation (Stone et al 1998, Bryden and Gwinnutt 1998). LMA training is currently being extended to nursing staff in many acute and critical care areas in hospital trusts, as a means of first line airway management.

Professional issues

Before deciding to expand nursing practice into areas such as this, there are several issues for the nurse to consider. Role expansion must be seen as more than acquiring new skills, it is about enhancing patient care and accepting the responsibility that comes with it. It is, then, the responsibility of each nurse to assess his or her situation carefully and to ensure that any attempt to expand their role is, first and foremost, patient led.

The following principles found in the Scope of Professional Practice (UKCC 1992a) are based on the Code of Professional Conduct (UKCC 1992b) and should govern any adjustments to the scope of professional practice. The first principle, Clause 9.1 states that nurses must be satisfied that the new role serves the interests of patients. This implies patients' interests, as opposed to the interests of the organisation that nurses are employed by, or indeed the interests of the individual nurses concerned. With regards to the LMA, as will be seen later, research suggests that early insertion of the airway in cardiopulmonary arrest is indeed beneficial compared with the use of bag valve mask ventilation, thus satisfying this particular requirement.

Clause 9.2 of the Scope of Professional Practice states that nurses must make every effort to
'achieve, maintain and develop the knowledge, skill and competence to respond to clients' needs'. A commitment to undertake LMA training must therefore also be a commitment to complete the training, attend yearly update sessions and to take every opportunity to develop the skill and the associated knowledge. As with any skill, the technique of LMA insertion is not easily retained without practice. It should not be undertaken by nurses working in areas where the skill is not likely to be used on a reasonably regular basis. Even in areas where the skill may be appropriate, such as A&E and coronary care units, some nurses may not encounter many cardiac arrests, and should therefore be constantly mindful of the need to keep the skill fresh.

Clause 9.3 states that nurses must 'honestly acknowledge any limits of personal knowledge and skill and take steps to remedy any relevant deficits' to meet patients' needs effectively and appropriately. This clause applies both prior to and during LMA insertion. If nurses do not feel competent to begin the procedure, they should acknowledge this and use an alternative method of airway management until assistance arrives. Alternatively, if an attempt is being made and difficulty is encountered, the nurse should be prepared to abandon the attempt quickly and resume basic life support. If this is the case then, as the clause implies, the nurse must take steps to refresh the skill at the earliest opportunity.

A further principle stated in clause 9.4 emphasises that taking on new practices must not be to the detriment of existing aspects of care, either by compromising or fragmenting it. The principle of accountability is stressed in clause 9.5 – practitioners must be able to justify any action or decision not to act, in the course of their professional practice. Finally, clause 9.6 suggests that practitioners must not, in the performance of any expanded role activity, make any inappropriate delegation that would compromise patients' best interests.

TIME OUT 1

It has been demonstrated that there are many issues for the nurse to consider before deciding to expand nursing practice. Write down five things that the Scope of Professional Practice indicates you will need to consider if you decide to expand your nursing practice to include LMA insertion.

The laryngeal mask airway

The LMA was invented by Dr Archie Brain in 1981 (Baskett 1994), using plaster casts of a human cadaver's pharynx as a structure on which to model the mask (O'Meara 1995). This first model was a crude device made in his workshop at home from sections of tracheal tube and a dental nasal face mask. (Baskett 1994). The first prototype was used in 1981. As experience grew, and new materials became available, the development of the LMA progressed through numerous prototypes. The final design produced an airway that can be inserted blindly, without trauma and can, because of the simple insertion technique, easily be learnt by non-anaesthetists, medical practitioners and nursing and paramedical staff.

The LMA is composed of silicone rubber, and is reusable, being sterilised by steam autoclaving. It consists of a flexible curved tube opening at the distal end into the lumen of a small elliptical mask that has an inflatable outer rim (Fig. 1). When inserted correctly, the LMA occupies the entire hypopharynx and rests against the upper oesophageal sphincter behind the cricoid cartilage. The cuff is inflated to form an airtight seal around the larynx. Since 1988, when the first model became commercially available, Brimacombe et al (1996) suggest that the LMA has gained widespread acceptance as a general purpose airway for routine anaesthesia where usage rates commonly reach 30-60 per cent. Its use during cardiopulmonary arrest is also gaining momentum (Baskett and Brain 1998).

Fig. 1. Laryngeal mask airway

In the majority of cases of cardiac arrest in hospital, nurses are the first responders (Stone et al 1994). Previously, nurses had been taught mouth to mask or bag valve mask (BVM) ventilation. According to Stone et al (1994), it is clear that the lungs of the majority of patients managed in this way are inadequately ventilated and in addition, the patient is exposed to gastric inflation, regurgitation and pulmonary aspiration.

Mouth to mask ventilation is obviously preferable to mouth to mouth for both aesthetic reasons and fear of cross infection. The technique for mouth to mask ventilation is not difficult and can be managed single-handedly. The mask is applied to the patient's face using the thumbs of both hands. The jaw is then lifted into the mask using the remaining fin-
Write a list of the advantages and disadvantages of using both the face mask and the BVM method of ventilation in a cardiac arrest.

**TIME OUT 3**

Advanced airway management

The conventional definitive airway is recognised to be the cuffed endotracheal tube (ETT), but placement requires a considerable amount of training and regular practice to achieve and maintain competence. Baskett (1994) also believes that the skill of tracheal intubation rapidly atrophies and that the increasing use of the LMA in theatre has, paradoxically, reduced the opportunities for practice and updating of the skill of intubation. Stone et al (1998) believe that to provide training and practice to all healthcare professionals who might attend a patient suffering from a cardiac arrest is probably an unattainable goal. For this reason, endotracheal intubation is likely to remain a skill for trained anaesthetists and theatre practitioners only. For this reason airways, such as the LMA, are being suggested as effective alternatives.

In 1994, Baskett suggested that on the evidence then available, it was justified to introduce widespread training in the use of the LMA during resuscitation in hospitals. He suggested that a reasonable goal should be to train all doctors in the technique and ensure that there is always one first responder nurse on duty in the wards, who is competent with LMA insertion and subsequent ventilation. Several advantages exist in the use of the LMA as opposed to the BVM method of airway management. Stone et al (1998) undertook an investigation comparing the incidence of gastric regurgitation using both methods. They studied 256 patients who had an LMA inserted during a resuscitation attempt, 170 of whom had been ventilated with a BVM prior to the LMA insertion. They found that of the 86 who were ventilated only via an LMA, only three patients (3.5 per cent) regurgitated during CPR and none regurgitated afterwards. Of the 170 ventilated using the BVM prior to LMA insertion, 20 patients (11.8 per cent) regurgitated during CPR and eight patients (4.7 per cent) afterwards. They concluded that regurgitation was found to be significantly less likely when the LMA was used as the first line airway device, thus confirming results of previous similar studies (Stone et al 1994, Kokkinis 1994, Lack 1993). Roberts et al (1997) suggest that when positioned correctly, the LMA provides a clear airway with a reduced risk of gastric over-inflation. Although not a perfect seal, the LMA also provides some protection from aspiration compared to the BVM. Roberts also points out that reports associated with regurgitation and aspiration during CPR do not seem to affect patient outcomes adversely, probably due to the adequacy of oxygenation achieved with the LMA.

A further issue to consider with the use of the LMA is training and retention of the skill of insertion. Several studies have been carried out looking at competency in LMA insertion, and retention of the skill over a period of time. Leach et al (1993) found that the skill did not appear to fade over the 13 months of their study and identified one nurse who had successfully inserted an LMA for the first time during a cardiac arrest, eight months after her initial training. A multicentre study was undertaken by Stone et al (1994) to assess the potential value of the LMA when inserted by nurses. They found that out of 164 LMA insertions during cardiac arrest, 117 (71 per cent) were inserted correctly on the first attempt, 97 per cent on the second attempt and 100 per cent at the third attempt. They also reported that the LMA remained stable during external chest compressions and did not become dislodged in any of the arrests. Sasada and Gabbott (1994) suggest other advan-
tages of the LMA. They state that insertion of the LMA is easier and more rapid than ETT intubation, and requires less equipment. The LMA is reusable up to 40 times following sterilisation and can also be used for the administration of drugs. Actual theoretical and practical training is much shorter and the increasing use of the LMA in theatres presents more opportunities for practical training and refreshing. Once positioned, the LMA only requires one operator to provide effective ventilation, making more efficient use of personnel during a cardiac arrest.

Sasada and Gabbott (1994) also point out that as the LMA does not require laryngoscopy, the technique is associated with a lower incidence of damage to the upper airway structures than with the ETT. It is also of proven value in the management of failed intubation in patients with a difficult airway, and as it can be placed without flexing the neck, is of potential significant value in accident and emergency departments. The use of ETT intubation in patients with actual or suspected neck injuries is fraught with risks. The recent introduction of the intubating LMA, where an ETT can be passed through an already inserted LMA, will undoubtedly prove even more beneficial in both trauma areas and for paramedic use.

**TIME OUT 4**

Write a list of the advantages and disadvantages of using the LMA to manage the airway in cardiac arrest.

### LMA insertion technique

The manufacturers of the LMA suggest that training to an adequate standard of competence has proved to be simple. They recommend two hours of theoretical tuition followed by a multiple choice test paper, and a practice session in the operating theatre where five successful LMA insertions must be observed. This should be followed by either a yearly or three yearly refresher depending on use (Baskett and Brain 1998). Although they acknowledge that it has been demonstrated that practical training on a mannequin can provide adequate expertise, they recommend that supervised insertions on patients adds confidence for the trainee.

**Preparation for use** When electing to use an LMA, it is important to select the appropriate sized mask for the patient (Table 1). If there is doubt, then a larger mask should be chosen as this will ensure a fit without leakage around the cuff. Once a cuff has been selected, it is recommended that checks are carried out to ensure that the LMA is safe to use (Baskett and Brain 1998). The inside of the tube must first be checked for blockages or foreign objects; the tube is transparent to allow easy examination. The cuff should then be fully deflated and reinflated with the maximum recommended volume of air. It must then be examined and discarded if there are any signs of splitting or herniation. The tube must also be flexed to observe for kinking.

**Table 1. Choosing the appropriate sized LMA**

<table>
<thead>
<tr>
<th>LMA SIZE</th>
<th>PATIENT</th>
<th>CUFF VOLUME (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Small adult</td>
<td>20 ml max</td>
</tr>
<tr>
<td>4</td>
<td>Normal adult</td>
<td>30 ml max</td>
</tr>
<tr>
<td>5</td>
<td>Large adult</td>
<td>40 ml max</td>
</tr>
</tbody>
</table>

**Insertion technique** The LMA should only be used in patients that are profoundly unconscious and unresponsive, without glossopharyngeal reflexes and in those who have an identified need for an artificial airway, such as cardiac arrest. If necessary, the upper airway should be cleared prior to insertion of the LMA, particularly if resuscitation by the BVM method has been used. The person inserting the...
LMA should be positioned at the back of the patient, and should be wearing gloves.
The patient's neck and head should be positioned as for normal intubation – the typical 'sniffing the morning air' position. The neck must be kept flexed and the head extended by pushing on the occiput with one hand and inserting the mask into the mouth with the other (Fig 3).

Holding the LMA like a pen with the index finger placed anteriorly at the junction of the tube and cuff, the tip of the airway should be pressed up against the hard palate, ensuring that the tip is not folded over. It should then be advanced in one fluid movement, through the oropharynx while maintaining pressure against the palate (Fig 4).

Insert the index finger fully into the mouth to complete the insertion (Fig 5). When resistance is felt, withdraw the finger while holding the tube in place with the other hand (Fig 6).

The cuff should now be inflated with the appropriate volume of air (Table 1).

Normally, the mask will rise up slightly out of the hypopharynx as the cuff is inflated and the mask finds the correct position. This should not be impeded by holding the tube, or incorrect placement will result. It is also important that no equipment is attached to the tube until the cuff has been inflated, again to avoid accidental displacement.

Once the airway has been successfully inserted a bite block or oropharyngeal airway should be inserted to guard against tube compression. The tube should then be secured, ensuring that the connector is directed downwards, with the black line on the spine of the airway tube facing the nose. A standard bag valve device can be attached to the tube, which with an attached oxygen reservoir receiving 10 l/minute will provide an oxygen concentration of over 90 per cent (Fig. 7).

The bag should be squeezed gently to avoid high inflation pressures, and a tidal volume of 400-600 ml as recommended by the European and UK resuscitation councils should be achieved. The LMA should only be removed when the patient has recovered and his or her protective reflexes have returned.
Conclusion

The priority in a cardiac arrest situation is to provide effective oxygenation and ventilation, while protecting the patient's airway by minimising the risk of regurgitation and pulmonary aspiration of gastric contents. Research suggests that although not a superior alternative to tracheal intubation, the LMA has distinct advantages over the current face mask and BVM methods used by nursing staff. It is a skill that is not difficult to master, requires little training, and is relatively simple to retain. The fact that the LMA can be inserted by nursing staff means that good oxygenation and ventilation can be established soon after the onset of cardiac arrest, without the risk of trauma from direct laryngoscopy, and with very obvious benefits for the patient.

Although aspiration may still occur, the risk has been shown to be small, particularly compared to the BVM method. The LMA has also been shown to be of benefit with difficult intubations and patients with suspected spinal injuries where intubation would be contraindicated. LMA insertion, therefore, appears to present an excellent opportunity to expand nursing practice directly in the patient's best interests.

Glossary

- Hypoxaemia – an abnormal deficiency of oxygen in arterial blood
- Hypoventilation – occurs when the volume of air entering the alveoli and taking part in gaseous exchange is not adequate for the body's needs
- Hypercapnia – greater than normal amounts of carbon dioxide in the blood
- Acidosis – an abnormal increase of hydrogen ions in the blood (Mosby 1998)

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REFERENCES


What do I do now?

- Using the information in Box 1 to guide you, write a Practice Profile of between 750 and 1,000 words – ensuring that you have related it to the article that you have studied. See the Practice Profile on page 56 and the examples in Box 2.
- Mark the title of the entry as: Practice Profile and include your name, followed by the title of the article which is Cardiopulmonary resuscitation: the laryngeal mask airway and the article number which is 502.
- Complete all of the requirements of the cut-out form provided and attach it securely to your Practice Profile. Failure to do so will mean that your Practice Profile cannot be considered for accreditation.
- Using an A4 envelope, send it with your free RCN assessment voucher or £10 fee (£15 for non-RCN members) to: RCN CPD articles, Royal College of Nursing, Freepost CF 3790, Cardiff CF5 1ZZ by July 14 2000 (cheques payable to RCN).
- Please do not staple cheques or vouchers to your Practice Profile and cut-out slip – paper-clips are recommended.
- You will be informed in writing of your result. Six Continuing Education Points are awarded for successful completion of this CPD article. You are entitled to one retake if you are unsuccessful.
- Feedback is not provided: notification of accreditation indicates that you have been successful. If you wish your Practice Profile to be considered for publication in Nursing Standard (page 56), ensure that you have indicated this in the place provided on the cut-out form.
- Keep a copy of your Practice Profile and add this to your professional profile – copies are not returned to you.
- Study the checklist (Box 3).

Box 1. Framework for reflection

- What have I learnt from this article?
- To what extent were the intended learning outcomes met?
- What have I learnt from this article?
- What can I apply immediately to my practice or client/patient care?
- Is there anything that I did not understand, need to explore or read about further, to clarify my understanding?
- What else do I need to do/know to extend my professional development in this area?
- What else do I need to do/know to extend my professional development in this area?
- How might I achieve the above needs? (It might be helpful to convert these to short/medium/long-term goals and draw up an action plan).

Box 2. Examples of possible Practice Profile entries

Example 1 After reading a CPD article on ‘Communication Skills’, Jenny, a practice nurse, reflects on her own communication skills and re-arranges her clinic room so that she will sit next to her patients when talking to them. She makes a conscious decision to pay attention to her own body language, posture and eye contact, and notices that communication with patients improves. This forms the basis of her Practice Profile.

Example 2 After reading a CPD article on ‘Wound Care’, Amajit, a senior staff nurse on a surgical ward, approached the nurse manager about her concerns about wound infections on the ward. Following an audit which Amajit undertook, a protocol for dressing wounds was established which led to a reduction in wound infections in her ward and across the directorate. Amajit used this experience for her Practice Profile and includes her name, followed by the title of the article which is Cardiopulmonary resuscitation: the laryngeal mask airway and the article number which is 502.

Box 3. Portfolio submission

Checklist for submitting your Practice Profile
- ✓ Have you completed the cut-out form and attached it to your entry?
- ✓ Have you indicated whether you would like your Practice Profile to be considered for publication in Nursing Standard?
- ✓ Have you enclosed your RCN CPD voucher or cheque?
- ✓ Have you kept a copy of the Practice Profile for your own portfolio?
- ✓ Have you related your Practice Profile to the article?
- ✓ Have you completed the cut-out form and attached it to your entry?
- ✓ Have you indicated whether you would like your Practice Profile to be considered for publication in Nursing Standard?
- ✓ Have you enclosed your RCN CPD voucher or cheque?