

Nerve injury and the laryngeal mask airway

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Abstract

The laryngeal mask airway is a widely used, non-invasive, general purpose airway. We report the case of a temporary vocal cord palsy following the use of such an airway. The development of inappropriately high cuff pressures secondary to nitrous oxide diffusion into the cuff is proposed as the most likely cause. Knowledge of the existence of nerve injuries complicating laryngeal mask use is particularly important when counselling certain patients. Mandatory intraoperative cuff pressure monitoring should lower the risk of subsequent voice problems.

Key words: Vocal Cord Palsy; Lingual Nerve Palsy; Hypoglossal Nerve Palsy; Anaesthesia, Complication; Laryngeal Mask Airway

Introduction

Following anatomical studies in human cadavers, Brain designed the laryngeal mask airway (LMA).¹ Today, the LMA is widely used as a non-invasive, general purpose airway in both the spontaneous breathing and controlled ventilation setting. It comprises a silicone rubber tube opening into the lumen of a moulded rubber ring that has an inflatable outer cuff. When placed in the hypopharynx and inflated it forms a circumferential low pressure seal around the larynx. Once correctly inserted the tip of the mask should rest at the upper oesophageal sphincter level with its sides facing into the piriform fossae and the proximal edge lying beneath the tongue base.²

Airway-related complications are much less frequently encountered with the LMA compared with the endotracheal tube.³ A case of a temporary vocal cord palsy following the use of an LMA is reported, with discussion of the likely aetiology and a review of neurological complications associated with the LMA.

Case report

A 21-year-old man underwent surgery for correction of bat ears. He was fit and well and was of anaesthetic grade ASA 1 (American Association of Anaesthesiologists). Following

induction of anaesthesia with 100 µg fentanyl and 200 mg propofol, a size 5 LMA was inserted. Anaesthesia was maintained with a mixture of oxygen, nitrous oxide and sevoflurane. Uneventful anaesthesia and surgery lasted 75 minutes and the patient was discharged on the first postoperative day. Two days following surgery the patient presented with hoarseness; fiberoptic laryngoscopy revealed a unilateral left vocal cord palsy. There was no history of upper respiratory tract infection or previous dysphonia. Physical examination did not reveal the cause for the palsy and a computed tomography (CT) scan of the skull base to the mediastinum was normal. Steady improvement in vocal cord function followed and normal function was confirmed 5 months after presentation.

Discussion

Vocal cord palsy following the use of a laryngeal mask airway is a rare but significant complication. Reported predominantly in anaesthetic literature, the resultant weakness is usually temporary, and cases reported to date are summarized in Table I.^{4–8}

Several mechanisms have been proposed to explain the development of a vocal cord palsy; these include misplacement of the mask with subsequent pressure

TABLE I
REPORTED CASES OF VOCAL CORD PALSY FOLLOWING LMA USE

Operation	Duration (min)	Nitrous oxide	Uni/bilateral	Outcome
Hysterectomy	97	Yes	Bilateral	Temporary ⁴
Inguinal hernia	90	Yes	Unilateral	Temporary ⁵
Breast biopsy	60	Yes	Unilateral	Temporary ⁵
Colonoscopy	30	Yes	Unilateral	Permanent ⁵
# NOF	55	Yes	Unilateral	Temporary ⁶
Hysterectomy	60	Yes	Unilateral	Temporary ⁶
Foot surgery	30	Yes	Unilateral	Temporary ⁷
Varicose veins	50	Yes	Unilateral	Permanent ⁸

For further details of individual cases and outcome, refer to the references cited. # NOF = fractured neck of femur.

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TABLE II
REPORTED CASES OF LINGUAL NERVE PALSY FOLLOWING LMA USE

Operation	Duration (mins)	Nitrous oxide	Uni/bilateral	Outcome
Varicose veins	30	Yes	Unilateral	Unknown ¹¹
Laparoscopy	35	Yes	Unilateral	Temporary ¹²

For further details of individual cases and outcome, refer to the references cited.

effects upon the vocal cords, arytenoid cartilage dislocation, stretching of the laryngeal nerve supply due to neck hyperextension, and local effects resulting from lidocaine gel applied to the cuff.^{4,5,7} The most widely accepted mechanism is pressure neuropraxia resulting from cuff over-inflation.⁴⁻⁸

Diffusion of nitrous oxide into the air-filled cuff during maintenance of anaesthesia causes an increase in cuff volume and pressure; this resultant over-inflation is thought to cause distension of the hypopharynx. The most likely site suggested for recurrent laryngeal nerve injury is the cricoid region at the level of the lower part of the piriform fossae.^{5,7}

Lumb and Wrigley⁹ demonstrated that the silicone-based rubber used to manufacture LMA cuffs is more permeable to carbon dioxide and nitrous oxide than oxygen and nitrogen. Diffusion of nitrous oxide (and to a lesser extent carbon dioxide) into the cuff can therefore be expected to proceed more rapidly than diffusion of oxygen and nitrogen out of the cuff. During anaesthesia the cuff is exposed to relatively high partial pressures of nitrous oxide via its lumen and carbon dioxide as a result of its position above the glottis. The same authors demonstrated a constant and linear increase in LMA cuff pressure in 18 patients undergoing anaesthesia with nitrous oxide. After 30 minutes of anaesthesia the mean cuff pressure had increased by 30 mmHg. In response to these concerns, Brain¹⁰ indicated that the inflation values recommended for LMA usage represent maximum values, not necessarily the normal amount of air to be injected. He also suggested that cuff pressure should be routinely monitored and adjusted to compensate for any increase as a result of N₂O anaesthesia.

- **The laryngeal mask airway is a widely used, non-invasive, general purpose airway**
- **A case of temporary vocal cord palsy following use of the airway is reported**
- **The cause of the palsy is thought to be due to the development of inappropriately high cuff pressures secondary to nitrous oxide diffusion into the cuff**

Lingual and hypoglossal nerve damage has also been reported following LMA use (Tables II and III).¹¹⁻¹⁴ In both cases of lingual nerve damage, the postulated aetiology was that of compression of the nerve against the mandible. Similarly, direct compression of the hypoglossal nerve against the hyoid bone has been suggested as the

explanation for the two reported cases of hypoglossal nerve palsy following LMA use. One of these patients was anticoagulated with warfarin at the time of surgery, and localized bruising resulting from trauma from the cuff was therefore thought to have further contributed to the nerve compression.¹⁴ Supporting the possibility of localized bleeding complicating LMA usage, a single case of right vocal cord haematoma following the use of an LMA has been reported. However, a severe bleeding disorder as a result of myelodysplasia was thought to be responsible.¹⁵

We considered the possibility that alteration in the position of the cuff resulting from intraoperative changes in head position could have contributed to the exertion of unusually high local pressures in this case. However, all previous recorded cases involved neutral head positioning.

This report and review highlights the possibility of neural injury by an LMA at several different sites within the neck, even after correct placement of the LMA. Previous studies have shown that the LMA causes less vocal change compared with endotracheal intubation.³ However, two potential risks to speech quality should be considered when using an LMA, namely, interruption of the motor supply to either the tongue or the larynx. Such nerve damage is rare and usually temporary, but knowledge of the existence of neural complications of LMA use is particularly relevant when counselling certain patients; when used in the professional voice user in particular, intraoperative cuff pressure monitoring should be considered mandatory.

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TABLE III
REPORTED CASES OF HYPOGLOSSAL NERVE PALSY FOLLOWING LMA USE

Operation	Duration (min)	Nitrous oxide	Uni/bilateral	Outcome
Shoulder surgery	<180	Yes	Unilateral	Temporary ¹³
Minor orthopaedic	25	Yes	Unilateral	Temporary ¹⁴

For further details of individual cases and outcome, refer to the references cited.

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