

# Unilateral Hypoglossal Nerve Palsy after the Use of a Novel Supraglottic Airway Device

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## Abstract

**Background:** The LMA<sup>®</sup> Protector<sup>™</sup> Airway is a new supraglottic airway device with Cuff Pilot<sup>™</sup> Technology that enables visual monitoring of intra-cuff pressure, to reduce the risk of complications from an overinflated device.

**Case:** We present a case of unilateral hypoglossal nerve injury after its use. In our knowledge, this is the first reported case of hypoglossal nerve injury after LMA<sup>®</sup> Protector<sup>™</sup> use. **Learning Points:** Hypoglossal nerve injury is a rare but distressing complication of LMA use. The greater horn of the hyoid bone is a potential site of injury, as the cuff of the LMA may compress the nerve against bone. In our patient, possible contributing factors included cuff over-inflation with/without failure of the Cuff Pilot<sup>™</sup> technology, inappropriate sizing and placement of an unfamiliar device. Fortuitously, injury is often neuropraxia with complete recovery in 6 months following conservative management. Consideration should be given to down-sizing the device for Asian patients who tend to have smaller jaws for their weight range. We caution that whilst the green zone of the Cuff Pilot<sup>™</sup> corresponds to 40 - 60 cm H<sub>2</sub>O cuff pressure, it may be more than the “just-seal” pressure required and the cuff may still be overinflated relative to the size of the patient’s airway.

## Keywords

Airway Complication, Nerve Injury, LMA

## 1. Introduction

The LMA<sup>®</sup> Protector<sup>™</sup> Airway is currently the newest second generation supraglottic airway device (SAD) from the inventors of laryngeal mask (Teleflex Medical, Co. Westmeath, Ireland) [1]. Like other second generation SADs, it has an

integral bite block and a preformed curvature to allow easy insertion without the use of an introducer device. In addition, the airway tube allows intubation via the LMA<sup>®</sup> Protector™ and both tube and cuff are made of 100% silicone, reducing the risk of sore throat [2] and allowing higher seal pressures [3] as compared to polyvinylchloride cuffs. Additional features include dual gastric channels for pharyngeal and gastric drainage to reduce risk of aspiration of gastric contents. What makes the LMA<sup>®</sup> Protector™ Airway unique is its integrated Cuff Pilot™ Technology—a cuff pressure indicator that enables continuous cuff pressure monitoring through visual means, to facilitate easy and accurate adjustments and reduce the risk of complications from an overinflated device [4] [5].

Nerve injuries such as recurrent laryngeal nerve palsy, lingual nerve palsy and hypoglossal nerve palsy have been reported with the use of laryngeal mask airways (LMAs), caused by overinflation of the cuff or high cuff pressures on the surrounding structures [6]. A review of the current literature revealed 12 cases [6] [7] of hypoglossal nerve injury after LMA use (nine with the use of Classic LMA, two with ProSeal LMA and one case of hypoglossal nerve palsy after LMA Protector [8] which was reported after this case was presented at Euroanaesthesia Conference in 2018). In this case report, we present the first case of a unilateral hypoglossal nerve palsy after the use of the LMA<sup>®</sup> Protector™ Airway.

## 2. Report

A 39 year old (51 kg and 151 cm) female of American Society of Anesthesiologists (ASA) physical status I presented for an elective left knee arthroscopy, chondroplasty with medial and lateral patellar release and medical meniscal repair. She had normal airway features with good mouth opening, Mallampati score of 1, thyromental distance > 6 cm and full range of motion of her neck. She had a previous general anesthesia for tonsillectomy, which was uneventful.

The patient gave consent for both regional and general anesthesia after a thorough discussion and work-up. A left femoral nerve block was performed under ultrasound guidance and 20 mls of 0.5% ropivacaine was deposited perineurally without any complications. General anesthesia was then induced and a size 3 LMA<sup>®</sup> Protector™ Airway was placed atraumatically on first attempt by an experienced Fellow in Anesthesiology. The cuff was then inflated with air until the cuff pressure indicator lay within the green zone. We were able to get a good seal with the LMA with no leakage observed around the cuff. The actual cuff pressure was not measured with a manometer. General anesthesia was maintained with a mixture of Sevoflurane and Oxygen/Air. The patient was in a supine position with standard ASA monitoring for the procedure which lasted for 2 hours and was uneventful. She was breathing spontaneously throughout the surgery and the black line indicator remained within the green zone on the integrated Cuff Pilot™.

Post-operatively, the LMA was removed in the Post Anesthesia Care Unit (PACU) when the patient was awake. She was subsequently discharged to the general ward.

Several hours later, she complained of mild throat pain associated with unusual sensation in the tongue with reduced movement. She also reported difficulty in pronunciation and chewing, but had no dysgeusia (alteration in taste) or dysphagia. Her symptoms persisted until post-operative day 1, and on examination by her attending anesthesiologist, it was noticed that her tongue deviated to the right during protrusion, with limited movement. No other neurological signs were elicited. The working diagnosis was an isolated right hypoglossal nerve injury. She was reassured that her symptoms would resolve over time, and it was unlikely that she had suffered a cerebrovascular event. She was subsequently discharged with a clinic appointment to see the Neurologist in a week's time. On postoperative day 7, the Neurologist reviewed the patient and did not detect any neurological abnormality in the tongue. His impression was that the patient most likely had hypoglossal nerve neurapraxia, which had resolved.

### 3. Discussion

Complications from the usage of Supraglottic Airway Devices are largely defined by minor pharyngolaryngeal complications such as: sore throat (17% - 42% of patients); soft tissue abrasion (16% - 32%); hoarseness and dysphagia. As such with regards to cranial nerve damage such as lingual nerve injury, trauma to the recurrent laryngeal nerve and hypoglossal nerve injury have been associated with the use of LMAs [6]. The postulated mechanism of injury is often direct mechanical compression secondary to cuff over-inflation or prolonged use [9]. On search of the literature, 12 cases of hypoglossal nerve injuries associated with LMA have previously been reported [7] [8]. Possible contributing factors to cranial nerve injuries with supraglottic airway devices are multi factorial (**Table 1**).

The hypoglossal nerve originates from the hypoglossal nucleus in the medulla,

**Table 1.** Possible Contributing factors to cranial nerve injuries with Supraglottic Airway Devices.

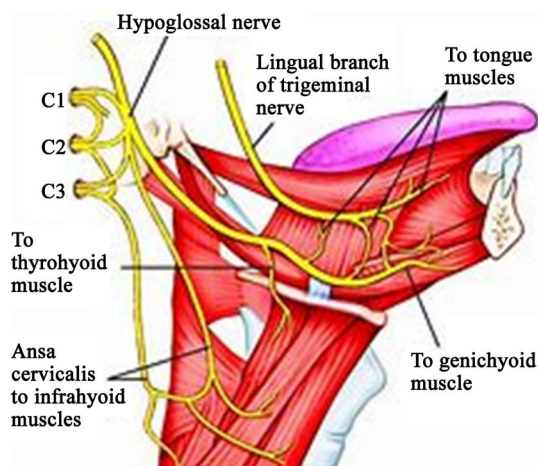
<u>Anaesthesia-related factors</u>	Excessive cuff inflation, >60 cm H <sub>2</sub> O
	Malpositioning
	Traumatic Insertion
	Poor technique or unfamiliarity with new device
	Nitrous oxide use
	Failure to measure cuff pressure after insertion of device
	Inappropriate sizing of Supraglottic Airway Device
<u>Patient related factors</u>	Diabetes mellitus
	Collagen vascular disorders
	Peripheral vascular disorders
<u>Surgery related factors</u>	Lateral position
	Extreme head rotation
	Prone position
	Prolonged duration

leaves the cranium through the hypoglossal canal, travels alongside the internal and external carotid arteries, before passing just above the hyoid bone to reach the myohoid and hypoglossus muscles. At the level of the angle of mandible it becomes superficial, passes just above the greater horn of the hyoid bone, and enters the mouth. The hypoglossal nerve provides motor control of the extrinsic muscles of the tongue, namely, the genioglossus (which acts to protrude the tongue), styloglossus (which retracts and elevates the tongue root) and the hypoglossus (which causes the upper surface to become more convex) muscles. It also innervates the intrinsic muscles of the tongue [10]. Damage to the infranuclear hypoglossal nerve leads to ipsilateral tongue deviation, dysarthria, and possibly dysphagia in severe cases. The tongue deviates towards the side that is affected [11].

**Figure 1** illustrates the course of the hypoglossal nerve which lies above the greater horn of the hyoid bone at the angle of the mandible before turning forwards and medially towards the tongue.

Hypoglossal nerve injury is a rare but distressing complication after airway management. In this case, we believe it is related to the LMA<sup>®</sup> Protector<sup>™</sup> Airway. Two factors are worthy of mention. Firstly, the potential mechanism behind hypoglossal nerve injury in this patient could be attributed to the compression of soft pharyngeal tissues by the distended LMA cuff against surrounding hard structures, such as the hyoid bone or vertebrae. The nerve itself is extremely vulnerable to neuropraxia from compression injury resulting from an overinflated or malpositioned cuff at the level of the hyoid bone [7] [13]. Secondly there is intervariability of cuff pressure for a given volume of air. Even with the inbuilt Cuff Pilot technology of the LMA protector, intracuff pressure can exceed the recommended values which can lead to reduce capillary perfusion pressure of the pharyngeal mucosa and thus its related complications.

The diagnosis of hypoglossal nerve injury is often missed by the anesthetic care team in the recovery room due to the delayed onset of symptoms. Most patients exhibit tongue deviation by post-operative day one [7] and hypoglossal



**Figure 1.** Anatomy and course of the hypoglossal nerve [12].

nerve injury is diagnosed after workup to exclude an acute cerebrovascular event, endotracheal trauma, airway haematoma or an impending airway obstruction. Signs and symptoms of hypoglossal nerve neurapraxia are self-limiting, with resolution occurring within 2 months in 50% of patients, with another 30% experiencing recovery within 2 to 4 months [7]. Currently, there are no specific preventive or therapeutic recommendations for hypoglossal nerve injury [7].

A review article reported that eight cases of isolated hypoglossal nerve injury associated with the use of the LMA had cuff inflation volumes ranging between 15 - 40 ml [7]. However, they did not specify the actual cuff pressures or if intraoperative monitoring of cuff pressure was done. In our case, we believe that the possible contributing factors include cuff over-inflation with/without failure of the Cuff Pilot™ technology and inappropriate placement of an unfamiliar device. The LMA® Protector™ Airway is a new supraglottic airway device introduced in 2015 and was under trial in our hospital. The manufacturer recommends weight-based selection of size of the SAD [1], however there is argument against using a single factor in size selection as there is no definite relationship between weight and size of oropharynx [14]. There is little literature on the appropriate size and cuff volumes/pressure of LMA® Protector™ in Asians [15] [16]. The Cuff Pilot™ technology is a unique, in-built feature that other LMAs do not possess. It allows continuous cuff pressure monitoring at a glance and this facilitates easy and accurate adjustment when necessary [4] [5]. The green zone corresponds to 40 - 60 cm H<sub>2</sub>O pressure, which is recommended by the manufacturer, while the yellow zone indicated a pressure of <40 cm H<sub>2</sub>O and the red zone indicates a pressure of >70 cm H<sub>2</sub>O [17]. Pressures in the green zone may be higher than “just-seal” pressures and may also cause distension of surrounding soft tissue as well as mucosal injury. We propose that this particular aspect of the LMA® Protector™ Airway should be looked into further because of our case of isolated hypoglossal nerve injury.

**Table 2** is Manufacturer’s recommendation on selection of size of LMA® Protector™ [17].

The LMA Protector™ is inflated with sufficient air to prevent a leak during positive pressure ventilation. The cuff pressure should not exceed a pressure of 60 cm H<sub>2</sub>O. If a cuff pressure manometer indicator is not available, the device should be inflated with enough air to achieve a sufficient seal to permit ventilation without leaks.

It is imperative to ensure that periodic checking of cuff pressure during maintenance of anesthesia remains a crucial factor in prevention of nerve trauma [18]. Attention should also be paid to preventing cuff malposition in relation to the tongue or soft tissues from external factors such as traction from fixation methods. Despite the LMA® Protector™ Airway having an inbuilt Cuff Pilot™ technology, it is not entirely fail proof, as we have presented here a case of injury to the hypoglossal nerve. Fortunately, the injury that our patient sustained was neurapraxia with complete recovery following conservative management.

**Table 2.** Specification for LMA Protector™.

	Size		
	3	4	5
Airway Connector	15 mm male (ISO 5356-1)		
Inflation Valve	Luer cone (ISO 594-1)		
Internal Volume of Ventilatory Pathway	18 ml	22 ml	23 ml
Internal Volume of Drainage Pathway	31 ml	41 ml	42 ml
Nominal length of the ventilator pathway	16 cm	18 cm	20 cm
Nominal length of the drainage pathway	18 cm	21 cm	23 cm
Pressure drop	<0.8 cm H <sub>2</sub> O at 60 l/min	<0.5 cm H <sub>2</sub> O at 60 l/min	<0.5 cm H <sub>2</sub> O at 60 l/min
Cuff pressure maximum	60 cm H <sub>2</sub> O	60 cm H <sub>2</sub> O	60 cm H <sub>2</sub> O
Min. interdental gap	28 mm	32 mm	32 mm

In our knowledge, this is the first reported case of unilateral hypoglossal nerve injury after the use of the new LMA® Protector™ Airway. Potential preventive measures to address the postulated mechanisms of injury include consideration to down-sizing the device for Asian patients who tend to have smaller jaws for their weight range, and routine cuff pressure monitoring with manometry could possibly decrease the incidence of hypoglossal nerve injury after surgery especially when the duration of surgery is anticipated to be prolonged.

### Statement

This case was presented as a poster at the Euroanaesthesia Conference 2018 in Copenhagen (Poster title: Unilateral Hypoglossal Nerve Palsy after the use of a novel Supraglottic Airway Device; 01AP03-8).

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Published with the written consent of the patient.

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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