British Journal of Anaesthesia **95 (3)**: 420–3 (2005)
doi:10.1093/bja/aei187 Advance Access publication July 8, 2005

BJA

Case Report

Lingual nerve injury associated with the ProSeal laryngeal mask airway: a case report and review of the literature

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We present a case of lingual nerve injury that was associated with use of the ProSeal laryngeal mask airway during shoulder replacement in a 61-yr-old male. We also review other cases of cranial nerve injury, most of which were associated with use of the classic laryngeal mask airway. In principle, the frequency of cranial nerve injuries can be reduced by avoiding insertion trauma, using appropriate sizes, minimizing cuff volume, and early identification and correction of malposition.

Br J Anaesth 2005; **95**: 420–3

Keywords: equipment, laryngeal mask airway; nerve, damage

Accepted for publication: April 22, 2005

Cranial nerve injuries are well-recognized complications of laryngoscopy and tracheal intubation[1 2] and face mask ventilation.[3–5] Recently, these have also been reported in association with extraglottic airway devices. Injuries to the lingual,[6–10] hypoglossal[11–15] and recurrent laryngeal nerve[16–23] have been reported with the classic laryngeal mask airway (LMA®),[†] and to the lingual[24 25] and glossopharyngeal nerve with the cuffed oropharyngeal airway (COPA).[24] However, most of these injuries were thought to be related to suboptimal use of the LMA. The ProSeal™ LMA is a relatively new device with a large, wedge-shaped cuff to improve the seal.[26] There is one report of hypoglossal[27] and one report of recurrent laryngeal nerve injury[28] with the ProSeal LMA. We present a case of lingual nerve injury lasting 15 days associated with optimal use of the ProSeal LMA; in addition, we review the literature.

Case report

A male patient of age 61 yr, height 174 cm, weight 74 kg and ASA II underwent elective shoulder replacement in the semi-beach chair position. He had a past medical history of hypothyroidism, for which he was on replacement therapy, and had gastro-oesophageal reflux roughly once a week. On examination the airway was Mallampati grade 1. Anaesthesia was induced with propofol 180 mg. Face mask ventilation was easy. A ProSeal LMA, size 5, lubricated with a water-based gel was easily inserted by an experienced user (G.C.) at the first attempt using the digital technique. The cuff was inflated with air 20 ml and fixed to the face with adhesive tape, as recommended by the manufacturer.[29] The mid-portion of the bite block was within the oral cavity. Care was taken to ensure that the tongue was not trapped between the bite block and the teeth. The head was placed on a head ring in the neutral position and held firmly against the table with adhesive tape across the forehead. The oropharyngeal leak pressure was 25 cm H_2O and there was no air leak from the drain tube at this pressure. A size 14 Fr gastric tube was easily inserted via the drain tube at the first attempt, and a trace of clear fluid was suctioned from the stomach. Anaesthesia was maintained with sevoflurane 1–2% and nitrous oxide 66% in oxygen. Neuromuscular blockers were not given. The lungs were ventilated with a tidal volume of 8–10 ml kg^{-1} and peak airway pressures of 16–20 cm H_2O using a fresh gas flow of 3 litre min^{-1} in a circle anaesthesia breathing system. Air was withdrawn from the cuff approximately every 30 min, so that the tension in the pilot balloon was similar to that at the start of the procedure.[30] There were no adverse events during the maintenance of anaesthesia or emergence from it. In particular, there were no episodes of hypoxia, hypercarbia, gastric insufflation or displacement. Haemodynamic parameters

[†]LMA® is the property of Intavent Ltd.

remained within normal limits. The head and neck was not moved during the procedure. The ProSeal LMA was removed with the cuff semi-inflated when the patient opened his mouth to verbal command. There was no visible blood on the surface of the cuff at removal. The ProSeal LMA was *in situ* for a total of 2.5 h. Immediately after the operation, the patient noticed a 2 cm area of numbness to touch and taste on the left side of the tip of the tongue, which was confirmed on examination. All other cranial nerves were intact. The area of numbness started to improve after 8 days and was back to normal by 15 days. There were no other sequelae.

Discussion

On search of the literature, we found five reports of lingual nerve injury, six of hypoglossal nerve injury and 11 of recurrent laryngeal nerve injury (Table 1). All but two reports were in adults.[15 23] All but two reports were with the classic LMA.[27 28] The onset of symptoms ranged from immediately after anaesthesia to 48 h after surgery. One injury resolved within an hour[17] and another had not resolved after 18 months and required thyroplasty.[22] One injury required a cricothyrotomy to prevent aspiration.[28] Both unilateral and bilateral injuries have been reported. In one patient, the LMA was inserted only briefly before the patient was intubated and it may not have been the cause.[14] Potential predisposing factors included use of nitrous oxide,[6–13 16–19 21–23 27 28] using an LMA that was too small,[6 7 9–12 14 16–22 28] the lateral position,[10–12] extreme head side rotation,[15] anticoagulants,[12] rheumatoid arthritis,[11] ankylosing spondylitis,[12] calcinosis, Raynaud phenomenon, [o]esophageal dysmotility, sclerodactyly, and telangiectasia (CREST) syndrome,[28] overinflation of the cuff,[20 21] lidocaine lubricant,[17] cervical epidural,[11] inexperience,[21] difficult insertion[14] and alternative insertion techniques.[21]

The most probable cause for cranial nerve injuries associated with LMA is a pressure neuropraxia from the tube (lingual) or cuff (hypoglossal and recurrent laryngeal). The lingual nerve is at risk of compression as it enters the mouth below the inferior border of the superior constrictor and continues against the periosteum of the mandible posterior to the third molar, the hypoglossal nerve as it crosses the hyoid bone, and the recurrent laryngeal nerve as it enters the larynx, where it passes deep to the lower border of the inferior constrictor.[31] The lingual nerve injury usually presents as loss of taste, and sensation over the anterior tongue, hypoglossal nerve injury as difficulty in swallowing and recurrent laryngeal nerve injury as dysarthria, stridor or postoperative aspiration. Other possible causes are a stretch neuropraxia from head/neck/body positional changes, a chemical neuritis by use of the wrong lubricant or cleaning fluid, and local inflammation because of insertion trauma.[31]

Two predisposing factors common to most of the reported cases were that LMA size was too small and that nitrous oxide was used. If the LMA is too small there is increased frequency of malposition and a tendency for the clinician to overinflate the cuff in an attempt to improve the efficacy of the seal.[32] If nitrous oxide is used, it rapidly diffuses

Table 1 Cranial nerve injury after use of the LMA. *TURP, transurethral resection of prostate; D&C, dilatation and curretage. †Aspiration occurred. ‡Treated with thyroplasty after 12 months. §Required a cricothyrotomy to prevent aspiration; #ProSeal LMA. Table modified from reference 41 with permission from Elsevier

Authors	Age (yr)	Weight (kg)	Sex	ASA	Surgery*	Operation time (min)	LMA size	N_2O used	Onset of symptoms	Location of injury	Recovery time
Lingual											
Ahmad and Yentis[6]	25		M	I	Varicose veins		4	Yes		Right	
Laxton and Kipling[7]	42	54	F	I–II	Laparoscopy	35	3	Yes	Few hours	Left	>4 months
Ostergaard *et al.*[8]	73		M		TURP	140		Yes		Unilateral	>6 months
Majumder and Hopkins[9]	27		F	II	Wrist	20	3	Yes	Recovery	Bilateral	6 weeks
Gaylard[10]	40		M	I	Shoulder	60	4	Yes	24 h	Unilateral	2 months
Current	61	74	M	II	Shoulder	150	5	Yes	Immediate	Unilateral	15 days
Hypoglossal											
Nagai *et al.*[11]	62	36	F	III	Shoulder	180	3	Yes	8–12 h	Right	1 week
King and Street[12]	55		M	III	Humerus	25	4	Yes	4 h	Left	8 days
Stewart and Lindsay[13]	54	83	M	I	Knee	45	5	Yes	Immediate	Bilateral	6 weeks
Umapathy *et al.*[14]	46		M	II	Sinus		4		6 h	Left	6 weeks
Sommer *et al.*[15]	15	88	M	I	Ear	180	4	No	Immediate	Bilateral	4 weeks
Trumpelmann and Cook[27]	28		M		Lower limb	210	5#	Yes	12–24 h	Left	4 months
Recurrent laryngeal											
Morikawa[16†]	38	51	F	I	Cholecystectomy	90	3	Yes		Left	14 days
Inomata *et al.*[17]	45	41	F	II	Hysterectomy	97	3	Yes	Immediate	Bilateral	1 h
Lloyd Jones and Hegab[18]	39	72	M	I	Lower limb	30	4	Yes	Recovery	Left	1 week
Daya *et al.*[19]	63		M	I	Hip	55	4	Yes	48 h	Left	6 weeks
Daya *et al.*[19]	64		F	I	Hysterectomy	60	3	Yes	48 h	Left	5 months
Cros *et al.*[20†]	19	67	M	I	Inguinal hernia	90	4	Yes	Few hours	Right	2 months
Cros *et al.*[20]	54	52	F	I	D&C, breast	60	3	Yes	12–24 h	Right	>6 months
Brimacombe and Keller[21]	74	83	M	II	Cystoscopy	60	3	Yes	Few hours	Left	>3 months
Lowinger *et al.*[22‡]	44		M	I–II	Varicose veins	50	4	Yes	24 h	Left	>18 months
Sacks and Marsh[23]	4	17	M	III	Lower limb	90	2	Yes	Emergence	Bilateral	24 h
Kawauchi *et al.*[28§]	71		F	III	Upper limb	120	3#	Yes	12–24 h	Unilateral	>2 months

into the cuff of reusable LMA devices, causing an increase in intracuff pressure.[33] A notable difference between our case and most of the previous cases was that the LMA device was used optimally. It was inserted by an experienced user and the insertion was atraumatic. The size of LMA, cuff volume and fixation technique were appropriate, and any increases in intracuff volume due to diffusion of nitrous oxide were minimized by intermittent withdrawal of air. An example of malposition would be the cuff sitting in the oral cavity.[34]

Our patient had five factors that may have contributed to the injury: he was in a non-supine position; the head was firmly taped to the table; he was undergoing shoulder surgery; nitrous oxide was used; and the procedure was prolonged. The first four factors may have increased the compressive and/or stretching forces within the oral and pharyngeal cavities, and the fifth factor would have allowed the injury to develop. In principle, the risk of injury for the ProSeal LMA may be greater than the classic LMA, as it is more difficult to insert[35] and the larger cuff will be in contact with a greater portion of the oral and pharyngeal cavities. However, the risk of injury may be smaller as mucosal pressures are lower than the classic LMA for a given seal pressure.[36] Also, malposition is less likely with ProSeal LMA as it can be easily detected. We consider that ProSeal LMA was correctly positioned in our case since there was no drain tube air leak during positive pressure ventilation, the gastric tube was inserted easily, and the mid-portion of the bite block was within the mouth.[37] Our case suggests that a correctly positioned ProSeal LMA can occasionally cause a cranial nerve injury.

Cranial nerve injuries are a well-established but rare complication of face mask ventilation (facial,[3] lingual[4] and greater occipital[5]) and laryngoscope-guided tracheal intubation.[1 2] There are also two reports of cranial nerve injury with the cuffed oropharyngeal airway: one involving transient bilateral lingual and glossopharyngeal nerve injury[24] and another a transient unilateral lingual nerve injury.[25] There have been no reports of glossopharyngeal nerve injury with the LMA. The glossopharyngeal nerve may be vulnerable to compression as it passes between the superior and middle constrictor muscles near the hyoid bone. Interestingly, one study reported a 1% incidence[38] and another a 2% incidence[39] of tongue numbness lasting 10–15 min, but no neurological testing was performed. There are no reports of cranial nerve injuries with other LMA or extraglottic airway devices.

Cranial nerve injuries usually present within 48 h of surgery and resolve spontaneously over a period of weeks or months. Differentiating between recurrent laryngeal nerve injury and arytenoid dislocation[20 40] is sometimes difficult, but can be facilitated by use of computer tomographic scanning and stroboscopic examination.

In summary, we present a case of lingual nerve injury after a shoulder replacement in a 61-yr-old male that was associated with the optimal use of ProSeal LMA. We also review 20 other cases of cranial nerve injury, most of which were associated with suboptimal use of the classic LMA. In principle, the frequency of cranial nerve injuries can be reduced by avoiding insertion trauma, using appropriate sizes, minimizing cuff volume, and early identification and correction of malposition.

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