

# Vocal cord paralysis following orthognathic surgery intubation

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## ABSTRACT

The incidence of recurrent laryngeal nerve paralysis following short-term oro-endotracheal intubation for any surgical procedure is very rare. The diagnosis becomes very difficult if the surgical procedure may alter the vocal characteristics following surgery. We report a case of a 24 year-old healthy male patient who developed prolonged hoarseness which developed after having undergone a bimaxillary orthognathic surgical procedure. Following surgery, the patient's complaints of hoarseness and mild coughing on taking thin liquids were investigated with the assistance of the otolaryngology voice department. A flexible fiberoptic laryngoscopy and videostroboscopy showed a partial paralysis of the left vocal cord suggesting damage to the left recurrent laryngeal nerve. The recovery was gradual and resolved without any intervention in approximately 6 weeks. Prolonged change or loss of voice quality following an orthognathic surgical procedure, as discussed in this case, when associated with difficulty in swallowing thin or thick liquids warrants a thorough investigation and can be managed at times with observation alone.

**Keywords:** Oro-endotracheal intubation, orthognathic surgery, prolonged hoarseness, recurrent laryngeal nerve paralysis

## INTRODUCTION

Surgery of the maxillofacial region involves sharing the airway. The first tracheal intubation for surgery was performed by MacEwen in 1878 for a patient requiring mandibular resection. Endotracheal intubation is currently accepted as a routine effective life-saving ventilation technique,<sup>[1]</sup> but in spite of the frequent use of tracheal intubation for both short-term events such as surgery or for long-term ventilatory support, complications still occur.<sup>[2]</sup> The dentition, esophagus, pharynx, the temporomandibular joint, and trachea may be injured in performing tracheal intubation or the tube itself.<sup>[2]</sup>

The larynx plays important roles in respiration, deglutition, and phonation. The recurrent laryngeal nerve innervates all the intrinsic laryngeal muscles except the cricothyroid muscle, and thereby regulates coordinated movements of the vocal fold.<sup>[3]</sup> Among the numerous pathologic disorders affecting the head, neck, and thorax regions resulting in recurrent laryngeal nerve paralysis, post-intubation incidences are also reported in the literature.

There are various reports mentioned in the literature on the effects of LeFort I osteotomy with maxillary movement and Bilateral Sagittal Split osteotomy with either setback or advancement of the mandible, on the articulation, resonance, velopharyngeal function and voice, as expected from the fact that both these procedures alter the shape of the vocal tract.<sup>[4]</sup>

In this case report, we are presenting a case of a 24 year-old male patient who returned with the complaint of hoarseness of his voice 2 weeks after a 2- piece LeFort I surgery with maxillary advancement and a Bilateral Sagittal Split osteotomy with mandibular setback procedure. The surgery was uneventful and was performed under general anesthesia with endotracheal intubation.

## CASE REPORT

A healthy 24 year-old male presented to the Oral and Maxillofacial Surgery Department at Tufts Medical Center for evaluation and treatment of dental malocclusion with skeletal facial discrepancy

by his orthodontist. The patient was diagnosed with masticatory dysfunction secondary to maxillary hypoplasia and transverse discrepancy as well as mandibular prognathism resulting in a severe class III malocclusion and elected to undergo orthognathic surgery for its correction. Before the surgery, he underwent leveling and alignment of both maxillary and mandibular arches and removal of all four third molars. The preoperative evaluation and work-up were performed by the surgical team and planned for a 2-piece Lefort I osteotomy for maxillary advancement of 3mm, a bilateral sagittal split osteotomy for mandibular setback of 6mm, an advancement genioplasty of 8mm and maxillo-mandibular fixation (MMF).

Two weeks prior to the procedure, he underwent a preoperative evaluation by the consultant physician and the concerned anaesthetist and was medically cleared by his primary care physician. On our preoperative assessment, the patient weighed 89 kg, was alert, awake, and oriented to person, place, and time. He denied any cardiovascular, pulmonary, renal, hepatic, gastrointestinal, genitourinary, hematologic, endocrine, or psychiatric disorders. He denied taking any medications or had no known reported drug allergies. Pertinent social history included being a fourth-year medical student with a supportive family structure, social alcohol use, and no tobacco or other illicit substances.

Intravenous access was obtained in the preoperative holding area and the patient was transferred to the operating room. Intravenous induction was performed by the anesthesia team and the patient was easily intubated through the right nares with a number 8 size nasoendotracheal tube which was taped at the 29 cm mark by the oral and maxillofacial surgery team. Bilateral breath sounds and capnography confirmed tube placement. The patient underwent a 2-piece Lefort I osteotomy for advancement of 3 mm, a Bilateral Sagittal Split osteotomy for setback of 6 mm, an advancement genioplasty of 8mm and fixation of the osteotomized segments with 2.0 mm Titanium miniplates and 6.0 mm long titanium screws, followed by maxillo-mandibular fixation with elastics without complication. The surgical procedure lasted 3 hours 56 minutes. Based on the clinical evaluation of the patient at the conclusion of the procedure, we noted positive hemostasis at all incision sites and significant postoperative edema of the face and oral cavity and made the decision to keep the patient intubated and sedated overnight in the post-anaesthesia care unit (PACU). The patient was extubated the following morning at 7 am without complications. The remaining postoperative course in the hospital, a 2-day stay, was uneventful and the patient was discharged home and followed up in the oral and maxillofacial surgery clinic 1 week postoperatively. At the 1-week postoperative check, the patient noted features suggestive of mild bilateral paresthesia of cranial nerve V<sub>3</sub> distribution and was optimizing his nutritional intake. Neither the patient nor his family observed any change in voice during the period that the patient was on MMF. At the 2 week postoperative evaluation, maxillo-mandibular fixation was removed. Two days after MMF removal we received a call from the patient's father with questions about changes in the quality of his son's voice, as the patient and his family noticed a change in his voice soon after the MMF was removed and the patient started speaking. We evaluated the patient and confirmed hoarseness of his vocal quality and noted mild coughing when taking thin liquids. He had no difficulty with swallowing thicker

consistency preparations or any dyspnea. The otolaryngology voice department at Tufts Medical Center was consulted for evaluation of vocal cord function. The otolaryngology service performed a flexible fiberoptic laryngoscopy that showed normal abduction and adduction of the right true vocal cord, normal abduction of the left true vocal cord but very limited adduction. This left the patient with significant glottal incompetence and secondary muscle tension dysphonia. At that time the patient was offered a temporary vocal fold injection to help with his hoarseness but denied having the procedure at that time. We continued to follow the patient on a weekly basis, and 6 weeks postoperative the hoarseness completely resolved without medical or surgical intervention.

## DISCUSSION

Voice production is a function of many systems including the respiratory, neuromuscular, endocrine and others; and requires harmony and coordination between these factors.<sup>[5]</sup>

Tracheal intubation is one of the main factors behind the evolution of both anesthesia and surgery but complications from the use of endotracheal intubation still occur. Although most serious manifestations are seen after a prolonged intubation, even short-term endotracheal intubation of approximately 1 day can adversely affect laryngeal and vocal function.<sup>[1]</sup> Short-term vocal changes such as roughness, decreased affect and intensity of the vocal signal are consistently associated with general anesthesia because they are readily perceived by the clinicians and moreover, tend to resolve in 12-72 hours unless substantial damage has occurred such as arytenoid dislocation, vocal cord granulomas, or recurrent laryngeal nerve paralysis.<sup>[5]</sup> Authors found a significant increase in the incidence of hoarseness, vocal fatigue, loss of voice, and throat clearing 2 hours after general anesthesia, the magnitude and frequencies of which, however, were almost back to normal within 24 hours.<sup>[5]</sup>

Minor injury to the airway resulting in a transient hoarseness is no longer considered as a complication post-intubation, with incidence as high as 30%. The reasons cited for the above include: mucosal injury from high-pressure cuffs, pressure from relatively stiff tracheal tubes on the posterior pharyngeal wall, arytenoid cartilages and vocal cords, and the use of lubricant gels and topical local anesthetic ointments.<sup>[2]</sup>

Vocal cord paralysis is a relatively common and often overlooked condition that can be difficult to diagnose based on the laryngeal examination alone.<sup>[6]</sup> Unilateral vocal cord paralysis manifests as hoarseness, occasional liquid aspiration and as airway obstruction in bilateral cases, thus adversely affecting the patient's quality of life.<sup>[3]</sup> Recurrent laryngeal nerve paralysis (RLNP) can be caused by inflammatory, neoplastic, cerebrovascular, or degenerative disorders of head, neck and thorax region, among which malignant tumors and trauma, including surgery, are reported to be the most frequent causes. A significant proportion of these cases, ranging between 1.5% and 41.3%, have an idiopathic etiology. Vocal cord dysfunction resulting from recurrent laryngeal nerve neuropraxia is common after long-term intubation as for long-term ventilation needs.<sup>[2]</sup> An incidence of 0.0042% was encountered in a study of 475 patients who underwent

short-term endotracheal intubation, where only 2 patients were diagnosed to have RLNP.<sup>[7]</sup> It is thought to arise secondary to the neuropraxia compression of the recurrent laryngeal nerve by the cuff of the tracheal tube as it enters between the arytenoid and cricoid cartilages. Excessive or poorly distributed cuff pressure and placing the tracheal tube immediately below the vocal cords rather than distal are said to increase the risk.<sup>[2]</sup>

In a classic study, Van Lierde *et al.*,<sup>[4]</sup> investigated changes in the voice articulation following mandibular advancement with BSSO procedure. He hypothesized that articulation would change since the majority of consonants and vowels are produced by active variations in tongue position and constriction relative to the mandible and maxilla. As the surgical procedure of BSSO may alter the shape of the vocal tract, changes in resonance characteristics may occur. It is hypothesized that the objective vocal quality and the perceptual evaluations of the voice characteristics after orthognathic surgery remain relatively stable as the surgical procedure does not involve laryngeal tissue.

The present case report emphasizes the clinical dilemma that a clinician might face, observing the change in voice quality following an orthognathic surgical procedure especially when the procedure was being performed under endotracheal intubation. The change in voice quality in the presented case was due to the injury sustained to the recurrent laryngeal nerve during endotracheal intubation.

Post-intubation RLNP is known to have a favourable prognosis, with reported recovery of vocal cord mobility in 68.4% of patients.<sup>[3]</sup> If vocal cord paralysis does not recover in several months, laryngeal surgery may be indicated.<sup>[8]</sup>

The influence of factors such as intubation tube diameter, the size of the patient's larynx, length of intubation, and patient's smoking history on the incidence of RLNP and prognosis are still unclear and further research is warranted.

Regarding transient dysphagia with thin liquids, the hydration

should preferably be performed through an intravenous line.<sup>[1]</sup>

## CONCLUSION

The vocal changes experienced by patients shortly after endotracheal intubation are common, transient, and usually not significant. Although a change in resonance characteristics after double-jaw surgery is expected since the alteration of the jaw positioning alters the shape of the vocal tracts, a hoarseness of voice which does not improve within 24-48 hours and which may or may not be associated with intermittent aspiration with liquid food items, as seen in the case presented, should motivate the clinician to thoroughly investigate the reasons of voice alteration.

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