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<기술 보고서>

컴퓨터단층촬영술을 이용한 수술 후 편측 성대마비의 진단보고

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Finding Report of Unilateral Vocal Cord Paralysis Using Computed Tomography

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Abstract VCP (Vocal Cord Paralysis) is rare but one of most serious complications related to endotracheal intubation. This report is a clinical experience of radiography and laryngeal EMG (Electromyography) assessment for the VCP. A 50-year-old woman with hoarseness, which was occurred after urethral diverticulum excision was examined by laryngoscopy. As a result of laryngoscopy, VCP was observed in left side of her vocal cord, and then recurrent laryngeal nerve damage was detected with additional CT (Computed tomography) scan and laryngeal EMG. After that, the vocal cord movement was recovered as normal state with regular conservative treatment for the 6 months.

Key Words: Computed tomography, Electromyography, Endotracheal intubation, Hoarseness, Vocal cord paralysis
중심 단어: 성대마비, 컴퓨터단층촬영술, 쉰소리, 근전도검사, 기관내삽관

Ⅰ. Introduction

Endotracheal intubation is a routine procedure for anesthesiologists, but there may be various complications. Among them, sore throat and hoarseness are the most common complications. If a patient with hoarseness is caused by a unilateral loss of the vocal cord abduction, it could be the recurrent nerve injury caused by endotracheal intubation. We report a case of unilateral vocal cord palsy after endotracheal intubation. The neck computed tomography (CT) and laryngeal electromyography (EMG) showed recurrent laryngeal nerve damage. In this report, all the possible causes are discussed.

Ⅱ. Case

A 54-year-old woman (152.5 cm, 62.5 kg) was scheduled for an excision of urethral diverticulum. Preliminary investigations indicated that she was previously healthy, with preanesthetic evaluation being unremarkable.

The patient was monitored with electrocardiography, pulse oximetry, noninvasive blood pressure and neuromuscular transmission measurements. After proxygenation with 100% oxygen for 3 minutes, general anesthesia was induced with 100mg propofol. After successful ventilation with a facial mask, 50mg rocurunium was administrated. Mask ventilation was applied with 100% oxygen and sevoflurane. After

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confirming that train of four was 0, orotracheal intubation was performed using a 7.0-mm internal diameter endotracheal tube (Mallinckrodt, Covidien Inc., USA) under direct laryngoscopy without any difficulties. The endotracheal cuff was inflated with air using 5 ml syringe and the pressure manometer and the cuff manometer was not used. The endotracheal tube was fixed at 21-cm on the mouth angle and general anesthesia was maintained with sevoflurane and fentanyl. The patient was positioned for lithotomy and there was no positional change at the end of the operation. During operation, there was a hypotensive period for 30 minutes due to significant blood loss, and mean blood pressure was 52-57 mmHg. After the operation, extubation was performed, and there was no blood on the endotracheal tube. Time for operation and anesthesia was 235 minutes and 260 minutes, respectively.

One day after the surgery, the patient complained of sore throat and hoarseness. There was no tendency to aspirate but these symptoms lasted for 5 days and laryngoscopic examination was performed. The otolaryngologist observed left vocal cord paralysis by laryngoscopy [Fig. 1]. To evaluate the cause of unilateral vocal cord paralysis, a laryngeal electromyography (EMG) and neck CT were done. Laryngeal EMG demonstrated left recurrent laryngeal neuropathy by confirming the absence of recruitment of motor unit action potential in the left thyroarytenoid muscle. And neck CT revealed the dilatation of the left piriform sinus with air and medial deviation of the aryepiglottic fold with thickening suggesting recurrent laryngeal nerve palsy [Fig. 2]. There is no detectable lesion like dislocation and subluxation of the cricothyroid or cricoarytenoid joints on CT at larynx. Based on CT and EMG findings, the patient was confirmed by unilateral vocal cord paralysis caused by left recurrent laryngeal neuropathy. And the otolaryngologist decided to observe the patient without treatment.

Four weeks after the extubation, the left vocal cord showed improved movement above 60% compared with initial paralytic movement by laryngoscopic examination. Six month later in outpatient follow up, the left vocal cord's movement was fully recovered without specific treatment.

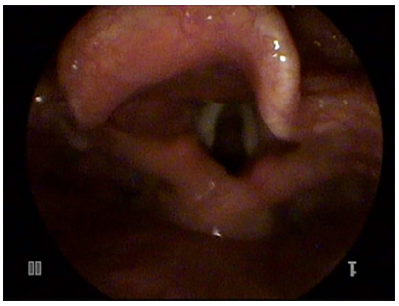
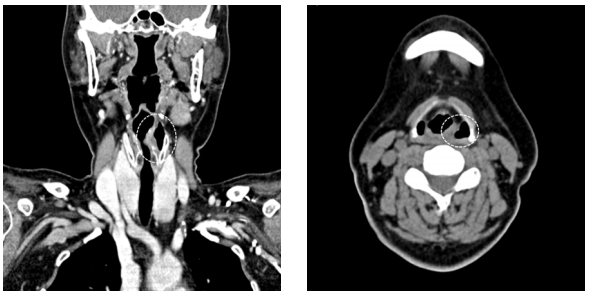


Fig. 1 Flexible laryngoscope showed left paralyzed vocal cord at lateralized position.



(a) (b)

Fig. 2 Axial image (a) and coronal image (b) of computed tomography in the neck showed the dilatation of the left piriform sinus with air and medial deviation of the aryepiglottic fold with thickening suggesting recurrent laryngeal nerve palsy (circular dotted point).

Ⅲ. Discussion

Airway injuries associated with endotracheal intubation are well-known complications of general anesthesia. The most common laryngeal injuries are vocal cord paralysis, granuloma, arytenoid dislocation and hematoma[1]. Vocal cord paralysis following endotracheal intubation is rare complication with an incidence of 0.077%, and is one of the most serious complications related to endotracheal intubation. The clinical symptoms of unilateral vocal cord paralysis are hoarseness and aspiration. Despite recovery of vocal fold motion, some patients might still have significant voice problem[2].

The causes of postoperative vocal cord paralysis could be classified into mechanical and neurological factors. Treatment depends on the cause of the vocal cord paralysis, and CT helps to determine the cause. The signs of vocal cord paralysis at CT are ipsilateral

piriform sinus dilation, medial rotation and thickening of the aryepiglottic fold, and ipsilateral laryngeal ventricle dilation[3]. Recurrent laryngeal nerve paralysis may be caused by head, neck and thoracic diseases, and imaging methods including CT, magnetic resonance imaging and ultrasonic echography can improve the diagnosis rate of hidden cause[4]. CT can also be used to determine the therapeutic effect of autologous fat augmentation of vocal fold[5] and helps to assess prognosis with EMG[6]. According to an economic study conducted by Peter F. Svider, routine CT scanning in the evaluation of idiopathic unilateral vocal cord paralysis is cost-effective[7]. In addition to CT, laryngeal EMG may be performed to assist decision-making about diagnosis, prognosis, and subsequent rehabilitative procedure[8, 9]. The commonly held assumption is that vocal cord paralysis is due to recurrent laryngeal neuropathy, but clinical management could be changed if laryngeal EMG results implied superior laryngeal neuropathy, cricoarytenoid joint fixation, myopathy and stroke. In this case, laryngeal EMG showed no recruitment of motor unit action potential at left thyroarytenoid muscle which meant left recurrent laryngeal neuropathy.

Mechanical injuries like dislocation and subluxation of the cricothyroid or cricoarytenoid joints may result from traumatic endotracheal intubation or using a unsuitable tube for a long time[10]. In this case, endotracheal intubation was performed without any difficulties. Even more there was no evidence of laryngeal trauma like abnormal arytenoid shape, bleeding or inflammation in postoperative laryngoscopic examinations and CT findings. So the mechanical factor did not seem to be a cause of the occurrence of unilateral vocal cord paralysis.

The neurological factor is associated with recurrent laryngeal nerve paralysis. There are some causes of postoperative recurrent laryngeal nerve paralysis, likewise direct surgical trauma, stretching of the nerve as a result of traction on certain distant organs and compression of the nerve by endotracheal cuff[10, 11]. In this case, the potential for the former cause is very low given the surgical site and position. If taking into consideration the latter cause, an unsuitable endotracheal tube position due to positional change or the high pressure of the endotracheal tube's cuff may be the cause of the nerve compression.

The anterior branch of the recurrent laryngeal nerve passes between the lamina of the thyroid cartilage and trachea. So, if the endotracheal tube is placed too shallow, the cuff can compress the anterior branch of the recurrent laryngeal nerve and damage the nerve. Therefore, the cuff's position of the endotracheal tube should be located at more than 15 mm below the vocal cords in order to avoid expansion of the cuff in the larynx[12]. According to a study from the USA for estimation of the optimum length of endotracheal tube insertion in adult, the insertion length of 21 cm for women represented a high incidence of endobronchial intubation[13]. So we could assume that the possibility of shallow position of endotracheal tube is very low in this case.

Insufficient microcirculatory supply to the recurrent nerve and its peripheral branches in the larynx due to the cuff pressure may cause ischemic neuronal degeneration and subsequent recurrent nerve paralysis and vocal cord immobility[14]. It is also well understood that intracuff pressure will be increased if nitrous oxide would be used for anesthetic gas because of diffusing ability into the cuff. In this case, nitrous oxide was not used, but intracuff pressure was not checked. So the nerve damage due to over-inflated cuff cannot be ruled out.

Furthermore, Seegobin reported that over-pressurized endotracheal cuff impaired mucosal blood flow in patients who were normotensive, mean arterial blood pressure having been 85 mmHg[15]. In this regard, it is probable that capillary perfusion pressure which supplies tracheal mucosa and surrounding nerve became low level during hypotensive period in our case if endotracheal cuff was already over-pressurized.

Although we considered all the possible causes of unilateral vocal cord paralysis into consideration, there were no obvious factors which could make a sense clearly. Treatment of unilateral vocal paralysis is conservative management with obervation, and

steroid can be helpful to prevent dyspnea if edema on vocal cord or postextubation stridor is present[16]. Fortunately, the patient was completely recovered from the unilateral vocal cord paralysis. But we should always remind that even if the endotracheal intubation is somewhat routine to anesthesiologists, it can cause complications such as vocal cord paralysis which should be diagnosed and managed promptly.

Ⅳ. Conclusion

Vocal cord paralysis is rare but one of the most serious complications related to endotracheal intubation. There are known risk factors of vocal cord paralysis but the cause of vocal cord paralysis is unclear. But sudden blood loss and unstable hemodynamics might be another possibility of vocal cord paralysis. To evaluate the cause of unilateral vocal cord paralysis, CT scanning and laryngeal EMG is essential. To prevent vocal cord paralysis, anesthesiologists should pay close attention to avoid traumatic intubation and to monitor position and intracuff pressure of endotracheal tube. And, early diagnosis and treatment should be performed, if suspected.

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