Case Report
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Anesthetic management for emergency tracheostomy in patients with head and neck cancer: a case series

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Tracheostomy is a surgical procedure that is commonly used to treat upper airway obstruction. In particular, patients with head and neck cancer may require elective or emergency tracheostomy because of airway obstruction due to massive bleeding of the intraoral tumor mass and rapid growth of the tumor mass in the neck area. Here, we report four cases of tracheostomy in patients with head and neck cancer with narrowed airway space and difficulty in breathing. Based on these cases and a literature review, we recommend that oral and maxillofacial surgeons and dental anesthesiologists should cooperate closely and determine the appropriate timing to perform definitive airway management for such patients during palliative treatment, along with continuous evaluation of tumor location, risk of recurrence, and airway involvement.

Keywords: Airway Management; Airway Obstruction; Emergencies; Head and Neck Neoplasms; Tracheostomy.

INTRODUCTION

Airway maintenance is one of the most crucial procedures for patients undergoing oral and maxillofacial surgery. In patients with head and neck cancer and maxillofacial trauma, several factors affect the airway, including underlying disease, airway accessibility, and surgical technique. Head and neck cancer increases the risk of upper airway obstruction and is the most common cause of emergency and elective tracheostomy [1,2]. Tracheostomy is a procedure performed in cases of acute airway obstruction that involves opening the anterior wall of the trachea to facilitate breathing [3]. In patients with head and neck cancer, tracheostomy is usually performed simultaneously with mass resection and reconstruction to secure an airway in preparation for postoperative swelling or bleeding [1]. In addition, it is sometimes performed to prevent airway obstruction due to tumor growth. In general, endotracheal intubation is attempted first, and cricothyrotomy is performed if intubation fails or intubation is difficult because of the mass [3-7]. Therefore, emergency tracheostomy under local anesthesia is frequently performed for airway management in patients with head and neck cancer for whom endotracheal intubation cannot be performed [7,8]. The main purpose of a tracheostomy is to safely rescue patients with airway difficulties.

This paper reviews four cases of patients who underwent tracheostomy for prevention of airway obstruction caused by massive bleeding in the tumor mass or neck mass

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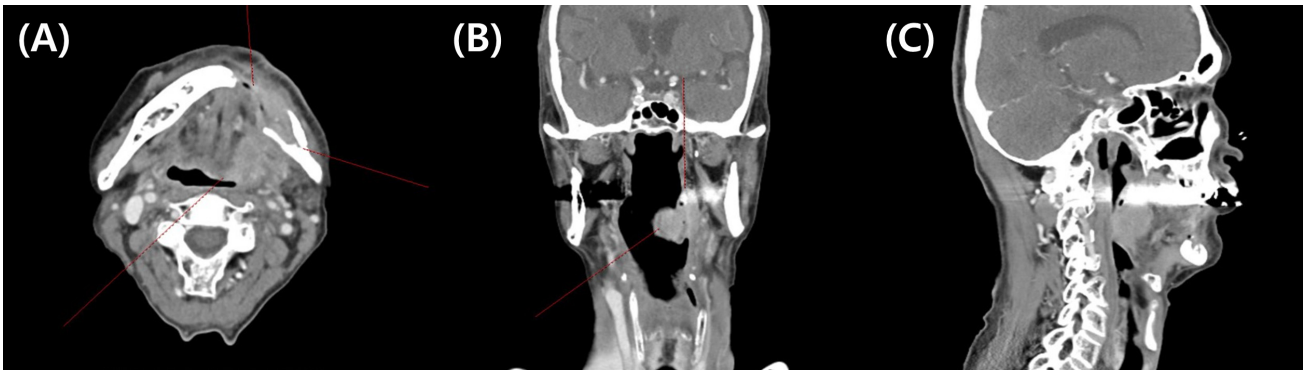

Fig. 1. Enhanced CT view of Case 1 patient shows recurrent squamous cell carcinoma (red indicators) in the oropharyngeal wall, tongue, left mandible and maxilla, resulting in narrowing of the airway space. (A) Axial view, (B) Coronal view, (C) Sagittal view. CT, computed tomography.

growth. In addition, we review previous literature reporting emergency tracheostomy of patients with head and neck malignancy and discuss it in view of dental anesthesiology.

CASE PRESENTATION

This report was approved by the Institutional Review Board (IRB) (ERI22036) and written informed consent was obtained from all the patients.

1. Case 1

An 80-year-old man with a body mass index (BMI) 16.12 (height, 170 cm; weight, 46.6 kg), was admitted to the Department of Oral and Maxillofacial Surgery, Seoul National University Dental Hospital (SNUDH) with persistent bleeding and pain in the left mandible affected by osteoradionecrosis. He had a medical history of rheumatoid arthritis, and had undergone several mass resection surgeries and postoperative radiotherapy of the left mandible for squamous cell carcinoma. Biopsy and radiographic imaging examination using enhanced computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET)-CT confirmed the diagnosis of recurrent squamous cell carcinoma at multiple sites (Fig. 1). While waiting for a consultation for palliative radiotherapy or chemotherapy in the Seoul National University Hospital (SNUH) outpatient clinic, active bleeding occurred from the mass of the oropharynx, and the patient complained of dyspnea. The patient was transferred to the emergency room, and rapid sequence intubation was attempted using a stylet. However, because of limited mouth opening caused by radiation-induced tissue fibrosis, poor vision due to bulky mass, and heavy bleeding, all three intubation trials by emergency medicine specialists failed. Emergency cricothyroidotomy was performed under muscle relaxation induced by etomidate 20 mg and rocuronium 60 mg. When saturation and vital signs were stable, the patient was transferred to the operating room under sedation with midazolam, with transfusion of packed red blood cells (RBC) and platelet pheresis. CT revealed extensive lesions extending to the left posterior palate, oropharyngeal wall, tongue, and buccal cheeks. The lesion on the lateral tongue invaded the posterior genioglossus muscle and had an anteroposterior diameter of 27 mm. The displaced tongue, owing to an enlarged mass on the tongue base, resulted in narrowing of the oropharyngeal airway.

Preoperative hemoglobin (Hb) and hematocrit (Hct) were 9.6 g/dL and 30.2%, respectively. The patient showed limited mouth opening of about one finger, and his neck extension was limited due to previous radiation therapy.

When the patient arrived in the operating room, routine patient monitoring (pulse oximetry, end-tidal CO_2, ECG lead II with continuous ST-segment analysis, and

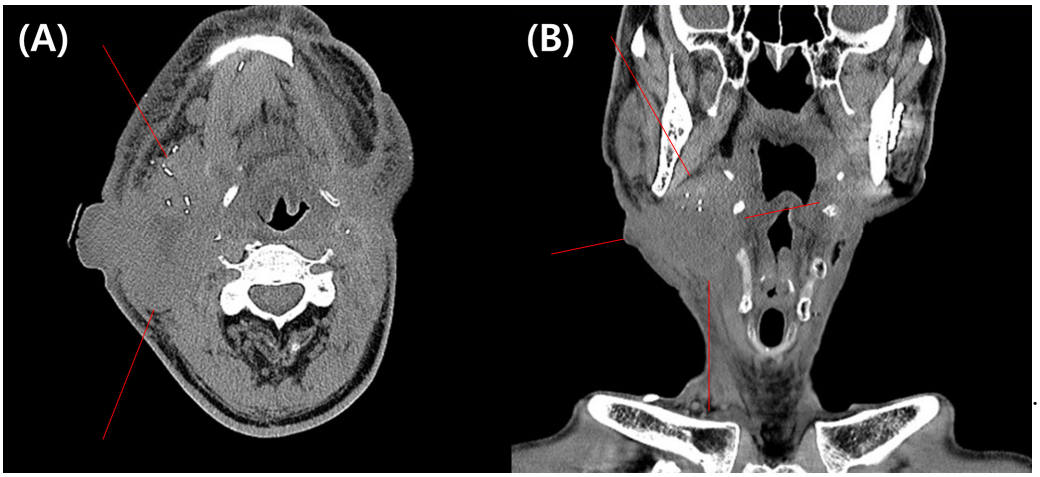

Fig. 2. Enhanced CT view of Case 2 patient obtained on admission with the complaint of dyspnea and orthopnea demonstrates a severely narrowed airway space. Recurrent squamous cell carcinoma (red indicators) in right submandibular and cervical area. (A) Axial view, (B) Coronal view. CT, computed tomography.

noninvasive blood pressure [BP] monitoring) and bispectral index (BIS) were performed. The preoperative BP was 169/99 mmHg, heart rate (HR) was 119 beats/min, and pulse oximetry oxygen saturation (SpO_2) was 100%. General anesthesia (GA) was induced with 10 mg of sevoflurane and rocuronium. Anesthesia was maintained using an O_2/air mixture and adjusted for sevoflurane. The respiratory rate was adjusted to maintain the partial pressure of end-tidal CO_2 at 30–35 mmHg. Emergency tracheostomy with an #8.5 cuffed T-canular was performed by an oral and maxillofacial surgeon. The skin incision at the previous cricothyroidotomy site was sutured. The total anesthesia time was 85 min and the total surgery time was 35 min. During the operation, one unit of packed RBC was transfused. After one week of care, he was transferred to the hospice ward and died four months later.

2. Case 2

A 61-year-old man with BMI 22.84 (height, 170 cm; weight, 66 kg) underwent partial maxillectomy, marginal mandiblectomy, and reconstruction of a latissimus dorsi free flap for squamous cell carcinoma of the left buccal cheek, 1.5 years ago. Subsequently, postoperative concurrent chemoradiotherapy was performed; however, necrosis of the mandible and harvested latissimus dorsi occurred due to radiotherapy complications. Partial mandibulectomy and re-reconstruction with a latissimus dorsi free flap were performed; however, regional neck metastasis and distant lung metastasis were observed eight months later. The patient underwent systemic chemotherapy, but progressive growth of the neck lesion began to compromise the airway space. The mass eventually caused airway obstruction, and the patient complained of orthopnea and dyspnea (Fig. 2).

Despite the symptoms associated with airway obstruction, there were concerns about acute toxicity and tumor cell dissemination. Therefore, while observing the patient's condition, we planned to perform an emergency tracheostomy if the dyspnea worsened. Two weeks later, the patient visited the emergency room again at SNUH, with severe orthopnea and dyspnea arising from the stridor. The pharyngeal airway was narrowed by a swollen mass surrounding both carotid spaces. In particular, the airway at the thyroid cartilage level was obstructed, except for a 1–2 mm narrow gap on CT. After the vital signs stabilized, he was admitted to the SNUDH, and a tracheostomy was planned. Because of airway narrowing, intubation was expected to be impossible; therefore, we decided to proceed with monitored anesthesia care (MAC). The patient showed limited mouth opening of approximately two fingers due to

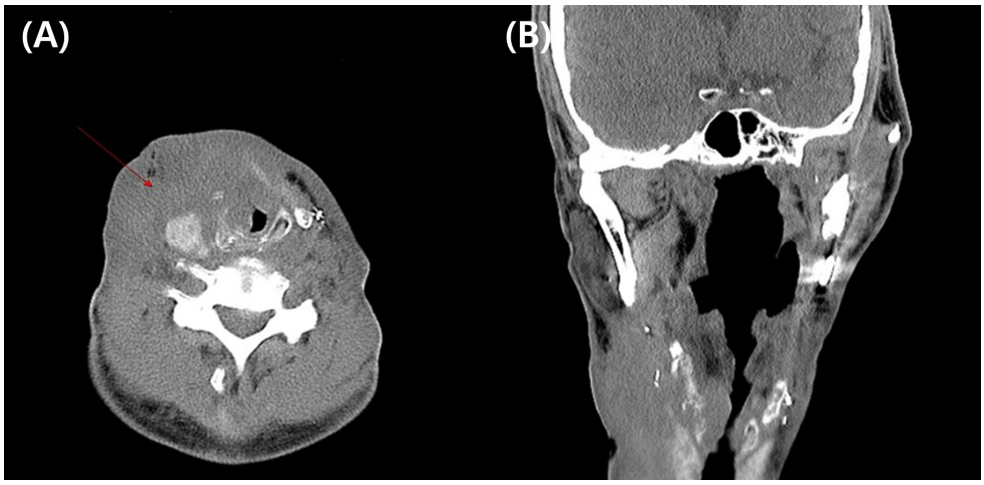

Fig. 3. Enhanced CT view of Case 3 patient obtained when the patient visited for dyspnea and orthopnea demonstrates a severely narrowed and deviated airway space due to he growth of recurrent squamous cell carcinoma centered on a recurrent lesion (a red arrow) in the right cervical region. (A) Axial view, (B) Coronal view. CT, computed tomography.

previous surgery and radiation therapy, and his neck extension was within the normal range.

The preoperative BP was 90/79 mmHg, HR was 125 beats/min, and SpO_2 was 98%. Emergency tracheostomy was performed at the bedside with MAC. The BP and HR were controlled with phenylephrine, and additional pain control with fentanyl was performed. A #8.5 cuffed T-canular was inserted, and the patient was transferred to ICU. The total duration of surgery was 25 min. The patient's orthopnea and dyspnea resolved, and he was discharged after two weeks. Palliative chemotherapy was then restarted; however, the patient died two months later.

3. Case 3

A 55-year-old man with BMI 17.99 (height 170 cm, weight 52 kg), was admitted to the Department of Oral and Maxillofacial surgery, SNUDH with dyspnea. Two years ago, he had undergone partial maxillectomy, orbital floor reconstruction, and reconstruction with a rectus abdominis free flap after three sessions of neoadjuvant chemotherapy. However, after one year following surgery, metastasis to the cervical lymph node recurred thrice in two years. Selective neck dissection was performed each time, along with postoperative concurrent chemoradiotherapy. Despite these treatments, multiple metastases occurred three months later, and palliative chemotherapy was administered. However, a persistent progressive disease pattern was observed, which resulted in airway compression and hospitalization due to dyspnea (Fig. 3). The patient showed limited mouth opening of about one finger and limited neck extension due to previous surgery and radiation therapy. The mass in the visceral space of the right neck and near both sides of the thyroid cartilage displaced the trachea to the left. The airway narrowed as the lesion extended downward, particularly at the vocal cord level. At the site where the mass invasion was the most severe, the remaining airway, except for approximately 5 mm in diameter, was obstructed.

As in Case 2, tracheostomy under MAC was planned because intubation was expected to be difficult due to airway obstruction. The preoperative BP was 104/70 mmHg, HR was 77 beats/min, and SpO_2 was 99%. Fentanyl was administered for pain control. A #7.5 cuffed T-canular was inserted, and the patient was transferred to the ICU after surgery. The patient's dyspnea resolved, and was discharged without abnormalities in saturation or vital signs. The patient died five months later.

4. Case 4

A 63-year-old man with BMI 15.94 (height, 168 cm; weight, 45 kg) was admitted to the Department of Oral

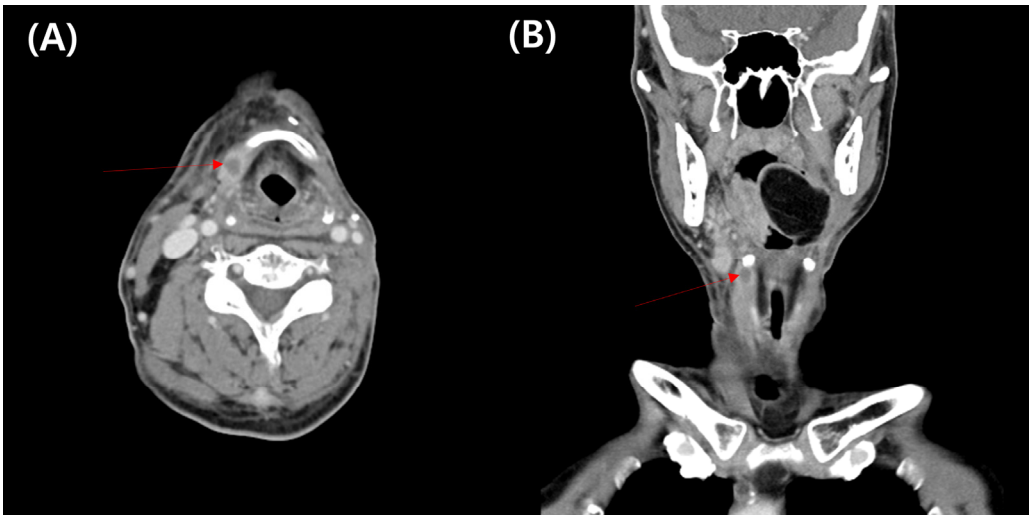

Fig. 4. Enhanced CT view of Case 4 patient obtained after the occurrence of local recurrent and distant metastasis reveals enhancing lesion of squamous cell carcinoma at inferior to right hyoid greater horn(red arrows). (A) Axial view, (B) Coronal view. CT, computed tomography.

and Maxillofacial Surgery, SNUDH, for managing pain and dyspnea due to advanced oral squamous cell carcinoma. Two years ago, after two sessions of neoadjuvant chemotherapy, he had undergone mass resection with hemiglossectomy, selective neck dissection, reconstruction with a rectus abdominis free flap, and tracheostomy for squamous cell carcinoma of the left posterior tongue. One month later, a modified radical neck dissection and further resection with mandibulectomy were performed for ipsilateral lymph node metastasis. After successful weaning from the tracheostomy and recovery of the intraoral and neck operation site, the patient was discharged. Postoperative radiation therapy was administered to the left tongue and neck region. However, seven months later, recurrent malignancy lesion on thyrohyoid muscle inferior to right hyoid greater horn was identified on enhanced CT and PET-CT images (Fig. 4). In addition, distant metastases to the lung and right gluteus maximus muscle were observed. The patient continued to complain of difficulty in breathing and stiffness of the tongue after radiotherapy. Objective airway narrowing was not severe when compared to the subjective symptoms of dyspnea. However, despite chemotherapy, the lesion in the strap muscle layer inferior to the right hyoid bone continued to grow. As palliative chemotherapy was performed, tracheostomy was planned in preparation for an emergency due to airway obstruction and bleeding from the advanced cancer lesion. Despite repeated radiation therapy, the patient's mouth opening was approximately three fingers, and neck extension was within the normal range.

The preoperative BP was 153/85 mmHg, HR was 100 beats/min, and SpO_2 was 100%. Tracheostomy was performed under MAC with a continuous remifentanil infusion. The remifentanil infusion was adjusted to maintain a BIS of 75–90. O_2 inhalation was administered via a nasal prong at 3 L/min, and SpO_2 was maintained at 100% during surgery. A #8.0 cuffed T-canular was inserted, and the patient was transferred to the recovery room. The total anesthesia time was 50 min and the total surgery time was 25 min. The dyspnea resolved, and he was transferred to a hospice hospital and continued to receive palliative chemotherapy.

DISCUSSION

In cases of upper airway obstruction where endotracheal intubation is expected to be very difficult or impossible, securing an airway through tracheostomy is sometimes necessary [2]. Airway obstruction and associated symptoms due to upper airway involvement are frequent [9]. Among the indications for tracheostomy defined by

the American Academy of Otolaryngology (AAO), many symptoms can be present in patients with advanced malignancy of the head and neck [3-5]. Upper airway obstruction with previous neck surgery or previous irradiation to the neck obstructing mass and/or inflammation in the pharynx are common events when the mass increases during the process of receiving radiotherapy or concurrent chemoradiotherapy as a definitive treatment, or during the palliative period (cases 2, 3 and 4). Although alleviation of the airway using tracheostomy cannot change the poor prognosis, it can improve the patient's quality of life for the remaining period [1]. Therefore, oral and maxillofacial surgeons should continuously evaluate the tumor location, risk of recurrence, and airway involvement to determine the appropriate timing and provide definitive airway management.

The optimal time to perform tracheostomy remains controversial. Some recommend performing definitive airway management before starting chemoradiotherapy; however, others recommend performing it when airway obstruction patterns and symptoms are clearly present. Tracheotomy is difficult because of acute toxicity and complications due to the cytotoxicity of chemotherapy drugs as well as the potential risk of stromal tumor dissemination. In addition, soft tissue swelling and secretion may occur with chemoradiation therapy, making surgical airway management difficult [3,5]. Therefore, whether and when to perform tracheostomy should be carefully determined. Langermand et al. suggested an algorithm for airway management in head and neck cancer patients and recommended airway management such as debulking and tracheostomy with modality evaluation before chemoradiotherapy initiation [3]. According to Crosher et al., tumor size and location are important factors in deciding whether to perform tracheostomy [10,11]. In addition, the patient's age and general condition, particularly the chest condition, are also important factors to consider [10].

The anesthesiologist and surgeon must cooperate in advance and plan the anesthesia and surgical methods based on the patient's general condition, airway condition, and possible complications [12]. Because the anesthesiologist and surgeon must share the airway, access to the airway by the anesthesiologist is limited in the event of an airway emergency during tracheostomy [12]. Hence, proper cooperation is necessary to thoroughly prepare for and respond to various situations.

Prior to anesthesia induction, patient evaluation, including preoperative examination and airway evaluation, is essential. Because it is an emergency, it is important to perform prompt airway evaluation, including ASA classification [13,14]. A review of CT images is very important in determining the characteristics of the mass, such as the location and size of the tumor mass, whether there is potential bleeding, and the correlation with the airway internal diameter, particularly the severity of obstruction [15,16]. In addition, it is necessary to check whether radiation therapy was performed after surgery, which was accompanied by tracheostomy during the previous head and neck cancer surgery.

Depending on the patient's condition, GA, conscious sedation, or tracheostomy under local anesthesia can be planned. During anesthesia induction, coughing, laryngeal spasm, and complete airway obstruction are dangerous complications that threaten the patient's life [17,18]. The more severe the tumor-induced airway obstruction, that is, the narrower the airway, the more difficult it is to ventilate the patient at the start of GA induction and the greater the risk [17]. A comfortable environment can be created with an injection of a neuromuscular blocker because there is no cough reflex, laryngeal spasm, or muscle movement during surgery. However, failure of intubation due to the inability of the endotracheal tube to pass into the airway should also be anticipated. In the above cases, CT scans of the remaining cases, except Case 1, showed an enlarged mass and nearly total airway obstruction due to cancer recurrence. When intubation was attempted, it was expected that it would be difficult to pass the tracheal tube if the mass was hard. It could be even more dangerous if bleeding or spasm occurs during insertion. Therefore, conscious sedation under

MAC was judged to be the safest approach.

In this case series, one of the considerable points of cooperation between surgeons and anesthesiologists was the provision of MAC for tracheostomy. For highly difficult airway cases, such as the above cases, appropriate sedation and analgesia, which do not cause respiratory depression, could be better than local anesthesia alone because anxiolysis and analgesia can provide more stable surgical conditions to surgeons as well as patients. To provide safe MAC, an experienced anesthesiologist chose sedatives or analgesics based on the patient's condition or required level of sedation. ECG, BP, HR, BIS, pulse oximetry, and capnography were used to monitor the patients' hemodynamic parameters, consciousness level, and respiratory status during surgery. We attempted to maintain an appropriate MAC to prevent bleeding and inadvertent injury to the adjacent structures during emergency tracheostomy. To rescue patients in emergency situations, we prepared airway devices such as laryngeal mask airway, I-gel, endotracheal tube, emergency cuffed cricothyrotomy catheter set, video-scope, fiberoptic bronchoscope, and ventilator setting.

In conclusion, for successful tracheostomy outcomes in patients with head and neck cancer, oral and maxillofacial surgeons and dental anesthesiologists must cooperate closely. It is important to plan anesthetic and surgical methods and prepare for possible emergencies in advance, while taking into consideration the anatomical location of airway obstruction, the patient's comorbidities, and whether there is an emergency.

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Seongji Cho: Conceptualization, Data curation, Writing - original draft
Seung-Hwa Ryoo: Supervision, Writing - review & editing

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