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Reconstruction of a Large Cricotracheal Defect Using a Sternocleidomastoid Myoperiosteal Flap : A Case of Locally Aggressive Papillary Thyroid Carcinoma with Tracheal Invasion

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갑상선 수술 후 흉쇄유돌근 근골막피판을 이용한 큰 기도 결손부 재건 1예

인제대학교 의과대학 해운대백병원 이비인후과학교실
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= **국문초록** =

기관을 침범한 갑상선 악성종양을 제거한 후에 성문하부에 비교적 큰 기관 결손이 발생할 수 있다. 단단문합술은 넓은 부위의 결손부를 재건하는 방법으로 널리 받아들여지고 있지만, 문합부 파열, 반회후두신경마비, 재협착 등의 합병증이 발생할 수 있다. 본 증례는 기도를 침범한 갑상선 유두암종을 제거한 후 윤상연골과 기관연골의 비교적 큰 결손부를 흉쇄유돌근 근골막피판을 사용하여 안전하게 재건한 사례이다. 55세 남자 환자가 기도를 침범한 갑상선 유두상암으로 내원하였으며 기도침범은 윤상연골(둘레의 약 30%)과 4개의 기관연골(둘레의 약 50%)을 해당하는 넓은 부위였다. 수술 전 기관절개술을 시행하여 주위 기관연골의 상태가 좋지 않아 단단문합술 시행 후 문합부 파열 가능성이 있다고 판단하여 흉쇄유돌근 근골막피판을 이용하여 재건하기로 계획하였다. 갑상선 절제술, 경부림프절 절제술, 흉쇄유돌근 근골막피판을 이용한 재건술을 시행하였으며 수술 후 12일째 별다른 문제없이 퇴원하였다. 환자는 수술 후 현재 22개월 간 기도 협착 등의 별다른 합병증 없이 지내고 있다. 흉쇄유돌근 근골막피판은 성문하부나 기관지 전외측벽의 비교적 큰 결손부를 재건하는 데 유용하게 사용될 수 있다.

중심 단어 : 기관 재건술 · 흉쇄유돌근 근골막피판 · 유두상 갑상선암.

Introduction

Subglottic tracheal defects can occur following surgical treatment of either subglottic stenosis or tracheal invasion of locally aggressive thyroid carcinoma, and reconstruction of these defects is challenging. During reconstruction, it is important to initially create a stable airtight barrier along the airway. Several methods of airway reconstruction have been reported : end-to-end anastomosis, autologous cartilage grafting, local flaps, and free flaps. The type of procedure chosen is influenced by the defect size, risk of complications, and the prognosis. End-to-end anastomosis is generally considered after resecting seven or fewer tracheal cartilage rings if the width of the defect is greater than 50% of the tracheal circumference. However,this method requires dissection of the soft tissues surrounding the tracheal cartilage, and there is a risk of recurrent laryngeal nerve injury and pexy rupture.

This case describes the reconstruction of a large cricoid and tracheal defect using a sternocleidomastoid(SCM) myo-

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periosteal flap following the removal of a papillary thyroid tumor invading the airway.

Case Report

A 55-year-old male presented to the pulmonology outpatient clinic with dyspnea. Bronchoscopic evaluation revealed an intraluminal protruding mass on the left anterolateral wall of the trachea below the glottis(Fig. 1). Pathology from the bronchoscopic biopsy diagnosed a papillary carcinoma. The patient was underwent tracheostomy and referred to the otolaryngology department for evaluation of thyroid. Physical examination revealed a 1×1 cm hard fixed mass on the anterior portion of the neck. Vocal cord movement was normal on indirect laryngoscopy. Ultrasonography(USG) of the left thyroid lobe nodule showed a 2.5×2.0×2.2-cm heterogeneous hypoechoic mass lacking a distinct boundary with the trachea indicative of malignancy. The fine needle aspiration cytology(FNAC) of the nodule was consistent with a papillary carcinoma without definite anaplastic change,which was consistent with the bronchial biopsy results. The *BRAF* exon 15 mutation was positive for c.1799T>A(Val600Glu). Computed tomography(CT) and Magnetic resonance imaging (MRI) showed an approximately 2.8×2.9 cm heterogeneous-enhancing mass in the left thyroid lobe with tracheal invasion. There was also suspected invasion of the left cricoid cartilage and endoluminal growth that resulted in significant tracheal lumen narrowing.The cervical lymph nodes were not significantly enlarged(Fig. 2A and 2B).

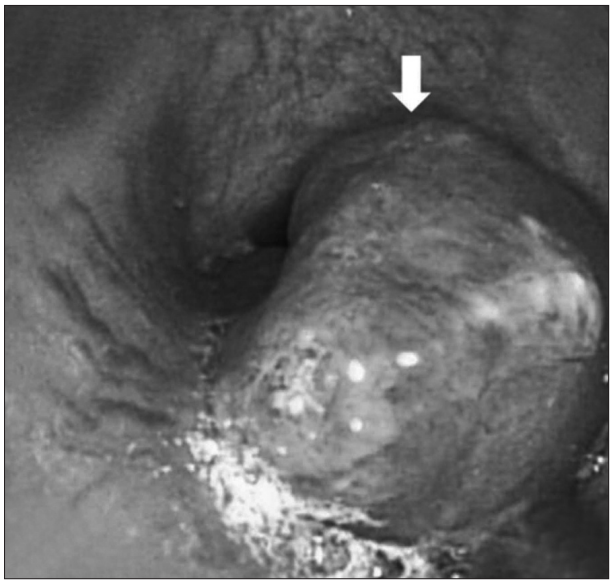

Fig. 1. Bronchoscopic findings. A protruding intraluminal mass(white arrow) located on the left anterolateral wall of the trachea below the glottis.

The patient underwent total thyroidectomy, bilateral central lymph node dissection, and ipsilateral selective neck dissection of levels II-IV. Wedge resection was performed on the tracheal rings with tumor invasion. The subglottic defect was greater than 50% of the tracheal circumference(the anterior position is considered 12 o'clock, the width of the defect extended from the 10 to 6 o'clock positions), 30% of the cricoid cartilage width(11 to 2 o'clock positions), and extended the length of four tracheal rings and the cricoid cartilage (Fig. 3B). The remaining portion of the tracheal rings was unhealthy and weakened due to previous tracheostomy. We harvested the SCM myoperiosteal flap cautiously to avoid injury to the subclavian vessel and lung. The periosteal flap of the SCM clavicular head was elevated from 4 o'clock to 8 o'clock(the most cephalic position of the clavicle is regarded as 12 o'clock). The initial incision was made using a knife, and the flap was elevated using a freer elevator. The harvested flap was rotated to the defect and closed, with the exception

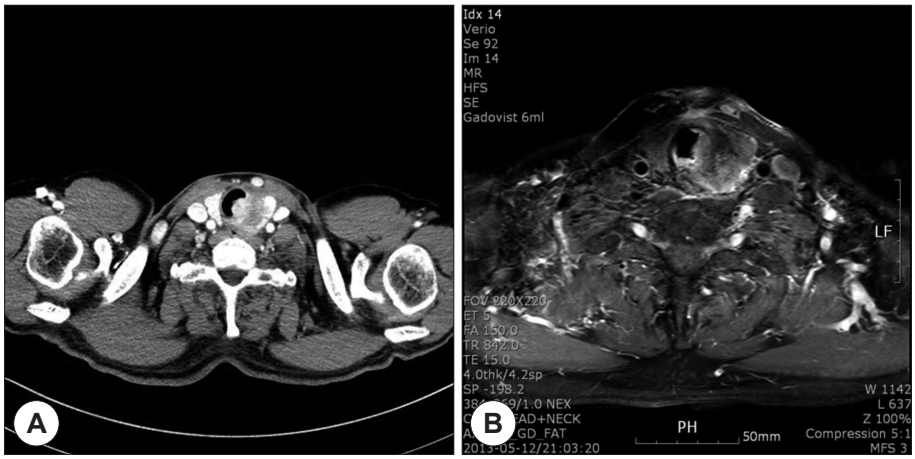

Fig. 2. Radiologic findings. A heterogeneous enhancing mass is located in the left thyroid lobe with tracheal invasion evident in the(A) axial view of contrast-enhanced CT, and an(B) axial view of gadolinium-enhanced T1-weighted MR images.

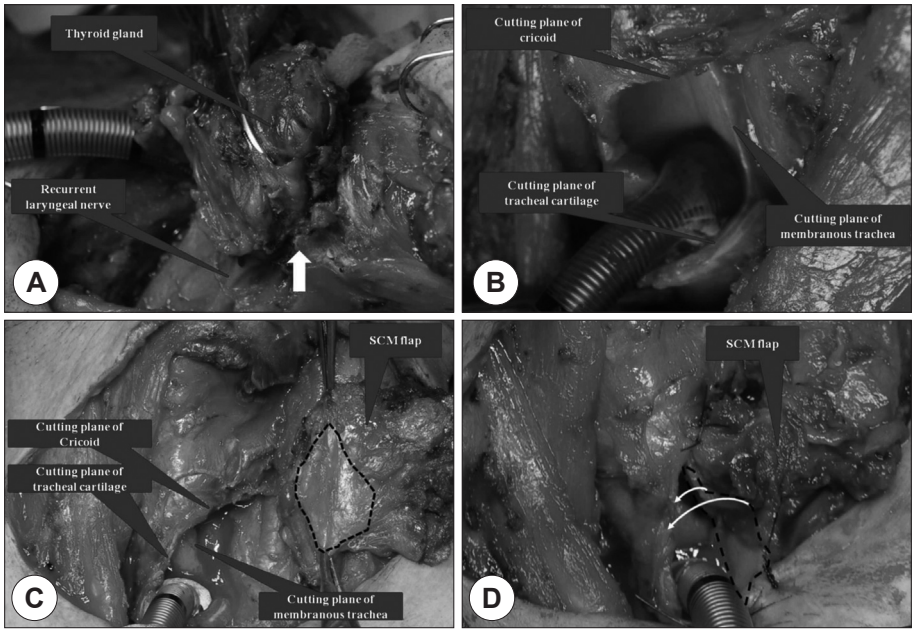

Fig. 3. Intraoperative findings. A : The tumor of the left thyroid lobe with cricoid cartilage and tracheal invasion(arrow). B : The subglottic defect consisting of greater than 50% of the tracheal circumference, 30% of the cricoid cartilage width, and the length of four tracheal rings and the cricoid cartilage. C : Harvesting the SCM myoperiosteal flap. D : Defect reconstruction using the SCM myoperiosteal flap.

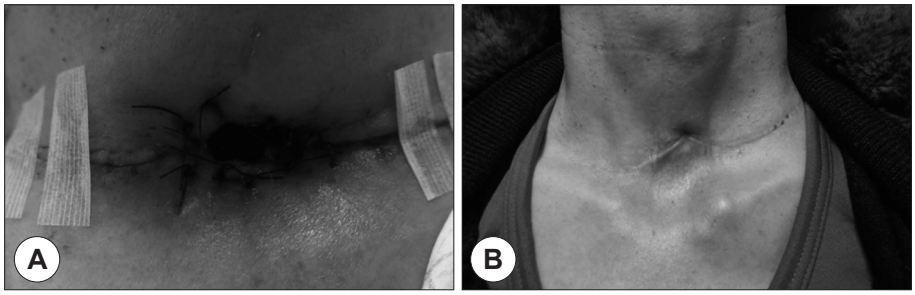

Fig. 4. Postoperative images. A : Tracheal fenestration 7 days following surgery. B : Healed tracheal fenestration 9 months following surgery.

of the tracheostoma, using VICRYL 4-0. The edge of tracheostoma was sutured with PROLENE 2-0 for fenestration(Fig. 3C and 3D).

On microscopic evaluation, the right lobe tumor was 0.3×0.2 cm, and the left lobe tumor was 3.0×2.0 cm. Both were histologically classic(M1) with elongated cells(M2). Extrathyroid extension(pT4) involved the sternothyroid muscle, trachea, and cricoid cartilage. Metastases were identified in one right paratracheal lymph node and one left cervical lymph node(total number of dissected nodes=18).

The negative pressure drain and tracheotomy tube were removed 4 and 9 days postoperatively, respectively. The patient was discharged after 12 days, and underwent radioiodine ablation. Postoperative stroboscopy after 3 months showed left vocal cord palsy with glottic insufficiency. The reconstructed SCM wall remained intact, and the airway was patent. Laryngoplasty injections(Rofilan®Rofil Medical International) were performed percutaneously under local anesthesia three and nine months postoperatively. A pinpoint sized tracheostoma was closed with 3-0 black silk 9 months postoperatively(Fig. 4B). The patient is alive and disease-free 22 months postoperatively, and maintains daily social interactions without significant problems. The Institutional Review Board of the Catholic Medical Center approved this retrospective study.

Discussion

One of the major prognostic factors of papillary thyroid cancer is the presence of extracapsular invasion of adjacent organs. With laryngotracheal invasion, a total thyroidectomy with laryngotracheal resection and lymph node removal is commonly performed. The most oncologically ideal method is to resect the tumor and surrounding tissue while leaving a cancer-free margin. Another option is to closely excise around the invaded tissues, and use postoperative adjunctive treatment to preserve essential functions such as swallowing, respiration, and vocalization.[1] This is only useful in cases with

restricted invasion of the superficial tracheal cartilage layer. Therefore, this was not a viable treatment option for this case due to the invasion of the tracheal inner mucosa or submucosa.

In this case, the subglottic defect was greater than 50% of the tracheal circumference, 30% of the cricoid cartilage width, and the length of four tracheal rings and the cricoid cartilage. When a large portion of the tracheal circumference is excised, end-to-end anastomosis would be the treatment of choice if the reconstructed length does not exceed 7 cm.[2] However, end-to-end anastomosis has several disadvantages. It requires bilateral soft tissue dissection adjacent to the trachea and the recurrent laryngeal nerve which risks injuring these structures. Also, the neck must be fixed during the 2 weeks following the operation to prevent pexy rupture. The pexy may fail if the remnants of the tracheal rings are unhealthy and weakened from a previous tracheostomy. In this case, the inferior border unaffected by the tumor was not in good condition due to tracheostomy tube insertion. Therefore, using sternocleidomastoid mucoperiosteal flap is considered to be more adaptable than end-to-end anastomosis. Lastly, the tube position in the tracheostoma must be reoriented for orotracheal intubation during the anastomosis, which is a cumbersome procedure. If artificial materials or autografts(auricular, nasal septum, or rib cartilage) are used, complications include granulation tissue formation, bleeding from artery erosion, or leakage from the reconstructed site resulting from inflammation.[3,4]

A SCM myoperiosteal flap was first described by Tovi, Gittot, and Friedman et al, and is widely used to reconstruct the subglottic airway. This flap is composed of the fibrous pliable clavicular periosteum, and is capable of creating an airtight, tension-free closure.[5,6] The periosteum is flexible enough to retain its original form. In a canine model, bone formation occurred in the periosteal flap 9 months following surgery, which provided a rigid airway framework and maintained a stable subglottic airway in the long term.[5,6] With ossification, the flexible airway becomes more rigid, enabling the periosteum to withstand pressure changes in the tracheal lumen.[7] This procedure is less invasive and easier to perform than end-to-end anastomosis, but results in a stable airway. Also, this procedure allows placement of stable, tension free airtight sutures even with unhealthy tracheal cartilage weakened by a previous tracheotomy. Neck flexion is unnecessary, and immediate resumption of oral feeding and other daily routines are possible in the early postoperative period. Tracheal defects less than 30% of the tracheal circumference are routinely reconstructed in many cases involving the thyroid. In this case, the defect was too large to support with a soft SCM myoperiosteal flap framework. Therefore, the stable lateral airway wall was stabilized with the SCM myoperiosteal flap while the anterior portion remained fenestrated for respiration. The lateral wall became stabilized over time, and the anterior fenestration had almost closed 9 months postoperatively.

A SCM myoperiosteal flap can be used for subglottic or tracheal reconstruction in cases with defects in the anterolateral tracheal wall greater than 50% of the tracheal circumference to provide a stable airtight airway.

References

1) No YH, Oh JH, Kim SW, Lee KD. *A Case of Window Resection and Secondary Reconstruction of the Trachea Invaded by Papillary Thyroid Carcinoma. Korean Journal of Otorhinolaryngology-Head and Neck Surgery. 2012;55:642.*
2) Czaja JM, McCaffrey TV. *The surgical management of laryngotracheal invasion by well-differentiated papillary thyroid carcinoma. Archives of Otolaryngology-Head and Neck Surgery. 1997;123:484-490.*
3) Furstoss JA, Toohill RJ. *Composite nasal septal autografts of the trachea. The Annals of Otology, Rhinology, and Laryngology. 1973; 82:831-837.*
4) Zalzal GH, Cotton RT, McAdams AJ. *The survival of costal cartilage graft in laryngotracheal reconstruction. Otolaryngology-Head and Neck Surgery: Official journal of American Academy of Otolaryngology-Head and Neck Surgery. 1986;94: 204-211.*
5) Friedman M, Grybauskas V, Toriumi DM, Kaplan A, Seiden A. *Reconstruction of the subglottic larynx with a myoperiosteal flap: Clinical and experimental study. Head and Neck Surgery. 1986; 8:287-295.*
6) Friedman M, Grybauskas V, Toriumi DM, Skolnik E, Chilis T. *Sternomastoid myoperiosteal flap for reconstruction of the subglottic larynx. The Annals of Otology, Rhinology, and Laryngology. 1987;96:163-169.*
7) Friedman M, Toriumi DM, Owens R, Grybauskas VT. *Experience with the sternocleidomastoid myoperiosteal flap for reconstruction of subglottic and tracheal defects: Modification of technique and report of long-term results. The Laryngoscope. 1988;98:1003-1011.*