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Title: Two cases of **glottic closure** for refractory aspiration pneumonia after vertical partial laryngectomy

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Abstract

Vertical partial laryngectomy is a well-established surgical procedure for early glottic cancers with acceptable functional and oncological outcomes. However, on a long-term basis, aspiration might be a serious problem with aging. Here we presented two cases of refractory aspiration pneumonia after vertical laryngectomy. Case 1: A 76-year old gentleman with a past history of malignant lymphoma treated by chemotherapy and radiotherapy had glottic cancer, which was treated by repeated vertical partial laryngectomies. Although glottic cancer had been well controlled, he started to suffer from refractory aspiration pneumonia. Since his cervical skin was very thin and hard and his general condition was poor, we employed modified Kano's method for **glottic closure**. Case 2: A 87-year old Japanese male had a past history of glottic cancer treated by radiotherapy and vertical partial laryngectomy. He was repeatedly hospitalized for severe aspiration pneumonia. At the age of 87, he had second primary oropharyngeal cancer. Kano's method was simultaneously performed at the time of resection of oropharyngeal cancer. Postoperative courses were uneventful without sign of leakage in both cases. The patients started oral intake 2 weeks after the surgery. They have been alive without aspiration pneumonia and

takes normal diet.

195 words / 200 words

Key Words: glottic closure, severe aspiration, laryngeal cancer,
Kano's method, vertical partial laryngectomy

Introduction

Repeated pneumonia may lead to a life-threatening event for patients with dysphagia. In general, patients are treated with swallowing rehabilitation using swallowing assisting foods. Surgical procedures such as laryngeal suspension and cricopharyngeal myotomy may be indicated to improve swallowing function and reduce risk of aspiration in selected cases. However, tracheostomy is required to prevent aspiration in refractory cases. In spite of the use of inflated tracheostomy cuff, some patients still may experience aspiration pneumonia. In addition, gastrostomy or nasogastric tube are often required for nutrition and patients are forced to abandon oral intake.

To prevent aspiration and enable oral intake in these situations, several surgical procedures have been reported including total laryngectomy, tracheoesophageal diversion, and **glottic closure** [1-3]. More recently, various safer and less invasive surgeries such as new **glottic closure** techniques, central-part laryngectomy, tracheal flap method [4-9] . Among them, we reported that Kano's method is reliable even in the patients with head and neck cancer treated by multidisciplinary therapy [5] . Based on our experience, we applied this method to two patients who had vertical partial laryngectomy after radiotherapy to prevent refractory aspiration pneumonia and enable oral intake of normal diet.

Surgical procedure of the Kano's method

We have previously reported surgical procedures [5] based on the method published in Japanese by Kano M, et al [4]. Therefore, here we show outline of the Kano's method (not for patients after partial laryngectomy), using the summary and schema (Fig.1). A vertical skin incision was made from the hyoid bone to the inferior margin of the cricoid cartilage. The strap muscles were carefully divided in the midline to expose the thyroid and cricoid cartilages. The perichondrium of the thyroid cartilages was peeled off and preserved (Fig.1a). The central parts of the thyroid and cricoid cartilages were widely removed. The cricopharyngeal muscles were detached from the cricoid cartilage to improve the passage of a bolus. A vertical incision was made along the anterior commissure to enter the laryngeal cavity (Fig.1b).

A horizontal mucosal incision was made along the upper edge of cricoid cartilage (Fig.1c). To close the glottis, the right and left incised vocal cords were sutured with 3-0 or 4-0 absorbable thread (Fig.1d). Then, a unilateral pedicled sternohyoid muscle flap was elevated (Fig.1e) to cover and reinforce the glottic closure site. A draining tube was inserted in the paratracheal space. (Fig.1f).

A large permanent tracheostoma was made with 3-0 Nylon thread at the level of the cricoid cartilage and the upper

tracheal ring for the intent of cannula-free management (Fig.1g). Finally, the remaining skin incision was closed (Fig.1h).

Case Reports

Case 1

76-year old Japanese male had a past history of malignant lymphoma treated by chemotherapy followed by radiotherapy (60Gy) to his bilateral necks in the previous hospital when he was 52 years old. At the age of 61, he had glottic cancer (T1bN0M0) and received vertical partial laryngectomy at the same hospital. After that, he moved in our area and was referred to our hospital. Since then, he had been followed up at our outpatient clinic for 10 years (Fig 2A). Then, he had second primary glottic cancer (T2N0M0) in the remaining right vocal cord at the age of 71. Encouraged by his strong will to preserve larynx, we performed repeated vertical partial laryngectomy. Surgical margins were pathologically negative of cancer and he achieved communicable vocal function and oral intake of a regular food without requiring supplemental nutrition, although glottic closure was insufficient (Fig.2B). While he had been followed up without recurrence for five years since the last vertical partial laryngectomy, he started to repeat aspiration pneumonia with age especially after he had pancreaticoduodenectomy for the

treatment of ampullary cancer at the age of 74. In spite of swallowing rehabilitation for about one year, the video-fluorography showed apparent barium aspiration, which was not exhaled due to degradation of laryngeal and tracheal sensation (Fig.3). At the age of 75, he had been administered to our affiliated hospital several times for the treatment of severe pneumonia and dyspnea. Finally, the patient and his family decided to accept glottic closure in order to prevent aspiration pneumonia. At first, we scheduled total laryngectomy since he had repeated partial laryngectomy. However, his cervical skin was very thin and hard due to previous radiation and repeated surgeries, suggesting high risk of postoperative laryngo-cutaneous fistula requiring reconstruction with deltopectoral (DP) flap or pectoralis major myocutaneous flap (PMMC).

Considering his local and general conditions, we decided to employ Kano's method. Surgical procedure was generally performed according to our previous report [5] and Fig1 but was modified in several points as follows. Since the central part of thyroid cartilage was already resected, we easily entered into laryngeal cavity by midline skin incision (Fig.4A, 4B). Then horizontal incision was made in the reconstructed vocal cords along the upper edge of the cricoid cartilage (Fig.4C). As vocal cords were reconstructed using cervical skin flap, reconstructed vocal cords were much thick and stout in comparison with normal

larynx. Thus, glottis was successfully closed with tight sutures (Fig.4D). Glottic closure was reinforced using bilateral pedicled sternohyoid muscles (Fig.4E). Finally, large tracheostoma was created (Fig.4F)

Postoperative course was uneventful without sign of leakage. The patient started oral intake 2 weeks after the surgery and was discharged soon later. He has been alive without episodes of aspiration pneumonia for 15 months. He takes normal diet 3 times per day and his body weight increased from 40 Kg to 45 Kg. Daily conversation is enabled using electrolarynx. Postoperative laryngoscopic imaging is shown in Fig.5.

Case 2

87-year old Japanese male had past histories of angina and vertebral fracture. At the age of 83, he had glottic cancer (cT2N0M0), which was treated by radiotherapy (74.4Gy). One year after the completion of radiotherapy, he had vertical partial laryngectomy for local recurrence (rT2N0M0). Surgical margins were pathologically negative. After surgery, he suffered from severe aspiration and was repeatedly hospitalized for aspiration pneumonia. Laryngo-cutaneous fistula had been left and he had been completely dependent on the percutaneous gastrostomy. Since he had almost lost vocal function, we recommended total laryngectomy to prevent aspiration in several times. However, he

refused further surgery at this time.

At the age of 87, he had second primary oropharyngeal cancer in soft palate (cT2N0M0). Although he and his family wanted to have surgical eradication, further increase in the risk of aspiration pneumonia was expected by the resection of soft palate would. Thus, we recommended a simultaneous surgery to prevent aspiration at the time of surgical resection of oropharyngeal cancer. Considering the poor general condition resulting from repeated pneumonia, we employed Kano's method instead of laryngectomy based on the experience of case 1. With his and his family's consents, Kano's method was simultaneously performed as in case 1 at the time of resection of oropharyngeal cancer. Postoperative course was uneventful without sign of leakage. The patient started oral intake 2 weeks after the surgery and was discharged soon later. He has been alive without episodes of aspiration pneumonia for 2 months.

Discussion

Vertical partial laryngectomy has been reported as a reliable conservative surgical procedure for early glottic cancers with acceptable functional and oncological results [10-11]. However, on a long-term basis, aspiration might be a serious problem due to declines in laryngeal sensation and cognitive function with age [12-13]. When these patients suffer from refractory severe

pneumonia, total laryngectomy has been indicated to prevent aspiration and enable oral intake of normal diet. However, high rates of postoperative complications such as salivary fistula have been reported in salvage total laryngectomy [14-15]. In addition, once formed, these postoperative complications often require several weeks of local treatment and/or reconstruction using DP or PMMC flap. In the present case, the cervical skin was very thin and hard due to previous radiation and surgeries. Besides, condition of the first patient was very poor due to refractory aspiration pneumonia and recent pancreaticoduodenectomy. Thus, we decided to apply Kano's method as a safer surgical technique to avoid postoperative complications.

As we expected, we easily entered into the laryngeal cavity, since the central part of thyroid cartilage was already resected. As the reconstructed vocal cords by the skin flaps were much thicker than normal glottic mucosa, glottis was strongly closed with tight sutures. Considering the severe local and general conditions, we reinforced the glottic closure using bilateral pedicled sternohyoid muscles, while unilateral pedicled sternohyoid muscle is usually used in original Kano's method [5]. After all, surgical procedure was completed smoothly and postoperative course was uneventful. The patient has been healthy without episode of aspiration pneumonia. He takes normal

diet and daily conversation is enabled by electrolarynx.

Although there might be a criticism that patients are still at a risk of primary laryngeal cancer in the remaining vocal cords, in this surgical procedure, remaining laryngeal mucosa is easily observed by laryngoscope and through tracheostoma. In addition, in case of recurrent or primary laryngeal cancer, the patient can be salvaged by total laryngectomy.

Taken together, the present cases suggested that the Kano's method may be an alternative for glottic closure in the patients with severe dysphagia after vertical partial laryngectomy.

Conclusions

We successfully performed the Kano's method in two patients after vertical partial laryngectomy. The present cases suggested that the Kano's method may be an alternative for glottic closure in the patients with severe dysphagia after vertical partial laryngectomy.

Presentation

A part of this study was presented in the 42nd Annual Meeting of The Society of swallowing and Dysphagia of Japan in March 2019 in Kurume, Japan.

Acknowledgment

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Conflict of interest

The authors have no conflict of interest related to this article to be disclosed.

Ethical statement

This study was performed in accordance with the Declaration of Helsinki. We have obtained written informed consent from both patients.

1644 words / 1800 words

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Legends of Figures

Figure 1. Surgical Procedure of Kano's method.

a) exposed thyroid and cricoid cartilages. asterisk: peeled perichondrium of the thyroid cartilage, b) Central parts of the thyroid and cricoid cartilages are removed and the laryngeal cavity is opened. white star: right vocal cord, c) red line: incision line of the subglottis, dotted line: upper edge of cricoid cartilage, d) Both sides of the upper vocal cord flaps are sutured with absorbable sutures. e) sternohyoid muscle flap was elevated. f) the sutured site was covered with sternohyoid muscle flap. g) suturing the permanent tracheostoma, h) The procedure of Kano's method was completed.

Figure 2. Laryngoscopic Imaging before glottic closure.

(A) Reconstructed glottis after 1st vertical partial laryngectomy (B) Reconstructed glottis after 2nd vertical partial laryngectomy with insufficient glottic closure

Figure 3. Preoperative Video-fluorography.

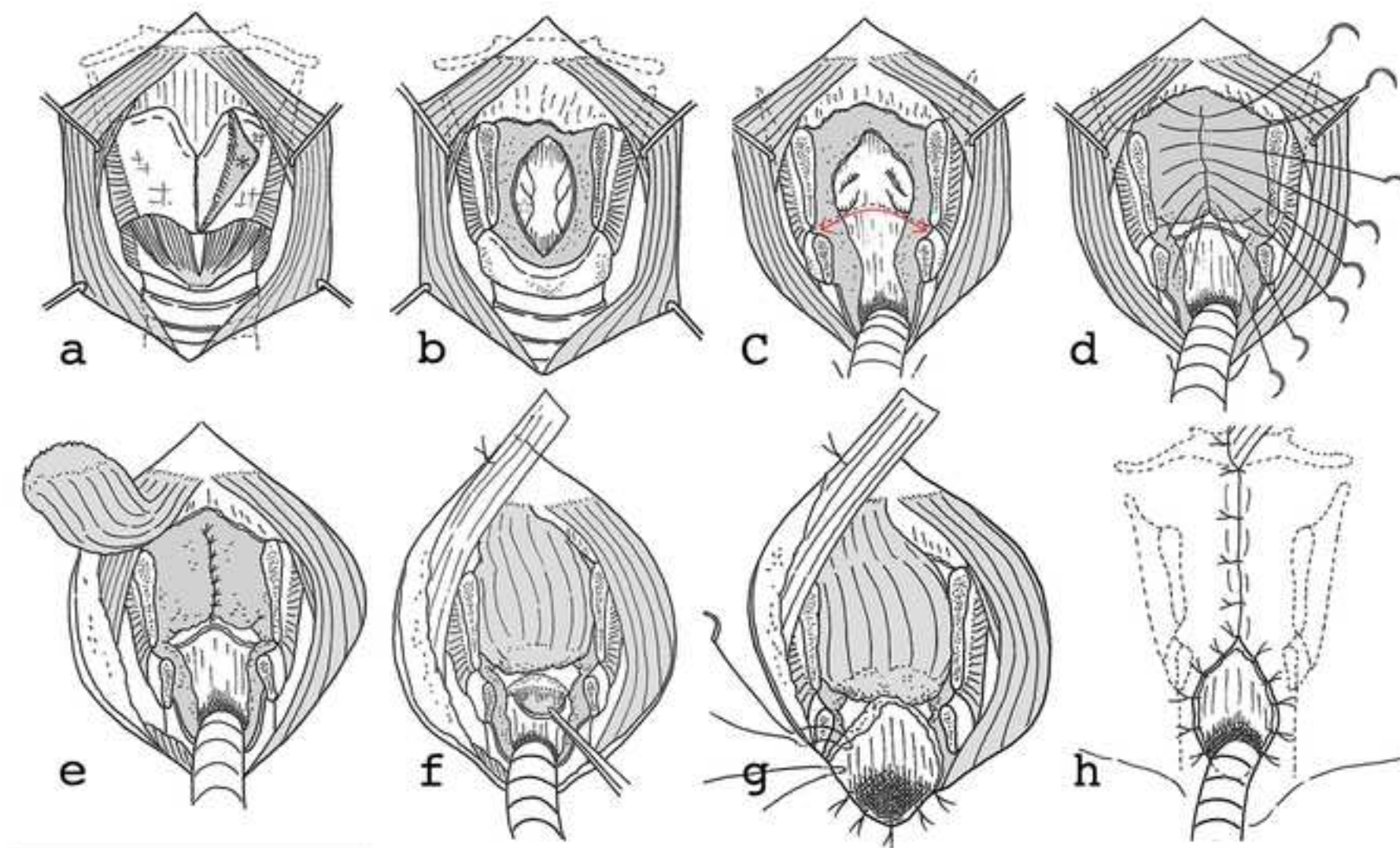
Video-fluorography showed barium aspiration. Laryngeal sensation was highly impaired and no coughing occurred.

Figure 4. Intraoperative Photograph of Modified Kano's method.

(A) Central part of thyroid cartilage was already resected to the same extent as resected by Kano's method. (B) A midline incision was made in the reconstructed vocal cords (skin flap) to open the laryngeal cavity. (C) Horizontal incision was made in the reconstructed vocal cords. (D) The upper thick skin flaps were successfully closed with tight sutures. (E) The sutured site was covered and reinforced by bilateral upper pedicled sternohyoids muscles. (F) Large tracheostoma was created and vertical skin wound was closed with two drainage tubes.

Figure 5. Status of larynx after glottic closure.

Saliva is pooling above the glottis. If the glottic cancer become local recurrence, it can be easily observed by laryngoscope.



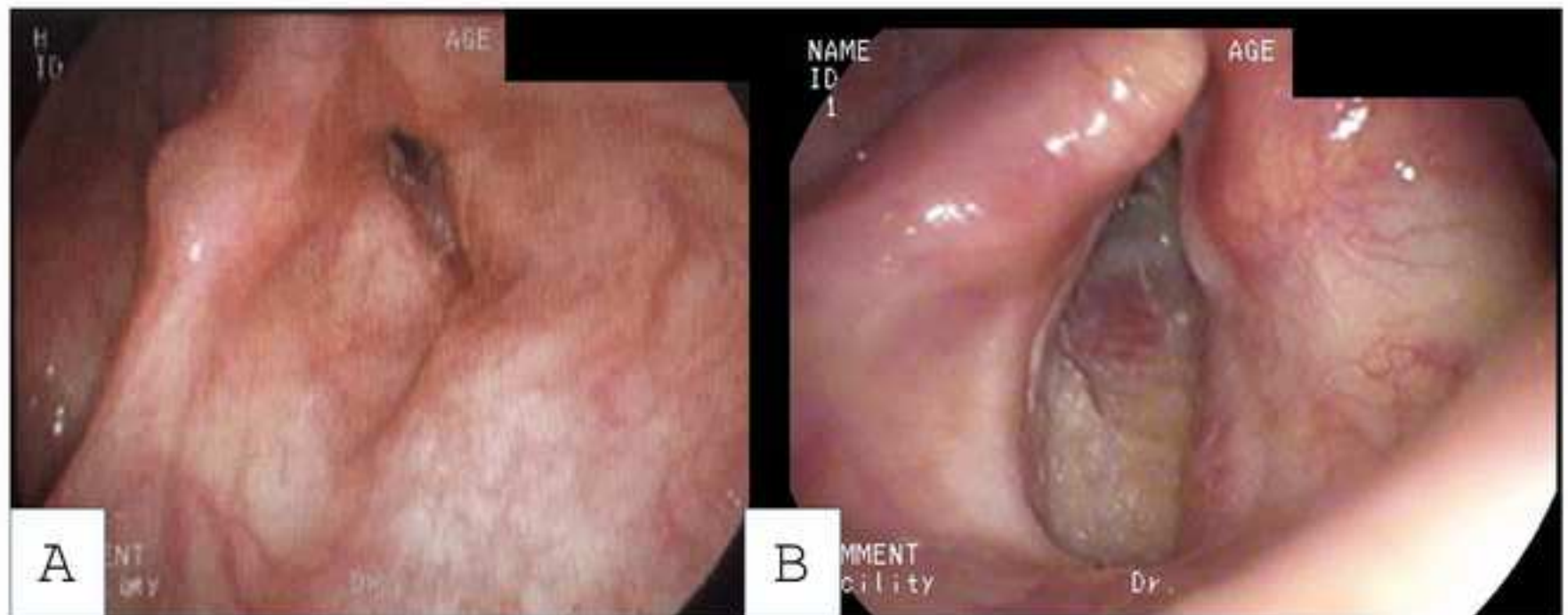


Fig.2 Pre-operative videofluorography



