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Buccal fat augmentation for insufficient neoglottal closure after supracricoid laryngectomy with cricohyoidoepiglottopexy

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ABSTRACT

Objective: Supracricoid laryngectomy with Cricohyoidoepiglottopexy (SCL-CHEP) is a functional organ preservation surgery for laryngeal cancers. Post-operative laryngeal function is generally promising. Some patients, however, cannot attain satisfactory functional results because of an excessively wide neoglottis resulting in an insufficient neoglottal closure. Autologous buccal fat augmentation was conducted to correct the insufficiency.

Patients and Methods: Two patients underwent intervention. Under general anesthesia, autologous fat was harvested from the buccal fat pad. Fat tissue was injected into the widest plane of the neoglottis under direct laryngoscopy; a navigation system was incorporated to identify the responsible site. Acoustic, aerodynamic, and perceptual analyses along with videofluoroscopic swallowing study and screening questionnaires were used for functional evaluation.

Results: A total of 0.8 ml (Case 1) and 0.7 ml (Case 2) of fat tissues were injected into the submucosal space of the responsible sites. Both patients experienced functional improvement subjectively after augmentation; psychological parameters for voice and swallowing also improved.

Conclusions: Buccal fat augmentation to correct insufficient neoglottal closure after SCL-CHEP was technically feasible. A navigation system was helpful for confirmation. Fat absorption occurred and one third of the volume remained at 3 and 6 months. Although, vocal measurements remained unchanged, psychological parameters for voice and swallowing improved.

1. Introduction

Supracricoid laryngectomy with Cricohyoidoepiglottopexy (SCL-CHEP) and with Cricohyoidopexy (SCL-CHP) are functional organ preservation surgeries for laryngeal cancers. In SCL, the entire thyroid cartilage is resected along with the tumor-bearing glottis; the remaining cricoid cartilage with one or two arytenoids is approximated to the hyoid bone, thus forming a neoglottis. In SCL-CHEP, the epiglottis is preserved, while in SCL-CHP, it is removed. Accordingly, SCL-CHEP is generally more advantageous than SCL-CHP in terms of post-operative laryngeal function [1,2]. However, some patients with SCL-CHEP cannot achieve satisfactory swallowing results because of an unexpectedly wide neoglottis.

Among our 92 SCL-CHEP patients, two suffered from chronic aspiration mainly as a result of insufficient neoglottal closure. These two patients could maintain oral intake but have been restricted from eating in public and one had a percutaneous gastrostomy inserted. They did not wish to receive completion total laryngectomy, but have been anticipating further intervention to improve their functional restrictions. After approval by our institutional review board, we proposed autologous buccal fat augmentation to correct the neoglottal insufficiency. The feasibility of technical and functional aspects is presented in this preliminary report.

2. Patients and methods

Between 1997 and 2012, 96 patients with laryngeal neoplasms (squamous cell carcinoma in 93 cases, mucoepidermoid carcinoma, sarcoma, leiomyoma in one case each) underwent SCL. There were 93 males and 3 females with a mean age of 61 years old (age range from 15 to 76 with 14 patients older than 70 years). SCL-CHEP was performed in 92 and SCL-CHP in 4 patients.

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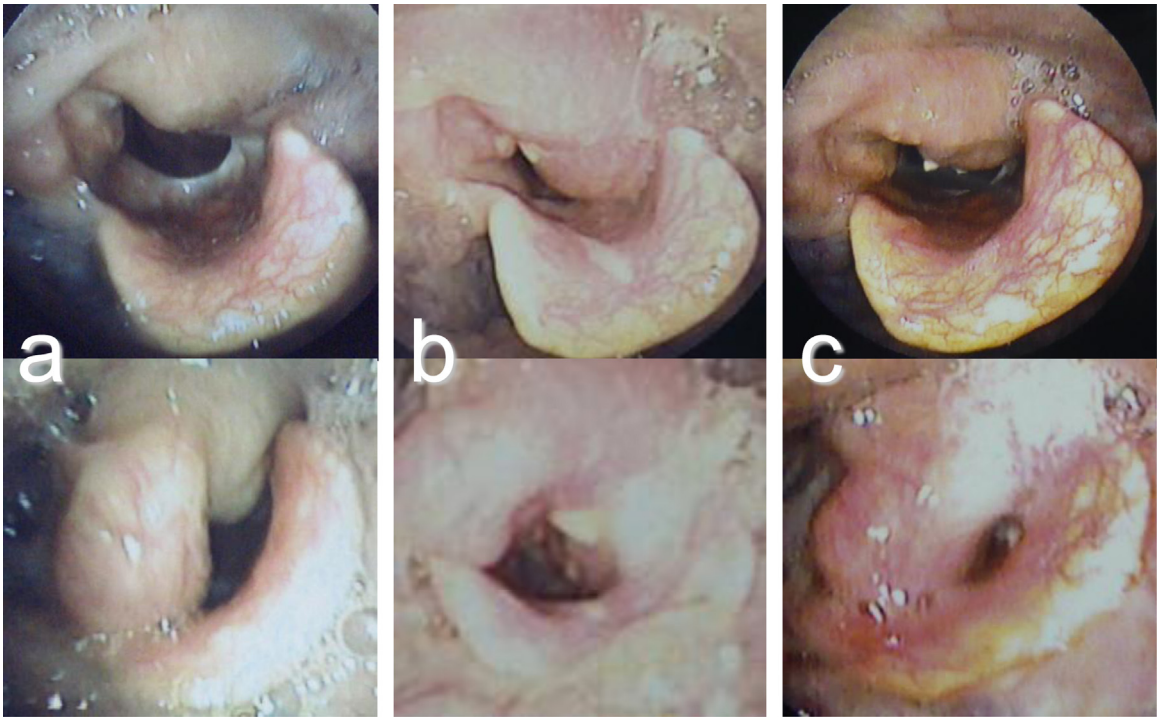

Fig. 1. Laryngoscopic views of the neoglottis in Case 1 in the respiratory (above) and phonetic (below) phases (a: before augmentation, b: 1 day and c: 5 months after fat augmentation). The neoglottal gap was wide before augmentation and tightened after augmentation, and this persisted at 6 months.

In this preliminary report, two patients with an excessively wide neoglottis underwent autologous buccal fat augmentation.

Case 1 was a 70-year-old man who received SCL-CEHP for T3N0 glottic cancer in October, 2008. The right arytenoid was fully spared and the left arytenoid was mostly removed, except for the corniculate cartilage. The neoglottis was excessively wide at the respiratory phase and complete closure was unattainable at the phonetic phase (Fig. 1a). He was able to eat a solid diet but required percutaneous gastrostomy alimentation for liquids. He never dined in public because of chronic aspiration. Autologous buccal fat augmentation was done approximately 3 years after SCL-CHEP. He was 73 years old at the time of fat augmentation.

Case 2 was a 69-year-old man who received SCL-CEHP for rT1N0 glottic cancer in January, 2006 after chemoradiotherapy failure (66 Gy). The right arytenoid was fully spared and the left arytenoid was mostly removed, except for the corniculate cartilage. He was able to eat solids and liquids, but seldom dined in public. Autologous buccal fat augmentation was done approximately 5 years after SCL-CHEP. He was 74 years old at the time of fat augmentation.

Due to the metamorphic features of post-SCL neoglottis, a navigation system (BrainLAB, Munich, Germany) was incorporated to assist the intervention.

Voice and swallowing evaluations including acoustic (F0, Jitter, Shimmer), aerodynamic (maximum phonation time), perceptual (GRBAS scale), and psychological (voice handicap index and swallowing score) analyses were performed. A concise 10-questionnaire version of the voice handicap index was used for voice evaluation (rating from 0 = never to 4 = always, with a best score of 0 to a worst score of 40) [3]. A modified 10-questionnaire version of the dysphasia score was used for swallowing evaluation (rating from 0 = never to 2 = always, with a best score of 0 to a worst score of 20) [4]. In the modified version of the dysphasia score, 10 of 15 questionnaires were selected to suit the post-SCL pathophysiology. To objectively evaluate swallowing function, videofluoroscopic swallowing study (VF) was done using jelly and liquid Iohexol (Omnipaque, water soluble radiographic contrast medium, Daiichi-Sankyo Co. Tokyo, Japan). All evaluations were done for Cases 1 and 2 at the time points of pre, 1, 3 and 6 months after fat augmentation.

To quantitatively assess the volume of injected fat tissue, a larynx-targeted CT scan (a 16-channel multidetector-row CT, Light Speed Ultra 16, GE Healthcare UK, Little Chalfront, UK) was utilized. Scanning was performed under the following conditions: (1) X-ray tube voltage 120 kV; (2) X-ray tube current, 250 mA; (3) slice thickness, 0.625 mm; (4) slice time, 0.6 s. The volume of injected fat tissue was estimated at an accuracy of 0.01 ml scale by identifying and delineating the fat density at each horizontal slice followed by reconstruction (Advantage Workstation VSXT, GE). Three-dimensional images of fat tissue and upper airway configuration were created using a volume rendering method.

3. Surgical techniques

3.1. Harvest of buccal fat

Under general anesthesia, fat tissue was harvested from a 5 mm incision made 10 mm inferior to the opening of parotid duct (Steno's duct) orifice. Through the mucosal wound, the buccinators muscle was divided using a fine hemostat. The fascia covering the buccal fat pad was incised and fat pad bluntly extracted (Fig. 2a). After harvesting sufficient fat tissue (3–5 ml), the mucosal incision was sutured.

3.2. Confirmation of the injection site using a navigation system

A navigation system was incorporated to identify the specific site for augmentation. Before intervention, a larynx-targeted CT scan was obtained in a chin-up position simulating the posture of laryngoscopic suspension. We used a paired point registration technique based on four pre-registered anatomical points (inner