

A survey of feeding and swallowing function after free jejunal flap reconstruction in cases of head and neck cancer

HIROSHI AKIOKA¹, HIROKAZU UEMURA², TAKASHI MASUI², ICHIRO OTA¹, TAKAHIRO KIMURA², SHIORI ADACHI², KEITA UEDA², MASAYUKI SHUGYO², AKIHISA TANAKA² and TADASHI KITAHARA²

¹Department of Otolaryngology-Head and Neck Surgery, Kindai University Nara Hospital, Ikoma, Nara 630-0293;

²Department of Otolaryngology-Head and Neck Surgery, Nara Medical University, Kashihara, Nara 634-8522, Japan

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Abstract. Reconstructive surgery using the free jejunum flap for locally advanced head and neck cancer is effective in preserving the swallowing function; however, it does not allow normal oral intake in all patients. A total of 47 patients underwent surgery at Nara Medical University between Jan 2010 and Dec 2019. The patients' ages ranged from 48 to 86 years. Sites were the hypopharynx (33 cases), larynx and cervical esophagus (5 cases each) and oropharynx (4 cases). Swallowing function was assessed using videofluorography, from the start of oral intake to discharge, as well as meal form at discharge. Lateral-retropharyngeal-lymph node dissection (LRPLND), preoperative radiation therapy, extended resection to the nasopharynx and incidence of stenosis in the jejunum-esophageal anastomosis were examined. Significant differences were revealed in the scores of pharyngeal residues of contrast medium and pharyngeal contraction, with and without preoperative radiotherapy. LRPLND did not affect swallowing function; dissection group cases had lower scores for soft palate elevation. Overall, resection extended to the nasopharynx, and the anastomosis method did not affect scores of swallowing function.

Introduction

The organs of the head and neck region perform essential functions in daily life such as speech and swallowing. Therefore, at the treatment of head and neck cancers, their preservation and restoration are important as well as eradication of disease. Surgical treatment for advanced head and neck cancers involves reconstructive surgery using appropriate free flaps to address the defect caused by tumor resection.

Reconstructive surgery using the jejunum of a luminal organ is particularly effective in preserving the ability to swallow (1-7), but it does not allow normal oral intake in all patients. A small number of patients may have difficulty in swallowing. Causes include damage to the glossopharyngeal and vagus nerves due to LRPLND (8-10), nasopharyngeal reflux, and reduced swallowing pressure due to resection of the pharynx (11,12), tissue scarring after radiotherapy (13-15), and stenosis of the jejunum-esophageal anastomosis (16,17). In this study, we investigated the postoperative swallowing dynamics of patients with head and neck cancers, who underwent reconstructive surgery using a free jejunum flap. The causes of their dysphagia were described with reference to current literature.

Materials and methods

Forty-seven patients with advanced head and neck cancers, who underwent reconstruction using free jejunum flap at Nara Medical University between January 2010 and December 2019, were retrospectively investigated. Table I shows the patients' backgrounds. There were 42 males and 5 females with a median age of 68 years (with a range of 44-86 years). The most common primary site was the hypopharynx (33 cases), followed by the larynx and cervical esophagus (5 cases each), and the mesopharynx (4 cases). Eleven cases were classified as T2, 15 as T3, and 21 as T4, with locally advanced cancers of T3 and T4 accounting for the majority. The swallowing function was assessed using videofluorography from the start of oral intake to discharge, as well as patients' diet form at discharge. The swallowing assessment was performed by three head and neck surgeons and one speech-language pathologist using the Modified Barium Swallow Impairment profile scores (MBSImp) shown in Table II. Residues could not be assessed in laryngopharyngeal valleys and piriform sinuses following total laryngopharyngectomy, so they were substituted with pharyngeal residues, as shown in Fig. 1 (18). A uniform scoring system was applied-3 points for good function, 1 point for poor, and 2 points for the range between those two ratings. Factors that may reduce postoperative swallowing function were also examined, such as the presence or absence of LRPLND dissection, the extent of the cephalic resection into the nasopharynx, preoperative radiotherapy, and incidence of stenosis due to jejunum-esophageal anastomosis.

Correspondence to: Dr Hiroshi Akioka, Department of Otolaryngology-Head and Neck Surgery, Kindai University Nara Hospital, 1248-1 Otodacho, Ikoma, Nara 630-0293, Japan
E-mail: hiro0711nmu@naramed-u.ac.jp

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StatMate V statistical software (ATMS Co., Ltd.) was used to perform statistical analysis. The Mann-Whitney test was used to identify significant differences between the two groups, and the Kruskal-Wallis test was used to evaluate significant differences between the multiple groups. P-value of <0.05 was considered statistically significant for both tests.

Results

The median length of hospitalization was 31 days (ranged from 14 to 90 days), and the median time from the start of oral intake to discharge was 17 days (ranged from 5 to 60 days), with 39 patients (83%) discharged within 4 weeks after resuming oral intake. Postoperative complication appeared in only one patient (flap necrosis). The remaining 46 patients had no postoperative complications on jejunal free flaps. The videofluorography results were assessed and pharyngeal residues of the contrast medium were measured. Table III displays the scoring: 1, 2, 3 points in 9, 25, and 13 cases respectively. Soft palate elevation was observed with 1, 2, and 3 points in 4, 11, and 32 cases respectively. Pharyngeal constriction was assessed at 1, 2, and 3 points in 6, 25, and 16 cases respectively. The duration from resumption of oral intake to discharge was shown in Fig. 2. There was no association between the passage of contrast medium through the free jejunum flap and the time from the resumption of oral intake to discharge. The diet form at the time of discharge consisted of plain food in 7 cases, soft food in 19 cases, chunky food in 15 cases, mixer food in 3 cases, jellied food in 2 cases, and tube feeding in 1 case. Of the 47 patients, 41 (87%) were able to consume at least 1 chopped meal.

Evaluation of the swallowing function after reconstruction surgery

The degree of dysphagia between patients with and without LRPLND, preoperative radiotherapy, nasopharyngeal resection, and the method of jejunum-esophageal anastomosis (hand-sewn vs. stapled) was investigated. There were 6 and 41 patients in the LRPLND and non-LRPLND group, respectively. Eleven patients had received preoperative radiotherapy and 36 had no history of radiation before surgery. Stapled jejunum-esophageal anastomosis was performed in 12 cases and hand-sewn in 35 cases. Fig. 3 shows the differences in dysphagia between patients with and without dissection of the Rouviere lymph nodes. There were no significant differences in any of the scores, but the dissection group tended to have a lower score for soft palate elevation ($P=0.070$). Fig. 4 shows the differences in dysphagia with and without preoperative radiotherapy. There was a significant difference in the scores of oral pharyngeal residues ($P=0.03$) and pharyngeal contraction ($P=0.005$) between patients with and those without preoperative radiotherapy. Patients who received preoperative radiotherapy had significantly worse oropharyngeal residual and pharyngeal constriction scores than those who did not. Fig. 5 shows the differences in dysphagia due to nasopharyngeal incision. There were no significant differences in any of the scores. Fig. 6 shows the differences in dysphagia according to the method of anastomosis of the lower end of the jejunum. There were no significant differences in any of the scores.

Table I. Patients's characteristics.

Characteristic	Category	Frequency, n
Sex	Female	5
	Male	42
Median age, years (range)		68 (44-86)
Primary site	Oropharynx	4
	Hypopharynx	33
	Larynx	5
	Cervical esophagus	5
T classification	T2	11
	T3	15
	T4	21
Rouvière lymph node dissection	+	6
	-	41
Nasopharyngeal incision	+	4
	-	43
Preoperative radiotherapy	+	11
	-	36
Method of anastomosis	Instrumental	12
	Manual	35

Table II. Swallowing assessment (extracted and modified from MBSimp).

Parameter	Score given
Oral pharyngeal residue	
None or in small quantities	3
Medium	2
Large quantities	1
Pharyngeal contractions	
Front and rear touch and air space disappears	3
Not very	2
Not seen at all	1
Elevation of the soft palate	
Contact between the soft palate and the posterior wall of the pharynx	3
Not very	2
Reflux of contrast medium into the nasal cavity	1

Discussion

Surgical treatment of advanced head and neck carcinoma often involves reconstructive surgery using free flaps to compensate for the defects. The free jejunum flap is a luminal organ flap, which is not only relatively easy to use for reconstruction of the upper digestive tract but is also effective in preserving swallowing function (1-7). However, post-operatively, not all patients can eat orally, and some number of patients actually

Table III. Distribution of scores for each swallowing function.

	Score, n		
Pharyngeal residue	3	2	1
Oral pharyngeal residue	13	25	9
Pharyngeal contractions	16	25	6
Elevation of the soft palate	32	11	4

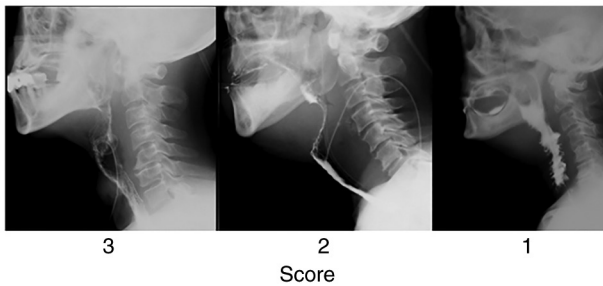


Figure 1. Scores of oral pharyngeal residue. Score 3 shows small quantities of oral pharyngeal residue. Score 2 shows medium quantities of oral pharyngeal residue. Score 1 shows large quantities of oral pharyngeal residue.

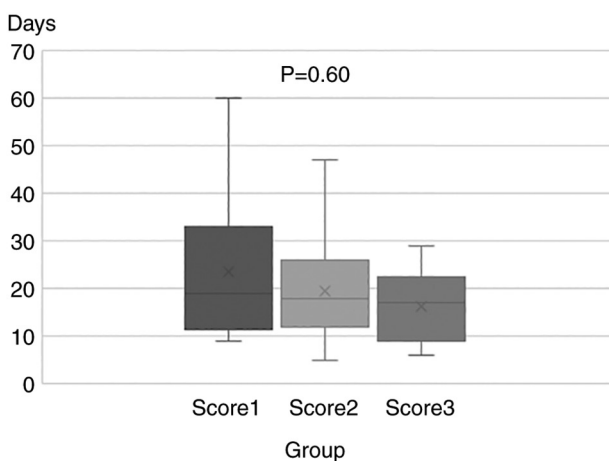


Figure 2. Pharyngeal residual score and days from the start of oral intake to discharge. There were no significant differences between the scores.

have dysphagia due to various factors. In this study, we investigated the postoperative swallowing dynamics of patients with head and neck cancers who underwent reconstructive surgery using a free jejunum flap at our institution.

The results showed that the median time from the start of oral intake to discharge was 17 days (with a range of 5-60 days), and 39 patients (83%) were discharged within 4 weeks after resuming oral intake. This is a relatively good outcome. At discharge, 7 patients had taken an ordinary diet, 19 were consuming a soft diet, 15 were eating a blended diet, 3 patients were consuming a mixed diet, 2 were on a jellied food diet, and 1 patient remained on tube feeding. In other words, although this is a good result, 13% of the patients still had some degree of dysphagia. This motivated us to investigate all 47 patient records to evaluate swallowing function. The time elapsed from resumption of oral

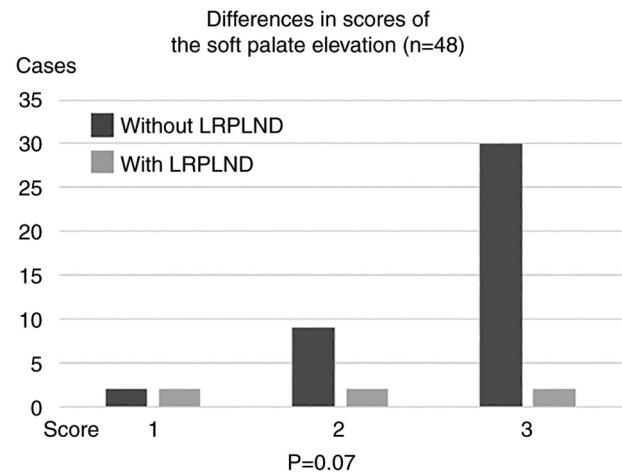


Figure 3. Differences in dysphagia between patients with and without dissection of the Rouviere lymph nodes. LRPLND, lateral-retropharyngeal-lymph node dissection.

intake to discharge was calculated for each of the patients. The result showed no association with the passage of contrast medium through the free jejunum flap. A good passage of contrast would mean an auspicious resumption of good oral intake. The duration of hospitalization, however, depends not only on the patient's swallowing function but also on the condition of the wound and psychosocial factors. Furthermore, swallowing function at the time of videofluorography a week after the operation possibly lowered because of dysfunction of the free jejunal flap as a food passage due to postoperative edematous change.

In this study, we examined whether four factors, that is, LRPLND, preoperative radiotherapy, nasopharyngeal incision, and the method of jejunum-esophageal anastomosis (hand-sewn or stapled) may cause postoperative dysphagia or not. The swallowing scores for these four factors were evaluated. There was no significant difference in scores between patients with and without LRPLND, however the patients in the dissection group tended to show lower scores for soft palate elevation. There were significant differences in both the pharyngeal residual and contraction scores between patients with and without preoperative radiotherapy. On the other hand, extended resection to the nasopharynx and the method of jejunum-esophageal anastomosis did not affect the swallowing scores. Although there were not significant difference, LRPLND may cause to damage important cranial nerves involved in swallowing, such as the glossopharyngeal and vagus nerves. Cutting off these nerves is rare, however, careful. Careful surgical manipulation is necessary to lower the chances of transient paralysis, a possible adverse event associated with performing lymph node dissection. LRPLNs are usually approached through the neck, and some reports of peroral LRPLND with no postoperative dysphagia were recently described (19,20). Radiotherapy to the head and neck region causes cell depletion, inflammation, and hypoplasia in the early stages and fibrosis, changes in the microvasculature, and tissue atrophy in the late stages, resulting in dysphagia during and after treatment (13). As postoperative thing is, therefore, more likely to occur in cases of salvage surgery after chemoradiotherapy, significant differences were found in the present study. The same dysphagia is likely to occur when resecting area extends to the nasopharynx. Inadequate

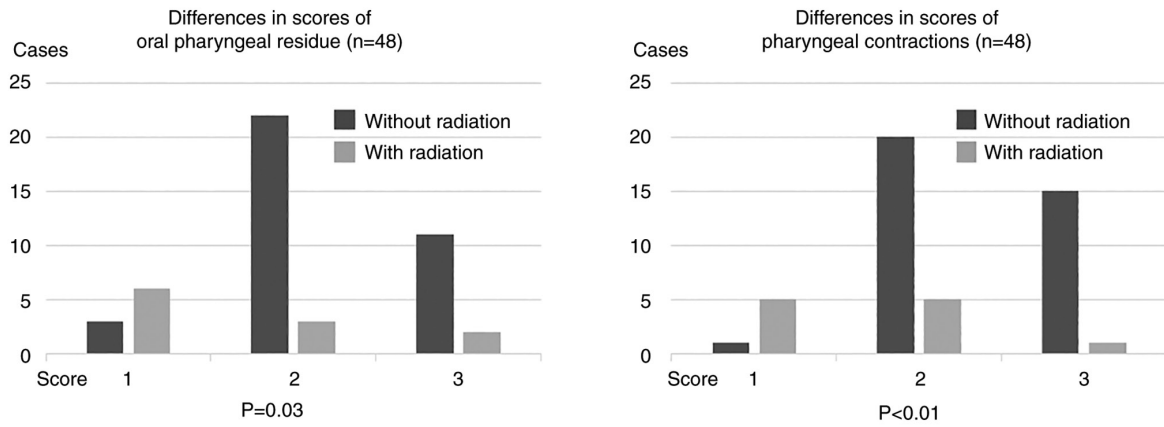


Figure 4. Differences in dysphagia with and without preoperative radiotherapy. There was a significant difference in the scores of oral pharyngeal residues ($P=0.03$) and pharyngeal contraction ($P=0.005$) between patients with and those without preoperative radiotherapy.

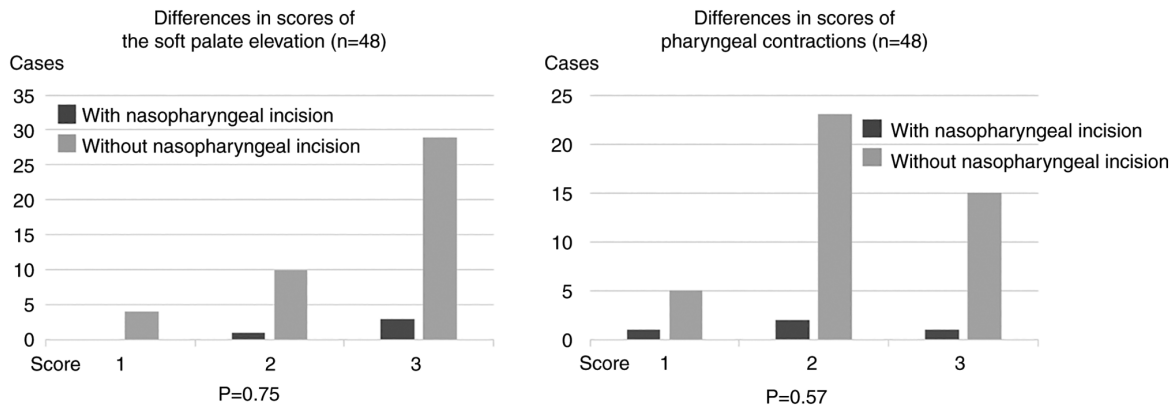


Figure 5. Differences in dysphagia due to nasopharyngeal incision. No significant differences were found between scores in soft palate elevation and pharyngeal contraction.

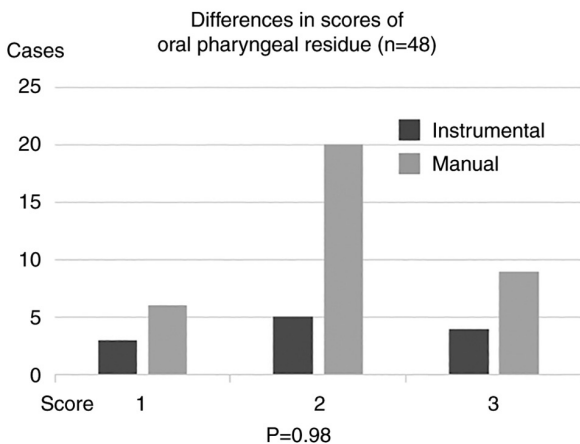


Figure 6. Differences in dysphagia according to the method of anastomosis of the lower end of the jejunum.

swallowing pressure due to inadequate closure of the soft palate may lead to nasopharyngeal reflux and inadequate feeding through the free jejunum flap due to reduced swallowing pressure. Previous reports of surgical teams using various innovations to prevent such dysphagia exist, such as placing a longitudinal incision in the free jejunum flap according to the

defect or using part of it as a patch (11,12). This procedure, which is called, *velopharyngeal reconstruction* is employed whenever the nasopharyngeal space is open to the oropharynx due to tumor resection. This is possibly the reason why the nasopharyngeal incision did not affect swallowing. Several reports have discussed the anastomosis between the jejunum and the esophagus (16,17). Since in these reports evaluation was done in the immediate postoperative videofluorography, it was inferred that the postoperative edema and other factors obscured the postoperative status of swallowing. However, it is widely reported that from the point of long-term prognosis, the incidence of jejunoesophageal anastomotic stenosis is overwhelmingly higher in patients with instrumented anastomoses than in those with hand-sewn anastomoses. Therefore, had-sewn anastomoses is recommended. General surgeons at our institution until 2014 employed stapled anastomosis. After 2015, our head and neck surgeons switched from the method to hand-sewn anastomosis. Since then, there has been no incidence of postoperative anastomotic stenosis. Another factor that may prevent anastomotic stricture is the blood flow at the esophageal margin of the anastomosis. Avoiding unnecessary dissection of the esophagus from the tracheobronchial fold, preserving the thyroid gland, omitting unnecessary paratracheal dissection, and reducing the field of postoperative radiation therapy may be important factors in maintaining esophageal blood flow.

Even though the prevention of recurrence is a priority, as stomal recurrence can be fatal, the cautionary notes described above should be strongly emphasized.

Extensive resection of advanced head and neck cancers severely impairs patients' ability to speak and swallow. Head and neck surgeons should focus not only on cures but also on the preservation of function. Even in patients undergoing free jejunal flap reconstruction, any and every effort should be made to optimize patient quality of life by developing and employing effective interventions for maintaining the ability to eat and swallow. This study focused on items related to surgery and did not evaluate nutrition support team intervention, nutritional guidance after discharge, or continued swallowing rehabilitation. Since these elements are necessary for long-term maintenance of swallowing function, this is an issue to be considered in the future. Furthermore, in this study, the total number of cases is relatively small. As more cases occur, they should be studied thoroughly, further investigations are necessary to assess the swallowing function after free jejunal reconstruction.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

HA, HU, TM, IO and TKit conceived and designed the current study. HA, HU, TM, IO, TKim, SA, KU, MS, AT and TKit acquired the data. HA, HU and TM confirmed the authenticity of all the raw data. HA, TM and IO analyzed and interpreted the data. HA, TM and TKit drafted the manuscript. HA, HU, TM, IO and TKit reviewed and edited the manuscript. All authors have accepted their responsibility for the entire content of this manuscript and approved submission. All authors read and approved the final manuscript.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Nara Medical University (approval no. 2995; Kashihara, Japan).

Patient consent for publication

The images in Fig. 1 belong to the patients, and written consent to use them for publication was obtained from all patients at the time of surgery.

Competing interests

The authors declare that they have no competing interests.

References

- Sharp DA, Theile DR, Cook R and Coman WB: Long-term functional speech and swallowing outcomes following pharyngolaryngectomy with free jejunal flap reconstruction. *Ann Plast Surg* 64: 743-746, 2010.
- Chan YW, Ng RW, Liu LH, Chung HP and Wei WI: Reconstruction of circumferential pharyngeal defects after tumour resection: Reference or preference. *J Plast Reconstr Aesthet Surg* 64: 1022-1028, 2011.
- Pegan A, Rašić I, Košec A, Solter D, Vagić D, Bedeković V and Ivkić M: Type II hypopharyngeal defect reconstruction—a single institution experience. *Acta Clin Croat* 57: 673-680, 2018.
- Denewer A, Khater A, Hafez MT, Hussein O, Roshdy S, Shahatto F, Elnahas W, Kotb S and Mowafy K: Pharyngoesophageal reconstruction after resection of hypopharyngeal carcinoma: A new algorithm after analysis of 142 cases. *World J Surg Oncol* 12: 182, 2014.
- Perez-Smith D, Wagels M and Theile DR: Jejunal free flap reconstruction of the pharyngolaryngectomy defect: 368 Consecutive cases. *J Plast Reconstr Aesthet Surg* 66: 9-15, 2013.
- Disa JJ, Pusic AL, Hidalgo DA and Cordeiro PG: Microvascular reconstruction of the hypopharynx: Defect classification, treatment algorithm, and functional outcome based on 165 consecutive cases. *Plast Reconstr Surg* 111: 652-660, 661-663, 2003.
- Benazzo M, Occhini A, Rossi V, Aresi G and Alessiani M: Jejunum free flap in hypopharynx reconstruction: Case series. *BMC Cancer* 2: 13, 2002.
- Togashi T, Sugitani I, Toda K, Kawabata K and Takahashi S: Surgical management of retropharyngeal nodes metastases from papillary thyroid carcinoma. *World J Surg* 38: 2831-2837, 2014.
- Otsuki N, Nishikawa T, Iwae S, Saito M, Mohri M and Nibu K: Retropharyngeal node metastasis from papillary thyroid carcinoma. *Head Neck* 29: 508-511, 2007.
- Hartl DM, Leboulleux S, Vélayoudom-Céphise FL, Mirghani H, Déandréis D and Schlumberger M: Management of retropharyngeal node metastases from thyroid carcinoma. *World J Surg* 39: 1274-1281, 2015.
- Nakatsuka T, Harii K, Takushima A, Yoshimura K, Ichioka S, Sugasawa M, Ichimura K, Seto Y and Nagawa H: Prefabricated free jejunal transfer: A new reconstructive technique for high pharyngeal defects. *Plast Reconstr Surg* 103: 458-464, 1999.
- Kimata Y, Uchiyama K, Sakuraba M, Ebihara S, Nakatsuka T and Harii K: Simple reconstruction of large pharyngeal defects with free jejunal transfer. *Laryngoscope* 110: 1230-1233, 2000.
- King SN, Dunlap NE, Tennant PA and Pitts T: Pathophysiology of radiation-induced dysphagia in head and neck cancer. *Dysphagia* 31: 339-351, 2016.
- Sassler AM, Esclamado RM and Wolf GT: Surgery after organ preservation therapy. Analysis of wound complications. *Arch Otolaryngol Head Neck Surg* 121: 162-165, 1995.
- Dubsky PC, Stiff A, Rath T and Kornfehl J: Salvage surgery for recurrent carcinoma of the hypopharynx and reconstruction using jejunal free tissue transfer and pectoralis major muscle pedicled flap. *Arch Otolaryngol Head Neck Surg* 133: 551-555, 2007.
- Liu QX, Qiu Y, Deng XF, Min JX and Dai JG: Comparison of outcomes following end-to-end hand-sewn and mechanical oesophagogastric anastomosis after oesophagectomy for carcinoma: A prospective randomized controlled trial. *Eur J Cardiothorac Surg* 47: e118-e123, 2015.
- Luechakiettsak P and Kasetsunthorn S: Comparison of hand-sewn and stapled in esophagogastric anastomosis after esophageal cancer resection: A prospective randomized study. *J Med Assoc Thai* 91: 681-685, 2008.
- Beall J, Hill EG, Armeson K, Garand KLF, Davidson KH and Martin-Harris B: Classification of physiologic swallowing impairment severity: A latent class analysis of modified barium swallow impairment profile scores. *Am J Speech Lang Pathol* 29: 1001-1011, 2020.
- Tanaka Y, Tomifuji M, Suzuki H, Yamashita T, Araki K and Shiotani A: Transoral videolaryngoscopic surgery with a navigation system for excision of a metastatic retropharyngeal lymph node. *ORL J Otorhinolaryngol Relat Spec* 76: 357-363, 2014.
- Fujiwara K, Fukuhara T, Koyama S, Donishi R, Kataoka H, Kitano H and Takeuchi H: Ultrasound-guided transoral videolaryngoscopic surgery for retropharyngeal lymph node metastasis of papillary thyroid cancer. *Case Rep Oncol* 10: 649-655, 2017.