



# Frontoanterior supracricoid laryngectomy with epiglottoplasty

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## ABSTRACT

**Objectives:** In this study, we aimed to investigate the efficacy and safety of a modified technique, namely frontoanterior supracricoid laryngectomy (FASCL) with epiglottoplasty.

**Patients and Methods:** A total of eight male patients (mean age 55 years; range, 53 to 68 years) with glottic cordo-commissural cancer underwent FASCL with epiglottoplasty between 2007 and 2018. Oncologic safety was ensured through the whole thyroid cartilage resection in the form of supracricoid partial laryngectomy (SCPL). Early laryngeal rehabilitation was given to all patients postoperatively.

**Results:** Five patients were in Stage T1a-b and three patients were in Stage T2. Five patients with Stage T1a-b cordo-commissural cancer underwent FASCL with bilateral cordectomy. The postoperative period was uneventful in all patients with early decannulation and nasogastric tube removal took place on the second postoperative day. Functional rehabilitation duration of Stage T2 cancer was slightly prolonged due to wider endolaryngeal resection. In three patients staged T2 cordo-commissural cancer decannulation was performed after 4 days and nasogastric tube was removed within the first week due to larger endolaryngeal tissue resection in this stage.

**Conclusion:** Our study results suggest that this modified technique followed by early laryngeal rehabilitation yields satisfactory postoperative laryngeal functions. In the laryngeal reconstruction, preservation of the thyroid's external framework maintenance of laryngeal situation and glottic reconstruction play the most important role for functional rehabilitation. Total resection of thyroid cartilage provide oncological safety of this technique. Removal of the thyroid cartilage resection does not cause any laryngeal functional rehabilitation problem in the neo larynx.

**Keywords:** Cordo-commissural cancer, epiglottic laryngoplasty, frontoanterior partial laryngectomy, laryngeal preservation surgery, thyroid cartilage resection.

Early stage T1-2 glottic laryngeal cancer with intact anterior commissure (AC) has a very good prognosis. On the other hand, at the same stage glottic cancer involving AC (cordo-commissural cancer), the prognosis is deceptive with higher local recurrence rates. Cordo-commissural cancer represents a great challenge for correct staging and requires adequate treatment. Many investigators and clinicians describe AC as an anatomically weak area due to its structural features which facilitate cancer invasion. The

anatomic histological and embryonal structure and pathways of dissemination of the tumor cells from the AC have been the subject of many studies with serial section of the larynx.<sup>[1-5]</sup> According to these studies, AC can be defined as an independent and vulnerable unit and, consequently, the AC plays a key role in decision making for the treatment modality.<sup>[4]</sup>

Current Tumor, Node, Metastasis (TNM) system is inadequate for the AC involvement of

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glottic cancer. Therefore, prognostic evaluation of the early stage glottic cancers and the objective comparison of their treatment outcomes should be performed for two different groups: one that infiltrates the AC, and the other one that does not. The prognosis of cancer involving the AC is poor due to the risk for deeply insidious invasion.<sup>[6]</sup> Cordo-commissural cancers are clinically understaged, as they do not show the true extension and may cause misdiagnosis with its incipient aspect. As a result, unexpected local recurrences may develop due to inadequate treatment.

Today, there is no consensus on the treatment of early glottic cancer reaching to AC. Radiotherapy, endoscopic transoral microsurgery, or open partial vertical laryngectomy techniques are performed as the main treatment modalities. Each treatment modality has its own advantages and disadvantages. Oncological safety and adequate restoration of laryngeal functions are the mainstays of all treatment options. In recent years, transoral microlaryngoscopic cordectomy has been applied rather than laryngofissure cordectomy. Despite success in early vocal cord cancer in midcordal glottic lesion, its application to cordo-commissural cancer is oncologically debatable due to the higher rate of local recurrences.<sup>[7-9]</sup> Radiotherapy is also still controversial for the same reason.<sup>[10,11]</sup>

Among the treatment modalities, open partial conservative laryngectomy techniques are oncologically the safest ones. In recent years, we have applied the total resection of the thyroid cartilage (TC) instead of its partial resection due to the late recurrence in the remaining cartilage after frontoanterior vertical laryngectomy (FAVL). Partial TC resection of the conventional FAVL techniques used for many years is still oncologically controversial. In cordo-commissural cancer surgery, the FAVL with epiglottic laryngoplasty and supracricoid partial laryngectomy (SCPL) with cricothyoidoepiglottopexy (CHEP) are the most commonly used techniques. The SCPL with CHEP is the oncologically most confident technique; however, it is quite problematic in terms of the restoration of the laryngeal functions, as in SCPL with CHEP or cricothyoidopexy (CHP)

consisting of end-to-end anastomosis of the cricoid arch and hyoid bone is performed rather than the true reconstruction of the resected endolaryngeal structures. Conversely, the FAVL technique is very satisfactory in early laryngeal rehabilitation owing to the reconstruction with epiglottic laryngoplasty.

Laryngoplasty with an epiglottic flap was previously used in 1964 by Bouche and Freche for vestibular stenosis repair.<sup>[12]</sup> The use of epiglottis in laryngeal cancer surgery as a reconstruction flap was first described and utilized with pull-down technique by Sadlacek in 1965<sup>[13]</sup> and Kambic in 1976.<sup>[14]</sup> The epiglottic laryngoplasty in vertical partial laryngectomy reconstruction was popularized by Tucker in 1989.<sup>[15]</sup> This (S-K-T's FAVL) technique has been applied frequently in recent years due to the wider resection and early laryngeal rehabilitation.<sup>[16,17]</sup> Nevertheless, this technique does not have the same oncological superiority regarding the partial TC resection and local recurrence in the remaining TC. The cure rates of SCPL has been reported to be higher compared to the SCPL and FAVL techniques.<sup>[18]</sup>

In the light of literature data, we modified the FAVL technique with entire TC resection due to the unexpected local recurrence in the remaining TC following its partial resection, as the remaining ossified cartilage poses a risk for local recurrence. In order to obtain the oncological resection safety of the SCPL technique and early rehabilitation advantages of the FAVL with epiglottic laryngoplasty, in the present study, we aimed to combine these two techniques with their unique advantages which was termed as frontoanterior supracricoid laryngectomy (FASCL) with epiglottic laryngoplasty.

## PATIENTS AND METHODS

Between between 2007 and 2010, a total of 97 consecutive patients with early cordo-commissural glottic cancer and transglottic laryngeal carcinomas underwent partial laryngectomy techniques at the Ear, Nose and Throat Department of Istanbul University, Faculty of Medicine. These techniques included Leroux Robert's frontal anterior laryngectomy (FAL) - frontolateral laryngectomy (FLL),

Cevanşir's two-stage FAL, Carlo-Teatini's horizontal glottectomy, Tucher's FAVL with epiglottic laryngoplasty, and our new FASCL technique in the final four patients. The SCPL with CHEP/CHP was performed to 79 in addition T1a- b cordocomissural patients with advanced transglottic cancer involving the AC. In the present study, a total of eight male patients (mean age 55 years; range, 53 to 68 years) with glottic cancer underwent FASCL with epiglottoplasty between 2007 and 2018. The modified technique consisted of the resection of the SCPL and reconstruction of FAVL with epiglottic laryngoplasty technique. Early laryngeal rehabilitation was given to all patients who underwent the modified FASCL technique with epiglottic laryngoplasty reconstruction.

A written informed consent was obtained from each patient. The study protocol was approved by the Istanbul University Medical Faculty Ethics Committee. The study was conducted in accordance with the principles of the Declaration of Helsinki.

### Preoperative examination

In the preoperative assessment of cordo-commissural carcinomas reaching and/or crossing the AC classified as T1a-b, a more careful examination was carried out than the other midcordal glottic carcinomas. If the videolaryngoscopic and microlaryngoscopic examinations were not decisive in the assessment of the AC, subglottis and ventricles, an endoscopic evaluation was added with 0°, 70°, 120° telescopes under general anesthesia without intubation in full oxygen saturation. For the investigation of the TC invasion and the extension of cancer, computed tomography (CT) and magnetic resonance imaging (MRI) were performed. However, these radiological examinations were often misleading due to the ossification of the TC.

*Indications for FASCL are as follows:*

1. Glottic T1a Stage cordo-commissural membranous vocal cord cancer extending to the AC. Glottic T1b Stage cordo-commissural cancer crossing the AC and extending to the contralateral vocal cord.

In these cases, bilateral cordectomy with the TC resection is applied together as supracricoid.

2. Glottic T2 Stage cordo-commissural cancer extending to the AC, ventricle, and false cord. In this early stage transglottic cancer that not yet having supraglottic infiltration, both true and false cords, paraglottic spaces, and TC are removed as *en bloc* resection.

*Contraindications for FASCL are as follows:*

1. This technique is not applicable in transglottic glotto-supraglottic cancer due to the resection of the supraglottic region with epiglottis. In this case, SCPL with CHP is the most effective option.

### Surgical technique

The application of FASCL except for total TC resection instead of partial resection was similar to the FAVL technique with epiglottic laryngoplasty. Tracheotomy was in its usual location and a small apron flap was performed. With the elevation of the apron flap and lateral retraction of the strap muscles, an adequate exposure was provided from the hyoid bone to the lower end of the cricoid arch. Thyrohyoid and cricothyroid membranes were transversely cut from the upper and lower ends of the TC. The external perichondrium was detached in both sides of the thyroid alar following the incision making through the upper and lower edges and midline of the TC. In order to prevent



**Figure 1.** Removed entire thyroid cartilage in three pieces (frontoanterior part with tumor and two posterolateral intact segments).

injury of the strap muscles during the TC removal as a single piece, TC was resected in three pieces with two vertical lateral thyrotomy incisions. Due to the risk for cancer spread in all parts, TC was removed in three pieces in total (Figure 1). The largest anterior frontal fragment of the TC is the tumor-bearing section. The latest two lateral pieces were removed by subperichondrial dissection to prevent possible recurrences in the remaining parts of the TC.

In Stage T1a-b cordo-commissural glottic cancer, the removed laryngeal tissues were as follows: AC with all TC, tumor-bearing vocal cords, thyroepiglottic ligament, conoid ligament, and subglottic mucosa extending up to the cricoid arch. In Stage T2 disease, the cordo-commissural cancer just became early transglottic. In this case, in addition to the laryngeal tissue resection as mentioned above, both the false cords and paraglottic spaces were removed via *en bloc* resection (Figure 2). For the glottic reconstruction and replacement of the anterior part of the removed TC, an epiglottic laryngoplasty was performed. Epiglottis was released with cutting the hyoepiglottic and lateral glossoepiglottic ligaments using the submucosal blunt scissor dissection. When the epiglottis was pulled down to the upper end of the cricoid arch, the lower

cutting side of the epiglottis was sutured to the upper edge of the cricoid. Cutting mucosa on the lower lateral sides of the epiglottis was sutured to the remaining perichondria of the resected pharyngeal posterolateral section of the

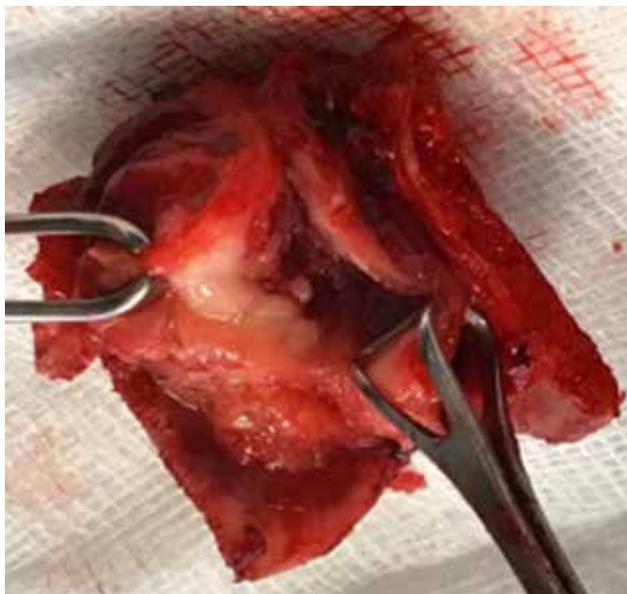


Figure 2. Frontoanterior laryngeal part of resection with tumor-bearing endolaryngeal tissue.

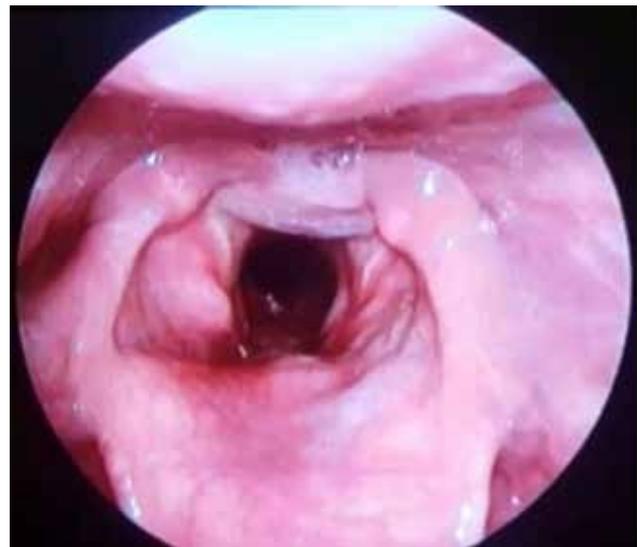


Figure 3. Glottic aperture in new larynx after bilateral cordectomy with two false cords in T1b glottic cordo-commissural cancer.



Figure 4. Removed glottis and glottic aperture with newly created AC in T2 cordo-commissural glottic cancer.



**Figure 5.** External thyroid cartilage perichondrium sutured in midline and intact strap muscles in its location. Integrity of external framework of larynx.

TC. In order to decrease the glottic patency after glottic resection, a small cartilage strip of 3 mm width and 15 mm length was removed from the anterior inferior midline in the ventral aspect of the epiglottis. The cut ends of the epiglottic cartilage were sutured to form a narrow angle and, thus, the new AC was reconstructed (Figures 3 and 4). During the closure, the incised external perichondrium was sutured in the midline, the intact strap muscles were brought in normal anatomic position, and the apron flap was sutured without drain (Figure 5). Since there is almost no cervical metastasis in early glottic cancer, elective neck dissection was not applied.

## RESULTS

Of all patients, five were in Stage T1a-b and three were in Stage T2. To provide the oncological safety, we performed the whole TC resection in the form of SCPL rather than its partial resection as previously described FAVL techniques. The postoperative period was uneventful in all patients with early decannulation and nasogastric tube removal. Five patients with Stage T1a-b cordo-

commissural cancer underwent FASCL with bilateral cordectomy and early decannulation and nasogastric tube was removed on Day 2 postoperatively in four of these patients.

As the compensation of the vocal cords by the false cords, glottic competence was regained (Figure 3). However, in the final patient (Patient No. 8) who was older than the other four patients, decannulation and removal of the nasogastric tube were slightly later (on Day 3 and Day 5, respectively). Due to the age-related adaptation delay, a light aspiration problem during fluid intake lasted for only two weeks. In three patients with Stage T2 cordo-commissural cancer, despite greater dysphonia compared to Stage T1 patients, decannulation was performed after four days and nasogastric tube was removed within the first week due to the larger endolaryngeal tissues removed. Early and satisfactory laryngeal rehabilitation outcomes were achieved in all patients. Using this technique, reconstruction with epiglottic laryngoplasty and preservation of the laryngeal framework integrity, except for the TC, and mobility of the remaining larynx were provided. After the glottic resection was expanded, glottic aperture of the larynx was narrowed owing to the newly created AC and, thus, the breathy voice in phonation was reduced. Consequently, functional rehabilitation was obtained smoothly.

Using this technique, during the resection and reconstruction, the preservation of the thyroid's external framework is of great importance. As a result, the new larynx would regain the anatomic location and its mobility on swallowing. In addition, the application of the total TC resection instead of the partial TC resection as in the other FAL and FLL techniques improved the oncological safety of the FASCL.

## DISCUSSION

The preservation of the laryngeal skeleton is one of the most important advantages of endoscopic microsurgery. Therefore, during the resection of the TC and adjacent tumor infiltrating into the endolaryngeal tissue, a particular care must be taken to protect the integrity and the location of the remaining new larynx for the recuperation of the laryngeal motility. As the elevated larynx in swallowing

plays a very important role to protect the airway, for the prevention of the damage to the strap muscles during the complete resection of the TC, its segmental resection was performed in three parts as the tumor-bearing middle part and the intact posterolateral pharyngeal sections in our study.

In the laryngeal reconstruction, released epiglottis was used for the replacement of the anterior portion of the removed TC and AC. Postoperative period of Stage T1 patients was nearly as smooth as in the endoscopic laryngeal resection, as the location of the larynx did not change and the larynx movement was maintained. For this purpose, the strap muscles, external thyroid perichondrium, and the superior and recurrent laryngeal nerves are carefully preserved. However, in the SCPL technique, prelaryngeal strap muscles are cut for easy removal of the entire TC, as well as for the application of the CHEP or the CHP. In the FAVL technique, the position and the dimension of the larynx with prelaryngeal strap muscles are left intact due to the partial TC resection. For the prevention of the strap muscles, damages during the extirpation of the TC instead of in one piece, we removed it in three pieces: the frontal anterior laryngeal part was removed with the tumor-bearing endolaryngeal tissue successfully, followed by the posterolateral pharyngeal sections.

Cordo-commissural carcinomas represent a great challenge for the correct staging and adequate treatment. To date, there is no consensus on the treatment of early glottic cordo-commissural cancer. Radiotherapy, endoscopic transoral microsurgery, or open partial vertical laryngectomy techniques are currently applied as the most common treatment options. Despite the physiological advantages of radiotherapy in cordo-commissural cancer, it is still a debatable treatment modality due to its higher recurrence rates.<sup>[10,11]</sup> Endoscopic microlaryngoscopic surgery with laser is also oncologically controversial for the same reason, as the transoral surgery is not suitable for safe resection including the TC in cancer involving AC.<sup>[7]</sup> However, partial laryngectomy techniques performed with open surgery are oncologically more confident. In open surgery, there is also no

unanimity nor on the surgical resection width or on the reconstruction methods. According to our experience and literature data in early cordo-commissural glottic cancer, there is discrepancy between the histological and clinic diagnosis. Clinical appearance of T1a cancer is often in Stage T3 due to its silent infiltration into the thyroid lamina of TC via the Broyles ligament, as the Broyles ligament directly inserts to the intermediate lamina of the TC and the lack of cancer-resistant inner perichondrium facilitates tumor invasion in the AC.<sup>[3-5]</sup> This region is the junction of three levels of the larynx. The AC is a pathway of invasion of the cancer cells into the TC and the three levels of the larynx. Therefore, AC is considered a weak and risky area of the larynx. The structure of the AC consists of vessels, glands, fibers of the vocal muscle, Broyles ligament, thyroepiglottic ligament, and conoid ligament of the conus elasticus.<sup>[4]</sup> The AC is anatomically non-separable unit from the glottis and subglottis. Based on the anatomic and histological studies of the larynx, Andreas and Guerrier<sup>[3]</sup> reported a small zone in the AC which they called O plan. This zone is deficient in vessels and glands, thereby, facilitating the oncological separation of the AC from the petiole of the supraglottis. In contrast to the supraglottis, the separation of the AC from subglottis is impossible due to the continuation of the conoid ligament up to the cricoid arch. Therefore, we adopted the principle of suprericoid laryngectomy with more resection rather than limited partial TC resection.

If the videolaryngoscopic and microlaryngoscopic examinations of early glottic cordo-commissural cancer in terms of the assessment of the AC, subglottis and ventricles are not conclusive. In this case, an endoscopic evaluation with 0°, 70°, 120° telescopes under general anesthesia without intubation in full oxygen saturation should be added.<sup>[18]</sup> For the investigation of TC invasion, radiological examination with CT and MRI is often not decisive, due to the ossification of the TC. Thyroid cartilage begins to be ossified after the age of 20 to 25 years, starting from the posteroinferior portion of the TC. Invasion of glottic cancer is common in the midline of the TC due to its ossification. There is almost complete

ossification in the elderly age, particularly in male patients. In contrast to the resistance of the TC and perichondrium to cancer infiltration, ossification with its vascularization of the TC facilitates the tumor cell spread through the ossified cartilage using the Haversian canals. Consequently, in glottic cancer affecting the AC, partial TC resection is not suitable. For the objective comparison and evaluation of the literature data in glottic carcinoma, these tumors must be determined as a different group than other glottic carcinomas. Besides, it should be remembered that, after partial TC resection of FAVL techniques, the remaining TC poses an early or late recurrence risk and lower cure rate, compared to the SCPL with CHEP.<sup>[19]</sup> Our clinical observations on unexpected local recurrence suggested the necessity of application of total TC resection instead of partial TC resection, as in conventional frontoanterior or frontolateral laryngectomy techniques. Although the SCPL technique performed with CHEP is oncologically the safest technique due to total TC and wide resection, its functional outcomes are still problematic.<sup>[20-21]</sup> In a previous study, intractable aspiration problem in T2 cordo-commissural cancer was reported to surprisingly resolve by a sacrificed arytenoid.<sup>[22]</sup> For the reasons mentioned above, we modified the Tucker's FAVL technique with the whole TC resection as in the SCPL owing to the laryngeal reconstruction with epiglottic laryngoplasty and newly created AC. In our procedure, the functional outcomes were much more satisfactory, compared to the SCPL, despite the same resection.<sup>[23-25]</sup>

In conclusion, in our study, we developed a modified technique combining the two strongest modalities, SCPL and FAVL and evaluated its oncological and functional rehabilitation outcomes. In this procedure, we attached a great importance for the protection of the laryngeal framework and the motility of the new larynx, as the elevation of the larynx plays an essential role in the protection of the airway. Based on our study results, this modified technique followed by early laryngeal rehabilitation yielded satisfactory postoperative laryngeal functions. In addition, narrowing the glottic aperture due to the newly created AC reduced the breathy voice in phonation compared to the SCPL with

CHEP or CHP. Removal of the TC resection to provide oncological safety did not cause any laryngeal reconstruction-related problem, either. However, further large-scale studies are needed to establish a definite conclusion.

#### Declaration of conflicting interests

The author declared no conflicts of interest with respect to the authorship and/or publication of this article.

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### REFERENCES

1. Kirchner JA, Fischer JJ. Anterior commissure cancer—a clinical and laboratory study of 39 cases. *Can J Otolaryngol* 1975;4:637-43.
2. Kirchner JA. Fifteenth Daniel C. Baker, Jr, memorial lecture. What have whole organ sections contributed to the treatment of laryngeal cancer? *Ann Otol Rhinol Laryngol* 1989;98:661-7.
3. Andrea M, Guerrier Y. The anterior commissure of the larynx. *Clin Otolaryngol Allied Sci* 1981;6:259-64.
4. Rucci L, Gammarota L, Borghi Cirri MB. Carcinoma of the anterior commissure of the larynx: I. Embryological and anatomic considerations. *Ann Otol Rhinol Laryngol* 1996;105:303-8.
5. Tillmann B, Paulsen F, Werner JA. Structures of the anterior commissure of the larynx. Biomechanical and clinical aspects. *Laryngorhinootologie* 1994;73:423-7. [Abstract]
6. Barboza R, Fox JH, Shaffer LE, Opalek JM, Farooki S. Incidental findings in the cervical spine at CT for trauma evaluation. *AJR Am J Roentgenol* 2009;192:725-9.
7. Chone CT, Yonehara E, Martins JE, Altemani A, Crespo AN. Importance of anterior commissure in recurrence of early glottic cancer after laser endoscopic resection. *Arch Otolaryngol Head Neck Surg* 2007;133:882-7.
8. Krespi YP, Meltzer CJ. Laser surgery for vocal cord carcinoma involving the anterior commissure. *Ann Otol Rhinol Laryngol* 1989;98:105-9.
9. Stephenson KA, Fagan JJ. Transoral laser resection of glottic carcinoma: what is the significance of anterior commissure involvement? *J Laryngol Otol* 2017;131:168-72.
10. Shimm DS. Early-stage glottic carcinomas: effect of tumor location and full-length involvement on local tumor recurrence after radiation therapy. *Radiology* 1994;192:873-5.
11. Zohar Y, Rahima M, Shvili Y, Talmi YP, Lurie H. The controversial treatment of anterior commissure carcinoma of the larynx. *Laryngoscope* 1992;102:69-72.
12. Bouche J, Freche C. Epiglottoplasty in the treatment of vestibular stenosis in adults. *Ann Otolaryngol Chir Cervicofac* 1964;81:5-11. [Abstract]

13. Sedláček K. Reconstructive anterior and lateral laryngectomy with the use of the epiglottis for the pedicle graft. *Cesk Otolaryngol* 1965;14:328-34. [Abstract]
14. Kambic V, Radsel Z, Smid L. Laryngeal reconstruction with epiglottis after vertical hemilaryngectomy. *J Laryngol Otol* 1976;90:467-73.
15. Tucker HM, Benninger MS, Roberts JK, Wood BG, Levine HL. Near-total laryngectomy with epiglottic reconstruction. Long-term results. *Arch Otolaryngol Head Neck Surg* 1989;115:1341-4.
16. Kennedy Thomas L. Epiglottic laryngoplasty. *Oper Tech Otolaryngol Head Neck Surg* 1992;3:199-201.
17. Schröder U, Eckel HE, Jungehülsing M, Thumfart W. Indications, technic and results following Sedlacek-Kambic-Tucker reconstructive partial resection of the larynx. *HNO* 1997;45:915-22. [Abstract]
18. Başerer N. Horizontal vertical laryngectomy in transglottic cancer. *Ann Otolaryngol Rhinol* 2017;4:1190-5.
19. Oysu C, Aslan I. Cricohyoidoepiglottopexy vs near-total laryngectomy with epiglottic reconstruction in the treatment of early glottic carcinoma. *Arch Otolaryngol Head Neck Surg* 2006;132:1065-8.
20. Laccourreye H, Laccourreye O, Weinstein G, Menard M, Brasnu D. Supracricoid laryngectomy with cricohyoidopexy: a partial laryngeal procedure for selected supraglottic and transglottic carcinomas. *Laryngoscope* 1990;100:735-41.
21. Bron L, Brossard E, Monnier P, Pasche P. Supracricoid partial laryngectomy with cricohyoidoepiglottopexy and cricohyoidopexy for glottic and supraglottic carcinomas. *Laryngoscope* 2000;110:627-34.
22. Çelik M, Doruk C, Başaran B. Unilateral arytenoidectomy for intractable aspiration following supracricoid laryngectomy. A case of surgical dilemma. *J Ist Faculty Med* 2018;81:99-101.
23. Akbas Y, Demireller A. Oncologic and functional results of supracricoid partial laryngectomy with cricohyoidopexy. *Otolaryngol Head Neck Surg* 2005;132:783-7.
24. Pinar E, Imre A, Calli C, Oncel S, Katilmis H. Supracricoid partial laryngectomy: analyses of oncologic and functional outcomes. *Otolaryngol Head Neck Surg* 2012;147:1093-8.
25. Basaran B, Unsaler S, Uluhan M, Aslan I. The effect of arytenoidectomy on functional and oncologic results of supracricoid partial laryngectomy. *Annals of otology, Rhinology & Laryngology* 2015;124:788-7.