Cricohyoidoepiglottopexy vs Near-Total Laryngectomy With Epiglottic Reconstruction in the Treatment of Early Glottic Carcinoma

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Objective: To compare functional and oncological outcomes of cricohyoidoepiglottopexy (CHEP) and near-total laryngectomy with epiglottic reconstruction (NTLER) techniques in early glottic carcinoma.

Design: Case series, clinical study.

Setting: Two tertiary care referral centers.

Patients: Seventeen patients with T1b glottic squamous cell carcinoma were treated with CHEP and 21 were treated with NTLER.

Main Outcome Measures: Fundamental frequency, maximum phonation time, maximum phonation intensity, Voice Handicap Index, and GRBAS (grade, roughness, breathiness, asthenia, and strain) scale were used to evaluate voice. Nasogastric tube removal times and late postoperative aspiration scales were used to evaluate swallowing ability.

Results: Fundamental frequency ($P = .78$), maximum phonation time ($P = .44$), and maximum phonation intensity ($P = .94$) measurements were not significantly different in the 2 groups. There was also no significant difference in mean Voice Handicap Index score ($P = .62$), mean decannulation time ($P = .25$), time to nasogastric tube removal ($P = .12$), or clinical grades of late postoperative aspiration ($P = .87$) between the 2 groups. The mean Voice Handicap Index score was 55.58 in the CHEP group and 52.78 in the NTLER group. According to the GRBAS scale, overall voice quality was moderately altered in both groups. All patients were successfully decannulated. In the CHEP and NTLER groups, the mean decannulation times were 27 and 20 days, respectively, and the nasogastric tubes were removed after an average of 23 and 17 days. The overall (Kaplan-Meier) survival rate was 94% in the patients who underwent CHEP and 90% in the patients who underwent NTLER ($P = .76$). The disease-free survival rates were 100% and 76% in the CHEP and NTLER groups, respectively ($P = .07$).

Conclusions: Functional and oncological results appear to be similar with both treatment methods. If open surgery is planned, the choice between these procedures mainly depends on the experience and preference of the surgeon.


Conservative laryngectomy and radiotherapy have long been advocated for the treatment of early glottic carcinoma. Both cricohyoidoepiglottopexy (CHEP) and near-total laryngectomy with epiglottic reconstruction (NTLER) allow comprehensive oncological control and conserve laryngeal function in patients with early glottic carcinoma.$^{1,2}$ They also allow complete resection of the true and false vocal folds and removal of the entire or greater part of the thyroid cartilage.

Both techniques have increased in popularity over the last few decades as a result of advantages such as preservation of speech and swallowing without a permanent tracheotomy. The accumulation of experience has led many authors to report their functional results and oncological outcomes as well as the pros and cons of each technique individually.$^{1,4}$ However, the current literature lacks a comparative study in terms of functional and oncological results. Our goal was to compare (1) perceptual and objective acoustic parameters, (2) short- and long-term respiratory and swallowing functions, and (3) oncological outcome after CHEP and NTLER techniques in early glottic carcinoma.

### METHODS

#### PATIENTS

The medical records of 38 patients who were treated with surgery for T1b glottic squamous cell carcinoma were analyzed, and the patients were invited by telephone to the clinic for voice evaluation. Seventeen patients (mean age, 52 years; age range, 39-67 years) were treated with CHEP, and 21 patients (mean age,
Alteration; 2, moderate alteration; and 3, severe alteration).8

with epiglottic reconstruction (NTLER) groups (0, normal voice; 1, slight
scores in the cricohyoidoepiglottopexy (CHEP) and near-total laryngectomy
handicap Index (VHI) scores in the cricohyoidoepiglottopexy (CHEP) and
near-total laryngectomy with epiglottic reconstruction (NTLER) groups. A Voice
Handicap Index score of 18 points on Likert analysis of the patient's responses (minimum score, 0;
maximum score, 120). A Voice Handicap Index score of 18 points or more or a Voice Handicap Index subscale parameter of 8 points
or more was indicative of deterioration in voice quality.7

The Voice Handicap Index was used to evaluate self-perceived emo-
tional, physical, and functional effects of vocal dysfunction based on
Likert analysis of the patient's responses (minimum score, 0; maximum score, 120). A Voice Handicap Index score of 18 points or more or a Voice Handicap Index subscale parameter of 8 points or more was indicative of deterioration in voice quality.7

Psychoacoustic evaluation was performed by audio recordings during vowel prolongation and conversational speech, which were analyzed by an experienced listener. The listener was instructed to use the GRBAS (grade, roughness, breathiness, asthenia, and strain) scale of Hirano,8 which rated the parameters on a 4-point equal-appearing interval scale (0, normal voice; 1, slight alteration; 2, moderate alteration; and 3, severe alteration).

RESPIRATION AND SWALLOWING

Early assessment of swallowing included removal time of nasogastric tube and initiation of oral feeding without restriction. Late postoperative aspiration was evaluated using the scale developed by Leipzing9 and Pearson10 (0, no problems or complications; 1, occasional cough, no clinical problems; 2, consistent cough, worsening with meals or swallowing; and 3, pulmonary complications).

STATISTICAL ANALYSIS

Kaplan-Meier survival analysis was used to compare the overall and disease-free survival rates between the 2 patient groups, and the t test was used to compare all the functional parameters except the GRBAS scale and clinical grading of late postoperative aspiration, which were evaluated with the Mann-Whitney U test. Statistical significance was set at P<.05. All values were expressed as mean (SD).

RESULTS

ACOUSTIC AND SPEECH ANALYSES

The fundamental frequency was 94.69 (14.20) Hz in the CHEP group and 96.65 (25.57) Hz in the NTLER group; the difference was not significant (P=.78). The maximum phonation time was 7.24 (1.11) seconds in the CHEP group and 6.95 (1.08) seconds in the NTLER group, and the difference was not significant (P=.44). The maximum phonation intensity was 81.43 (10.78) dB in the CHEP group and 81.73 (11.25) dB in the NTLER group, with no significant difference (P=.94).

VOICE PERCEPTION ANALYSIS

The total VHI score was 55.58 (17.98) in the CHEP group and 52.78 (14.62) in the NTLER group. The patients in both groups were equally handicapped, and the difference in the total scores was not significant (P=.62) (Figure 1). The emotional (CHEP, 16.53 [12.50]; NTLER, 15.63 [9.62]) and functional (CHEP, 20.94 [6.83]; NTLER, 17.88 [6.83]) disabilities in voice were equal in both groups of subjects. The physical influences of the voice disturbances were scored at 17.88 (7.88) in the CHEP group and 15.50 (5.69) in the NTLER group (P=.30).

Figure 2 shows the results of a subjective evaluation of a patient's voice using the GRBAS scale. Overall voice quality was moderately altered in both groups. The grades were 2.02 (0.93) and 2.18 (0.71) in the CHEP and NTLER groups, respectively. There was no significant difference between the 2 treatment modalities in any of the evaluation parameters (Figure 2).

RESPIRATION AND SWALLOWING

All patients in both groups were successfully decannulated, with no significant difference in decannulation time (P>.05). The mean decannulation time was 27.00 (22.84)

55 years; age range, 41-67 years) were treated with NTLER. With the exception of 1 female nonsmoker in the CHEP group, all of the patients were male smokers. The arytenoids were bilaterally preserved in both groups. Sixteen patients from each group underwent voice evaluation.

ACOUSTIC AND SPEECH ANALYSES

Acoustic analyses were performed with a commercially available software system (Dr Speech Version 4.50; Tiger DRS Inc, Seattle, Wash) a minimum of 6 months after surgery. The following parameters were assessed in each patient: (1) fundamental frequency, (2) maximum phonation time, and (3) maximum phonation intensity.

VOICE PERCEPTION ANALYSIS

The Voice Handicap Index was used to evaluate self-perceived emotional, physical, and functional effects of vocal dysfunction based on Likert analysis of the patient's responses (minimum score, 0; maximum score, 120). A Voice Handicap Index score of 18 points or more or a Voice Handicap Index subscale parameter of 8 points or more was indicative of deterioration in voice quality.7

Psychoacoustic evaluation was performed by audio recordings during vowel prolongation and conversational speech, which were analyzed by an experienced listener. The listener was instructed to use the GRBAS (grade, roughness, breathiness, asthenia, and strain) scale of Hirano,8 which rated the parameters on a 4-point equal-appearing interval scale (0, normal voice; 1, slight alteration; 2, moderate alteration; and 3, severe alteration).
days in the CHEP group. One patient with type 1 diabetes in the CHEP group needed the tracheotomy for 110 days, until the wound breakdown completely healed. The cannula was removed after an average of 20.00 (15.81) days in the NTLER group.

Nasogastric tubes were removed after 23.00 (13.58) days in the CHEP group and after 17.00 (11.36) days in the NTLER group. There was no significant difference in oral feeding initiation times between the 2 groups (P>.05). None of the patients developed pulmonary complications as a result of late aspiration. Seven of the patients in the CHEP group and 6 of the patients in the NTLER group reported no aspiration during the meals. Based on the clinical grading of postoperative aspiration assessment, 9 patients in the CHEP group and 9 patients in the NTLER group presented with grade 1 aspiration. One patient in each group reported consistent worsening of cough with liquids only (grade 2). The difference in clinical grades of late postoperative aspiration was not significant (P=.84).

ONCOLOGICAL RESULTS

The overall survival rate was 94% in the CHEP group and 90% in the NTLER group (P=.76) (Figure 3). Disease-free survival rates were 100% and 76% in the CHEP and NTLER groups, respectively (P=.07) (Figure 4). There was no recurrence in the CHEP group. One patient died of a cerebrovascular accident in postoperative month 8. In the second group, 4 tumor recurrences were observed. One patient with a recurrent tumor died of uncontrollable disease in postoperative month 29. Two of the remaining tumors were local recurrences that required total laryngectomy. One patient underwent postoperative radiation therapy and a neck dissection for a regional recurrence at the second cervical level. One of the patients with local recurrence in the NTLER group died of myocardial infarction in postoperative month 19.

COMMENT

The proper treatment method for early glottic carcinoma has been debated since the late 1970s. Both surgery and radiation therapy prove to have similar cure rates. Superior quality of voice is the main reason for choosing radiation therapy. On the other hand, the disadvantages of radiation therapy include long-term oncological problems and hidden costs such as work missed by the patient and family members, traveling time, and traveling distance. Furthermore, infiltration of the tumor into the cartilage of the anterior commissure was shown to significantly decrease local control in patients treated with radiotherapy. Endoscopic carbon dioxide laser surgery has recently emerged as a major therapeutic option for patients with early glottic carcinoma. In experienced hands, oncological results similar to those achieved with primary radiotherapy or open surgery may be attained with endoscopic surgery. However, according to some authors, involvement of the anterior commissure by tumor is still considered a contraindication to endoscopic resection. Moreover, endoscopic resection of the anterior commissure is technically challenging for many surgeons.

Both CHEP and NTLER have been used to treat early glottic carcinoma since the 1970s. There are numerous reports evaluating functional and oncological results of CHEP, but there are few reports in the English-language literature regarding the individual use of NTLER. In this study, we aimed to compare the 2 techniques regarding quality of speech, swallowing function, decannulation times, and oncological outcome.

Although there are optimistic reports regarding voice quality in patients who have been treated with CHEP and NTLER, we found that voice quality was negatively affected in both of our groups of patients. The fundamental frequency was equally below the normal range in both groups, and as a result, the voice pitch was deeper. Because both techniques destroy normal glottic closure, laryngeal resistance and loss of air during phonation lead to a reduction in maximum phonation time and intensity. In the current study, the maximum phonation times and intensities were found to be equally below the normal limit in both groups, resulting in an inability to increase the voice...
volume. Alterations in the objective voice parameters negatively influenced the patients’ self-perceived emotional, physical, and functional status uniformly in both groups (Figure 1). Listener evaluation scores, according to the GRBAS scale, were 2.02 and 2.18 in the CHEP and NTLER groups, respectively, indicating a moderate alteration in voice quality (Figure 2).

Theoretically, CHEP could be expected to influence deglutition more negatively than NTLER because the former procedure requires transection of the constrictor muscles along the thyroid cartilage, elevation of the pyriform sinus mucosa at the internal surface of the thyroid cartilage, and disarticulation of the cricothyroid joints. In the NTLER procedure, constrictor muscles remain untouched and dysfunction of the laryngeal nerves is less likely. However, we did not observe a significant difference in swallowing functions between both techniques. The mean initiation of oral feeding was 23 days in the CHEP group and 17 days in the NTLER group (P > .05).

Furthermore, in the long term, the swallowing function was as good in the CHEP group as in the NTLER group. The oncological rationale of supracricoid laryngectomy is based in part on the concept that the extent of the tumor should not change the amount of thyroid cartilage removed. The entire thyroid cartilage should be removed for better oncological control. Transcartilaginous access of vertical laryngectomies requires more subperichondrial tumor resection and violates the firm cartilage barrier as well, resulting in higher recurrence rates. In the present study, the incidence of tumor recurrence was higher in the NTLER group: there were 4 recurrences, 3 of which were salvaged with subsequent surgical procedures and 1 case in which the patient died of uncontrollable disease. In the CHEP group, no tumor recurrence was observed. However, the overall survival rates were not significantly different between the 2 groups. The disease-free survival rate was 100% in the CHEP group and 76% in the NTLER group. Despite the remarkable difference in disease-free survival rates between the 2 groups, no statistical significance was detected (P = .07).

As a result, objective measurements of voice were negatively influenced in both groups. Self-perceived effects of vocal dysfunction were equally negative in all patients. In both groups, the listeners assessed voice quality as moderately altered. The differences in decannulation times and swallowing functions were not significant between the 2 groups. Although the incidence of oncological failure was higher in the NTLER group, the overall and disease-free survival rates were not significantly different.

In conclusion, the functional and oncological results with the CHEP and NTLER procedures appear to be similar. If open surgery is the planned treatment method, the choice between these procedures mainly depends on the experience and preference of the surgeon.

Submitted for Publication: April 27, 2006; accepted June 19, 2006.

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Author Contributions: Drs Oysu and Aslan had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Oysu and Aslan. Acquisition of data: Oysu and Aslan. Analysis and interpretation of data: Oysu and Aslan. Drafting of the manuscript: Oysu and Aslan. Critical revision of the manuscript for important intellectual content: Oysu and Aslan. Statistical analysis: Oysu and Aslan. Obtained funding: Oysu and Aslan. Administrative, technical, and material support: Oysu and Aslan. Study supervision: Oysu and Aslan.

Financial Disclosure: None reported.

Acknowledgment: We thank Kursat Yelken, MD, for his help in performing acoustic analyses and Sarp Sarac, MD, for statistics.

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