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Long-term voice outcome after thyroidectomy using energy based devices

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ABSTRACT

Objective: Voice dysfunction is frequently reported after thyroidectomy even in absence of vocal fold paralysis. The energy-based devices such as Harmonic scalpel (HS) or LigaSure (LS) are commonly used in conventional thyroidectomy. The objective of this study was to investigate the long-term voice outcome after total thyroidectomy using energy based devices.
Methods: Patients who underwent total thyroidectomy with or without central neck dissection for papillary thyroid carcinoma using HS or LS from April 2012 to March 2013 were involved. The videolaryngostroboscopy, acoustic analysis, voice range profile, voice perceptual evaluation, and voice handicap index-30 were obtained preoperatively, 1 week, 1 month, 3 months, 6 months, and 1 year after thyroidectomy.
Results: Total 92 patients (HS group: 58 cases; LS group: 34 cases) were enrolled in this study. Demographics, tumor stage, and extent of operation were not significantly different between the HS and LS group. None of the patients evidenced any abnormalities at the pre- or postoperative videolaryngostroboscopic examination. The voice range profile (highest frequency), voice perceptual evaluation (grade, rough, and breathy), and voice handicap index-30 (total, functional, physical, and emotional) showed significantly worse scores in early postoperative period (<1 month), but gradually returned to preoperative values. The all parameters of acoustic analysis, voice range profile, voice perceptual evaluation, and voice handicap index-30 were not significantly different between the HS and LS group.
Conclusion: The long-term voice change after thyroidectomy shows similar results regardless of the type of energy-based devices.

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1. Introduction

Voice alteration is one of main complaint after thyroid surgery. The main cause of voice dysfunction is related to recurrent laryngeal and superior laryngeal nerve damage or cricothyroid or strap muscle damage [1–3]. In order to reduce potential injury to the cricothyroid and strap muscle, and recurrent laryngeal and superior laryngeal nerve, a fine hemostasis and a dry surgical field around nerve are required. Recently, using new energy-based devices such as a Harmonic Scalpel (HS) or a LigaSure (LS) has become a common practice for the hemostasis in thyroid surgery [4].

These 2 devices have different technology basis for vessel ligation: the HS is a mechanical vibration-based instrument,

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whereas the LS is a closed-loop bipolar instrument. Many studies have reported the efficacy and surgical outcome of sutureless thyroidectomy using energy based devices and compared surgical outcomes, rate of complications, and overall morbidity [5]. However, there has been no study of the postoperative long-term voice outcome of thyroidectomy using energy based devices. The purpose of this study was to investigate objective and subjective voice change after total thyroidectomy using energy based devices and to evaluate the difference of voice outcomes between the surgical techniques using these 2 devices.

2. Materials and methods

2.1. Subjects

The study involved the patients who underwent total thyroidectomy with or without central neck dissection for papillary thyroid carcinoma between April 2012 and March 2013. Exclusion criteria included age <18 or >75 years, previous vocal fold paralysis, suspicious invasion to nerve in image studies, history of voice or laryngeal diseases requiring therapy, speech disorders, pulmonary diseases, and gross extrathyroidal extension. Of 103 eligible patients, 11 patients were excluded because of insufficient voice evaluation or follow-up loss. The remaining 92 patients were analyzed for this study. The Institutional Review Board of our institution approved this study.

2.2. Operative technique

All operations were performed by one experienced surgeon (K.W. J.) with the use of either a HS FOCUS® (Johnson & Johnson, Ethicon Endo-surgery, Cincinnati, OH) or a LS™ Small Jaw Instrument (Covidien, Boulder, CO). There was no preference among these devices. Total thyroidectomy was performed through a standard 5–6 cm cervical incision. Operative technique was standardized with the only difference being the use of the HS or the LS for vessel ligation. The activated tip of both energy-based devices was applied at a distance of more than 2 mm from the recurrent laryngeal nerve (RLN). After performing the ligation, tip was often cooled down using wet gauze. If the vessel to be coagulated is running unexpectedly close to the RLN, hemostasis was achieved by small hemoclips. When dividing Berry's ligament, bipolar electrocautery was used to free the thyroid lobe from its attachment to the trachea because of the relatively blunt tip of devices. The superior pole vessels were individually identified and divided using the HS or the LS as close to the thyroid capsule as possible to avoid damage to the fascia of superior constrictor muscle. The superior laryngeal nerve was not routinely identified. In addition, we should be aware of keeping other tissues away from the tissue in the active jaw of HS to prevent lateral thermal spread. When making working space with the LS, judicious and careful dissection should be done due to blunt blades to prevent inadvertent damage to the surrounding structures. Furthermore, a specialized electrode-embedded endotracheal tube was used for intraoperative RLN monitoring when cases of tumor sized >4 cm or located close to the RLN. We identified the RLN and frequently checked that the nerve were intact and showed normal signal during operation.

2.3. Voice assessments

Voice function was assessed with videolaryngostroboscopy, acoustic analysis, voice range profile (VRP), voice perceptual evaluation, and patient's subjective voice preoperatively, 1 week, 1 month, 3 month, 6 month, and 1 year after surgery.

The videolaryngostroboscopy was performed by using a 70° rigid laryngoscope with KayPENTAX model RLS 9100B (Kay Elemetrics Inc., Lincoln Park, NJ) to assess vocal folds motion impairment, as well as bowing, inferior displacement of vocal fold, regularity and symmetry of the mucosal wave, and degree of glottic closure.

Acoustic recordings were collected by an experienced speech-language pathologist. Acoustic variables were measured using multidimensional voice program from the Computerized Speech Lab, Model 4500 (KayPENTAX, Lincoln Park, NJ) on few seconds of the sustained phonation of /a/. The following parameters were analyzed: fundamental frequency (F0, Hz), noise-to-harmonic ratio, jitter (%), and shimmer (%).

For VRP analysis, the patients were instructed to phonate using a sustained vowel /a/ as loud and as soft possible from the lowest to the highest frequencies. To obtain a VRP, an automated procedure was used. The following parameters were analyzed: lowest (F-low) and highest (F-high) frequencies (Hz).

The voice perceptual evaluation of voice quality was performed using the grade, roughness, breathiness, asthenia, and strain (GRBAS) scale designed by Hirano [6], one experienced phoneticians who had no information about the study design.

The patient's subjective voice was assessed voice handicap index (VHI)-30. VHI-30 consists of 30 questions divided by content into 3 categories: functional, physical, and emotional parameters. All patients filled out the VHI questionnaires using a 5-point rating scale to indicate their response. It is an ordinal scale that is scored from 0 (never) to 4 (always) for each of the questions, with a minimum score of 0 and a maximal score of 120. Higher score means a more severe perception of disability due to the voice problem.

2.4. Statistical analysis

The continuous data are presented as mean ± SD. The chi-square test or independent t tests were used to compare demographics and clinical characteristics between the 2 groups. A repeated measures analysis of variance was used to compare pre- and post-operative data and compare the HS and LS group. For all test, $P < 0.05$ was accepted as statistically significant. All statistical analyses were done with SPSS software version 12.0 (SPSS Inc., Chicago, IL).

3. Results

The demographic and clinicopathologic characteristics of the 2 groups are shown in Table 1. There were 92 patients in

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