

Superior Laryngeal Nerve Injury in Thyroidectomy Surgery

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Abstract

Introduction: The thyroid gland is one of the endocrine glands with the most frequent disorders or diseases compared to other endocrine glands. Treatment of these disorders is generally performed by surgery or called a thyroidectomy. Thyroidectomy surgery can pose a risk of complications, both early complications, and late complications. Common complications are hemorrhage, hypoparathyroidism, recurrent laryngeal nerve injury, and external branch of the superior laryngeal nerve.

Purpose: To analyze the effect of the surgical method of superior thyroideal vasa ligation as distally as possible on the prevention of injury to the external branch of the superior laryngeal nerve (EBSLN) in thyroidectomy.

Methods: Clinical trial study with pre and post-test design in patients undergoing thyroidectomy surgery. Patients were examined using a questionnaire of the injury-related voice of EBSLN (SKC-EBSLN), which tested the validity and reliability of the previous test and measured 1-octave sound ability before and after thyroidectomy surgery using the superior thyroidectomy vasa ligation method as distally as possible to see its effect on EBSLN function and tone ability function.

Results: There were differences in the scores of the SKC-EBSLN questionnaire before and after thyroidectomy surgery using the method of superior thyroideal vasa ligation as distally as possible ($p < 0.05$). Further analysis showed that clinical diagnosis, surgery, tumor size, and AP outcome did not have a statistically significant effect on the postoperative SKC-EBSLN score ($p > 0.05$). In this study, the SKC-EBSLN score had a significant effect on the 1-octave tone ability ($p < 0.05$).

Conclusion: As many as 51.9% of patients had a normal voice condition with few complaints and were able to sing 1-octave tone after surgery using the method of superior thyroideal vasa ligation as distally as possible. The SKC-EBSLN questionnaire is a valid and reliable questionnaire to evaluate the results of thyroidectomy surgery.

Keywords: external branch of the superior laryngeal nerve, superior thyroideal vasa, thyroidectomy, SKC-EBSLN

Background

The thyroid gland is one of the endocrine glands with the most frequent disorders or diseases compared to other endocrine glands. Abnormalities in the thyroid gland include birth defects, inflammation, malfunctioning, goiter, and benign or malignant tumors.

Treatment of these disorders is generally performed by surgery or what is called a thyroidectomy.

Types of thyroidectomy surgery may include lobectomy, isthmolobectomy, subtotal thyroidectomy, near-total thyroidectomy, total thyroidectomy, and Dunhill Procedure. Any thyroidectomy surgery will pose a risk of complications, both early complications, and late complications. Common complications are hemorrhage, hypoparathyroidism, recurrent laryngeal nerve injury, and external branch of the superior laryngeal nerve. Nerve injury can be in the form of

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temporary neuropraxia and permanent paralysis as a result of transection, traction, entrapment, thermal damage, or vascular injury during the release of thyroid tissue.

The recurrent laryngeal nerve (RLN) measures 3.2-4.0 mm, while the external branch of the superior laryngeal nerve (EBSLN) is 0.82 ± 0.18 mm in diameter, which is 5-6 times smaller (Veraldo et al. 2014; Gavid et al. 2017). RLN, one of which invades the vocal cords, which functions motorically to move the vocal cords so that they function to produce sound. If this nerve is injured, it will result in hoarseness symptoms. During thyroidectomy, identification and preservation of RLN are relatively easy because of its visible dimensions and anatomical location that is in the tracheoesophageal groove, medial to the inferior thyroid artery, and on the inside of the Berri ligament. The frequency of occurrence of RLN injuries during thyroidectomy surgery ranges from 2% - 13%. In stark contrast to the EBSLN, which invades the cricothyroid muscle and has motor functions to lengthen and shorten the vocal cords to produce high-pitched sounds. If this nerve is injured, it will cause paralysis and/or weakness of the cricothyroid muscles, resulting in changes in sound quality, sound projection, and production of high-pitched sounds.

The surgical implications of this classification system, namely type 2a and 2b, are considered to be the high risk of EBSLN injury during thyroidectomy. During thyroidectomy surgery and when superior thyroidal vasa ligation action, identification of this nerve is a little difficult because of its very fine dimensions (0.3 - 0.8 mm), and its anatomical location that is medial to the superior thyroid vasa, and may be above or behind the upper polar cross-section of the thyroid. The frequency of occurrence of this nerve injury during thyroidectomy surgery ranges from 0-58%.

Efforts to avoid EBSLN injury during the arctic release of the thyroid are by ligating the superior thyroid vasa by identifying the nerve by cutting the sternothyroideus muscle at its base and by slightly pressing the upper pole of the thyroid, but this action can be done if the thyroid mass is not too large and is rarely done. Another action to identify this nerve is using intraoperative nerve monitoring (IONM) device. This monitoring action is rarely performed because

not all hospitals have these facilities. Moreover, from some literature studies, monitoring the nerve will not guarantee that the nerve is free from injury.

Based on the efforts to identify EBSLN and the high risk of nerve injury despite using nerve monitoring device, it is necessary to find a way or method of how to ligate the superior thyroid vasa when releasing the pole over the thyroid without identifying the nerves and using a nerve monitoring tool safely so that no injury to the nerve occurs. So the act of ligation of the superior thyroid vasa as distally as possible (close to the thyroid capsule) at the upper pole of the thyroid to avoid EBSLN injury during thyroidectomy surgery, is a method that is expected to be able to secure the nerve from injury without identification and use of nerve monitoring (IONM) devices.

To prove that this procedure is safe to perform in thyroidectomy surgery, patients who will undergo thyroidectomy surgery using this method in the polar liberation of the thyroid (as research subjects) can undergo a clinical examination both pre-operatively and post-operatively using a questionnaire of the injury-related voice of EBSLN (SKC-EBSLN) as a means of screening (self-assessment) whether there is a sound disturbance. Other tests that can be used to objectively detect EBSLN disorders are acoustic analysis, video laryngostroboscopy, and laryngeal electromyography (L-EMG). The technical questionnaire examination can be done after thyroidectomy surgery in a certain period of time (2 weeks, 1 month, 3 months, and 6 months) for a period of 6 months, which is the time the wound healing process takes place in the tissue.

Methods

The method used was a clinical trial study with pre and post-test design in patients undergoing thyroidectomy surgery. Patients who have undergone thyroidectomy surgery in several hospitals that have been determined by several operators from the Head and Neck Surgery Division staff with the surgery method according to the research material and meet the inclusion and exclusion criteria were carried out their data collection including identity, preoperative diagnosis, date of operation, type of surgery, results of anatomical pathology examination, and contactable telephone/cellphone numbers.

After the patient's data was complete, then the researcher contacted the patient directly via telephone for an interview to fill out a modified TVQ questionnaire and test the vocal ability of 1-octave power from low to high notes by saying: do-re-mi-pa-sol-la-si-do. After all the required data were complete, including the results of testing the vocal skills of the voice, the data was then recapitulated. Furthermore, the data was processed and analyzed in accordance with the statistical program to obtain the conclusions of the study.

Results

In the last 6 months of 2020, the researchers found 27 patients who had undergone thyroidectomy surgery in several hospitals in the city of Surabaya with the doctor in charge of the patient (DPJP) who were several doctors from the staff of Head Neck Surgery Division of Faculty of Medicine of Unair / RSUD Dr. Soetomo Surabaya with the surgery method according to the research, which is the standard thyroidectomy operation procedure in the Head and Neck Surgery division. Researchers collected demographic data of patients who became the subjects of the study including gender, age, occupation, date of operation, date of the interview, and home address.

From gender data, the number of female patients was more dominant than males, specifically 22 female patients (81.5%) and 5 male patients (18.5%). According to the age group with a range between 15-81 years, most data appeared in the age group >50 years for 15 patients (55.6%), followed by the age group between 31-50 years for 8 patients (29.6%), and the age group <30 years for 4 patients (14.8%).

Other demographic data were patient occupation. Patients working in the private sector/entrepreneurship was the largest group for 10 patients (37.0%), followed by the unemployed group for 7 patients (25.9%), students for 4 patients (14.8%), civil servants for 4 patients (14.8%), and the teacher as a professional group for 2 patients (7.5%).

In this study, the basic clinical characteristics included clinical diagnosis, type of surgery, tumor size, and results of anatomical pathology (AP). In clinical diagnosis before surgery, the most were bilateral non-toxic multinodosa struma for 16 patients (59.3%), followed by thyroid carcinoma and non-toxic uninodosa

struma for 4 patients (14.8%) of each, and diffuse toxic struma for 3 patients (11.1%).

The majority of actions performed in this study were total thyroidectomy in 19 cases (70.4%), hemithyroidectomy and completion of total thyroidectomy in 3 cases (11.1%) of each, and subtotal thyroidectomy was the least surgical operation performed in this study, which was 2 cases (7.4%).

After measuring the mass of the removed thyroid tissue, the largest number was found in 20 patients (74.1%) with a size between 5-10 cm, then 5 patients (18.5%) with a size >10 cm, and 2 patients (7.4%) with a size <5 cm. In this study, the results of most anatomical pathology (AP) examinations were benign in 18 patients (66.7%) and malignant in only 9 patients (33.3%).

This study used the SKC-EBSLN questionnaire as a research parameter. The results of the SKC-EBSLN questionnaire score are normal if the score is <5 and abnormal if the score is >5. From the pre-operation data, it was found that the normal value was 26 patients (96.3%) and only 1 patient (3.7%) with abnormal value. After thyroidectomy surgery, there was a decrease in the number of patients with normal values by 13 patients (48.1%) and abnormal values by 14 patients (51.9%).

The results of the SKC-EBSLN questionnaire score could also be divided into 3 groups based on the severity of voice disorders due to thyroidectomy surgery, namely:

- a. Normal/Mild Group (0 -8) = 15 patients (55,6%)
- b. Moderate Group (9-23) = 9 patients (33,3%)
- c. Severe Group (24-32) = 3 patients (11,1%)

This vocal ability test was performed by the patient after filling in all the SKC-EBSLN questionnaire data by following the direction of the researcher over the telephone. The test was carried out by asking the patients to sing a tone voice: Do-Re-Mi-Pa-Sol-La-Si-Do, without stopping and with starting a low note to a high note with a 1-octave scale. There were 3 categories of ability assessment, namely: 1) capable, 2) less capable and 3) incapable. For the preoperative assessment of the ability of this vocal test, the assessment is only based on the subjective recognition of the patient with a fixed value of 3 categories, namely: 1) capable, 2) less capable

and 3) incapable.

In this study, preoperative data showed that 24 patients (88.9%) admitted to having the ability to produce high-pitched sounds, 3 patients (11.1%) said they were less capable to produce high notes, and not a single patient claimed to be incapable to produce high notes. Moreover, from the postoperative data, there were only 14 patients (51.9%) who were capable to produce

a 1-octave tone sound, then 10 patients (37.0%) were considered to be less capable, and 3 patients (11.1%) felt incapable to produce a 1-octave tone sound.

In this parameter, further analysis was carried out with a comparative test using the Mc Nemar Test. The results indicated that there was a significant difference between the pre-operative and post-operative sound quality ($p = 0.003$; $p < 0.05$).

Table 1 - The results of the comparative test analysis of patients who performed the superior thyroid vasa ligation surgery method against the pre and post-operative SKC-EBSLN scoring

		Post	Operative	Total	Nilai P
		Normal	Abnormal		
Pre Operative	Normal	13	13	26	0,003*
	Abnormal	0	1	1	
Total		13	14	27	

Postoperative SKC-EBSLN scoring was also analyzed for comparison of basic clinical characteristics such as clinical diagnosis, surgery, tumor size, and AP results in this study. The comparative test used in this study was the independent t-test, chi-square, and Fisher's exact test. The results of the analysis showed that clinical diagnosis, surgery, tumor size, and AP results did not have a statistically significant effect on the postoperative SKC-EBSLN scoring ($p > 0.05$).

Table 2 - Results of comparative test analysis on basic clinical characteristics and postoperative SKC-EBSLN

		Post		Operative		Total		Nilai P
		Normal	Abnormal	Normal	Abnormal	Normal	Abnormal	
Clinical Diagnosis	Non Toxic Uni Nodular Struma	2	(75,0%)	1	(25,0%)	4	(100%)	0.671
	Multi Nodular Struma	7	(43,8%)	9	(56,3%)	16	(100%)	
	Toxica	1	(33,3%)	2	(66,7%)	3	(100%)	
	Carcinoma Thyroid	2	(50,0%)	2	(50,0%)	4	(100%)	
Operation	Hemithyroidectomy	3	(66,7%)	0	(0,0%)	3	(100,0%)	0,287
	Subtotal Thyroidectomy	1	(50,0%)	1	(50,0%)	2	(100,0%)	
	Completion Total Thyroidectomy	1	(33,3%)	2	(66,7%)	3	(100,0%)	
	Total Thyroidectomy	8	(42,1%)	11	(57,9%)	19	(100,0%)	
Mass	< 5 Cm	2	(100,0%)	0	(0,0%)	2	(100,0%)	
Size	5- 10 Cm	7	(40,0%)	11	(60,0%)	20	(100,0%)	0,306
	>10 Cm	2	(40,0%)	3	(60,0%)	5	(100,0%)	
Anatomical Pathology Result	Benign	9	(50,0%)	9	(50,0%)	18	(100,0%)	1.000
	Malignant	4	(44,4%)	5	(55,6%)	9	(100,0%)	

In this study, the correlation between SKC-EBSLN scoring and postoperative test of 1-octave tone ability was also sought. After the statistical analysis was carried out through the independent t-test and chi-square test, the

results of the analysis showed that there was a significant difference in results ($p = 0.002$; $p < 0.05$) between the SKC-EBSLN score and the results of postoperative 1-octave tone ability.

Table 3 - Correlation between SKC-EBSLN and Postoperative 1-Octave Tone Ability Test

			1-OCTAVE TONE ABILITY			TOTAL
			NOT CAPABLE	LESS CAPABLE	CAPABLE	
MTVQ	NORMAL	count	0	0	9	9
EBSLN PASCA-OPERATION		% within MTVQ EBSLN Postoperative	0,0%	0,0%	100,0%	100,0%
	ABNORMAL	Count	3	10	5	18
		% within MTVQ	16,7%	55,5%	27,8%	100,0%
		EBSLN Postoperative				
TOTAL		count % within MTVQ Postoperative	3 16,7%	10 55,5%	14 51,9%	27 100,0%

Discussion

Thyroidectomy surgery has been performed since 956 AD by Albucasis. Thyroidectomy surgery is performed to remove the tumor mass or abnormalities in the thyroid gland. Types of thyroidectomy surgery include lobectomy, isthmolobectomy, subtotal thyroidectomy, near-total thyroidectomy, total thyroidectomy, and Dunhill Procedure. Any thyroidectomy surgery carries a risk of complications. Common complications include hemorrhage, hypothyroidism, hypoparathyroidism, recurrent laryngeal nerve injury, and external branch of the superior laryngeal nerve (EBSLN). Nerve injury can be neuropraxia which is reversible and paralysis which is non-reversible resulting from transection, traction, entrapment, thermal damage, or disrupted blood supply during the release of thyroid tissue ⁽¹⁾.

The external branch of the superior laryngeal nerve (EBSLN) has the function of invading the cricothyroid muscle which functions as a motor to lengthen and shorten the vocal cords to produce high-pitched sounds. If this nerve is injured, it will cause paralysis and/or weakness of the cricothyroid muscles, resulting in changes in sound quality, sound projection, and the inability to produce high-pitched sounds.

The anatomical location of the EBSLN lies at the junction between the superior thyroid vasa and the upper pole of the thyroid ⁽²⁾. The surgical implications of this classification system, namely type 2a and 2b, are considered to be the high risk of EBSLN injury during thyroidectomy. During thyroidectomy surgery and the superior thyroid vasa ligation action, identification of this nerve is a little difficult because of its very fine

dimensions (0.3–0.8 mm), and its anatomical location that is medial to the superior thyroid vasa, and may be above or behind the upper polar cross-section of the thyroid. The frequency of occurrence of this nerve injury during thyroidectomy surgery ranges from 0-58%⁽³⁾.

Efforts to avoid EBSLN injury during the arctic release of the thyroid are by ligating the superior thyroid vasa by identifying the nerve by cutting the sternothyroideus muscle at its base and by slightly pressing the upper pole of the thyroid, but this action can be done if the thyroid mass is not too large and is rarely done⁽⁴⁾. Another action to identify this nerve is by using intraoperative nerve monitoring (IONM) device, this monitoring action is rarely performed because not all hospitals have these facilities. Moreover, several literature studies stated that monitoring this nerve will not guarantee that the nerve is free from injury⁽⁵⁾.

Based on the efforts to identify EBSLN and the high risk of nerve injury despite using nerve monitoring device, it is necessary to find a way or method of how to ligate the superior thyroid vasa when releasing the thyroid pole without causing injury to the nerve. Furthermore, the superior thyroid vasa ligation as distally as possible (close to the thyroid capsule) at the upper pole of the thyroid to avoid EBSLN injury during thyroidectomy surgery, is a method that is thought to be able to secure the nerve from injury without identification and use of nerve monitoring (IONM) devices.

Recurrent laryngeal nerve (RLN) injury is the main cause of voice changes after thyroidectomy, while EBSLN injury is another cause of changes in both sound quality and high-pitched sound production. However, the effects that occur on sound and swallowing as common complaints often occur after thyroidectomy despite the absence of decreased function of the RLN and EBSLN.

The aim of this study was to assess the success rate of the surgical method of superior thyroid vasa ligation as distally as possible to avoid EBSLN injury without the identification of these nerves using a thyroidectomy-related voice questionnaire (TVQ). The modified score became the injury-related voice of EBSLN (SKC-EBSLN) score. The SKC-EBSLN questionnaire scoring was used as a research parameter by comparing the scores before and after thyroidectomy surgery. The results of this questionnaire can predict the occurrence

of EBSLN injuries and have been studied to have sensitivity and specificity values of 86% and 88%.⁽⁶⁾ Researchers have also tested the validity and reliability of the modified SKC-EBSLN questionnaire through the statistical test method, the value of Corrected Item-Total Correlation was >0.3 for validity, and the values of Cronbach's Alpha was >0.6 for reliability. The result was that the pre-operative SKC-EBSLN questionnaire scoring was invalid but reliable while the post-operative SKC-EBSLN questionnaire was valid and reliable. This means that the postoperative SKC-EBSLN scoring can be used as a research parameter.

In this study, each thyroidectomy surgery performed by surgeons from the Head and Neck Surgery staff of Faculty of Medicine of Unair / RSUD Dr. Soetomo Surabaya is considered to use the surgical method of superior thyroid vasa ligation as distally as possible when releasing the upper pole of the thyroid to avoid EBSLN injury. In accordance with the inclusion and exclusion criteria, during the last 6 months of 2020 carried out at Dr. Soetomo and several hospitals in the city of Surabaya and its surroundings, it is found that 27 patients as research subjects with a minimum sample size of $n = 22$.

From the data on patient demographic characteristics, female patients were more dominant than males, which was 22 patients (81.5%): 5 patients (18.5%). The age range of 27 patients was 15-81 years, mostly in the >50 years age group for 15 patients (55.6%), followed by the 31-50 years age group for 8 patients (29.6%), and the <30 years age group for 4 patients (14.8%). In accordance with the research of Kwon et al. 2017, which reported that 180 female patients as the study sample and their age range were between 18-82 years, the mean age of 51 + 12.6. The impression is that thyroid gland disease is more dominant in women than men with the largest age range between 50-60 years.

From 27 patients, the basic clinical characteristics of the patients were examined in the form of clinical diagnosis, type of surgery, size of tumor mass, and results of AP. The most clinical diagnoses in this study were bilateral non-toxic multinodosa struma followed by non-toxic uninodosa struma, thyroid carcinoma, and toxic diffuse struma. Previous studies have stated that non-toxic multinodosa struma was one of the most

common thyroid gland disorders worldwide. A study conducted in Shandong province of China stated that the prevalence of non-toxic multinodosa struma in the area was 40.1% (7).

The majority of types of surgery performed in this study were total thyroidectomy, while subtotal thyroidectomy was the least type of surgery performed. A meta-analysis study states that total thyroidectomy has a lower tumor recurrence rate than subtotal thyroidectomy, but with more side effects (8). However, this is not in line with the research conducted by Giles et al. which stated that the tendency for transient recurrent laryngeal nerve pareses in total thyroidectomy did not differ significantly from subtotal thyroidectomy, even in the study by Pappalardo et al. stated that the incidence of permanent recurrent laryngeal nerve paresis in patients undergoing total thyroidectomy was significantly lower than that of subtotal thyroidectomy (7,8).

Tumor sizes in this study were classified in the <5 cm group, between 5-10 cm and >10 cm. Tumors with a size of 5-10 cm were the largest group in this study. As for the results of AP, this study stated the most results were benign tumors.

The difference in the basic clinical characteristics of patients in this study was thought to provide variability in the analysis results. However, from the results of the analysis of each patient's basic clinical characteristics such as clinical diagnosis, type of surgery, tumor size, and the results of the AP examination on the results of the postoperative SKC-EBSLN score, the result indicated that there was no significant difference in any variability of patient characteristics on the results of the postoperative SKC-EBSLN scoring. This means that the clinical diagnostic factors, the type of surgery, the size of the tumor mass, and the AP results did not determine the post-operative SKC-EBSLN scoring results, therefore, the surgical method of superior thyroid vasa ligation for the release of the upper thyroid pole in thyroidectomy for 27 patients was not affected by the factors mentioned above.

The TVQ questionnaire score was developed by Chun et al. in 2012, which was used to measure the sound ability related to thyroidectomy surgery. Ideally, the measurement of the TVQ questionnaire score is carried out before and after surgery, to screen for voice

abnormalities before thyroidectomy surgery. This questionnaire has been extensively researched, has been validated, and has a specificity of 86% and a fairly high sensitivity of 88% (9,10).

In this study, EBSLN injury was detected or not by using the SKC-EBSLN questionnaire score performed before and after thyroidectomy surgery. There was 1 patient (3.7%) who had an abnormal SKC-EBSLN score before surgery. After surgery, the abnormal SKC-EBSLN score increased to 14 patients (51.9%). There was a significant difference between the data that was assessed from the SKC-EBSLN questionnaire scores before and after surgery.

The post-operative SKC-EBSLN questionnaire was valid and reliable, has 8 questions with the lowest score was 0 (without complaints and voice symptoms) and the highest was 32 (mood disorders with severe symptoms). Based on the index score of complaints and symptoms that arise after surgery, the normal or mild scores were 0-8, moderate scores were 9-23, and severe scores were 24-32. From the 3 scoring groups, it was found that 15 patients (55.6%) had normal or mild symptoms, 9 patients (33.3%) had moderate symptoms, and 3 patients (11.1%) had severe symptoms.

At the time of this study, the method of superior thyroid vasa ligation as distally as possible may not have been assessed as a safe surgical method to avoid trauma to the EBSLN. There is still a need for follow-up time to assess the success of the method of surgery in 3 abnormal patients with symptoms of severe voice disorders. So it is recommended to do a video diagnostic examination of laryngostroboscopy and EMG of the larynx, in order to prove the presence or absence of abnormalities in the vocal cord and EBSLN paralysis. This may imply that post-operative thyroidectomy sound quality disturbances often occur even though EBSLN does not necessarily occur.

Finally, in this study, the correlation between the SKC-EBSLN questionnaire score and the postoperative 1-octave tone ability test was also sought, namely a significant difference in the scores between the post-operative SKC-EBSLN questionnaire scores and the postoperative 1-octave tone ability test results. This ability test is more objective in assessing EBSLN function than filling out the SKC-EBSLN questionnaire

because the researcher directly listens to the patient's voice and can even be recorded for acoustic analysis. However, in this study, acoustic analysis was not included in the dependent variable. The results of the correlation were as follows:

a). There were 9 patients with normal and capable conditions, meaning that these patients had no problems with high-pitched sounds.

b). There were 5 patients whose condition was abnormal and capable, meaning that these patients were able to sing the high notes but there were still other complaints.

c) There were 10 patients whose conditions were abnormal and were still incapable to sing the high notes, therefore, these 10 patients still needed a follow-up to assess the ability to sing high-pitched sounds.

d) There were 3 patients whose conditions were abnormal and incapable, thus, these patients took time for having complete healing.

It is necessary to do video laryngostroboscopy and EMG of the larynx after 6 months postoperatively to diagnose the presence of vocal cord and EBSLN paralyze as prognostic factors and seek appropriate treatment.

There was a significant difference between the SKC-EBSLN questionnaire score and the postoperative 1-octave tone ability test. This means that; a) these test tools are very useful for assessing the current condition of the postoperative EBSLN, and b) the two tools can work together when used as a test tool to assess the condition of the postoperative EBSLN.

Voice changes after thyroidectomy surgery in the absence of injury to RLN or EBSLN often go unnoticed. Possible causes could be a laryngotracheal fixation with decreased vertical motion, cricothyroid muscle dysfunction, surgical injury, or temporary dysfunction of the extralaryngeal strap muscles, trauma to orotracheal intubation and laryngeal edema, severe retractile cervical scar, local neck pain, and psychological factors⁽¹¹⁾.

Researchers have used the SKC-EBSLN questionnaire to 27 patients as research subjects at the same time after surgery including data collection before surgery with the results described above.

In a previous study, this TVQ score has been used to evaluate the sound condition before and after thyroidectomy surgery for 4 periods of time, namely, before surgery, and after surgery (2 weeks, 2 months, and 8 months) with the result of a change in value⁽⁸⁾. Abnormal values were higher at 2 weeks to 2 months after surgery and there was a significant decrease in abnormal values at 8 months after surgery. So that there was a significant difference between normal values before surgery and abnormal values 8 months after surgery.

Although this questionnaire score has been shown to have high sensitivity and specificity, it is necessary to carry out a similar study using more standard parameters in assessing the presence of EBSLN injuries using video laryngostroboscopy and laryngeal electromyography (LEMG). The samples used in this study were few and no controlled randomization was carried out, for this reason, the sampling time span also needs to be extended so that a larger number of samples will be obtained.

In this study, 3 patients (11.1%) were suspected of having EBSLN injury after thyroidectomy surgery, compared to previous studies, the results varied depending on the method of surgery performed, those were:

a. Thyroidectomy without knowing the course and identification of EBSLN was 9-28%^(2,8)

b. Thyroidectomy with EBSLN identification was 8-14%^(2,8)

c. Thyroidectomy with EBSLN identification and using intraoperative nerve monitoring (IONM) was 0-1%^(2,8).

As a comparison, the results of the study by Hurtado-Lopez et al. 2017, from 100 patients undergoing thyroidectomy without EBSLN identification and with nerve identification using IONM who experienced EBSLN injuries was 28% with details of 20% EBSLN injuries that were transient/temporary and 8% permanent EBSLN injuries.

In this study, although the ligation method has been carried out well, if there are still EBSLN lesions, it may be due to excessive use of monopolar electrocautery for homeostatic in the upper arctic area of the thyroid, nerve

ischemic due to the disrupted blood supply, possibly the anatomical location of the EBSLN according to Cernea 2a and 2b criteria (37, 5%) which often led to the entanglement of EBSLN when performing superior thyroideal vasa ligation, especially during the large goiter mass for >25 cm in diameter. Therefore, to prevent the occurrence of EBSLN lesions, the researchers suggested that before performing superior thyroideal vasa ligation, do EBSLN tracking in the “Jolles area” or use a neurostimulator and IONM.

Conclusion

As many as 51.9% of patients had normal voice conditions with few complaints and were capable to sing 1-octave tone after surgery using the superior thyroideal vasa ligation method as distally as possible. The SKC-EBSLN questionnaire is a valid and reliable questionnaire to evaluate the results of thyroidectomy surgery.

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