



# Is Recovery of Preoperative Unilateral Vocal Cord Palsy Possible after Primary Bilateral Thyroidectomy?

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## Abstract

**Background:** This study evaluated recovery of unilateral vocal cord paralysis after primary bilateral thyroidectomy for benign and malignant pathologies.

**Methods:** Medical records of all consecutive patients who underwent primary bilateral thyroidectomy were reviewed retrospectively. Of these patients, those who had a symptomatic vocal cord paralysis preoperatively were selected. Multiple variables were collected: age, gender, clinical presentation, type of imaging, surgical procedures, and results of perioperative pathologic examinations to show possible association with preoperative vocal fold paralysis.

**Results:** 18 patients were included in this study. The population was equally divided between males and females. All had undergone an ultrasound, while 28% and 23% had undergone a CT scan and MRI respectively. Laryngoscopy performed in all the patient has shown a right sided and a left one vocal cord paralysis in 61% and 39% of the cases respectively. In one patient, the recurrent laryngeal nerve was sacrificed to reach an R0 resection. The final pathology showed benign and malignant pathologies in 17% and 83% of cases respectively. The overall recovery rate of vocal fold function was 6%. Recovery of a normal function of the vocal cords was seen in 33% and 0% with benign and malignant pathologies respectively.

**Conclusion:** In thyroid disease, vocal cord paralysis is more common in malignant as compared to benign pathologies. Laryngoscopy and imaging studies are important when planning surgery. Recovery of the normal function is possible, especially in benign pathologies, and underlines the importance of preserving the affected nerve.

**Keywords:** Thyroid; Benign; Malignant; Vocal cord; Palsy

## Introduction

The Recurrent Laryngeal Nerve (RLN) nerve receives a special attention in thyroid diseases due to its position posterior to the thyroid lobes after traveling in the tracheoesophageal groove to enter the larynx [1,2]. This anatomical position of RLN makes it prone to palsy in thyroid diseases especially in malignant ones and is also a sign of invasiveness [3]. Injury to RLN may lead to Vocal Cord Paralysis (VCP), in particular due to progressive disease involving the thyroid gland or by iatrogenic trauma during thyroid surgery [4]. Whilst RLN palsy is a recognized complication of thyroid surgery, it is not commonly seen pre-operatively [5-8]. The association of pre-operative RLN palsy and thyroid disease is suggestive of locally advanced malignant disease by invasion of the nerve. However, the risk of Benign Thyroid disease (BT) causing paralysis to the nerve is extremely rare and has only been reported in isolated case reports and small case series [5,9-13]. According to the current scientific literature, this association is extremely rare [4].

The aim of this study is to highlight the recovery of normal function of vocal cord after primary bilateral thyroidectomy for benign or malignant pathologies in patients presenting with preoperative symptomatic unilateral vocal cord paralysis.

## Patients and Methods

### Patients

The medical records of all consecutive patients who underwent primary thyroid surgery between June 2000 and February 2020 were retrospectively reviewed. Of these patients, those who presented with dysphonia, dysphagia or recurrent aspirations suggesting vocal cord paralysis prior to the thyroidectomy were selected. The reports of the performed indirect laryngoscopies to all the selected patients by consultant otorhinolaryngologists at the hospital Ear, Nose and Throat (ENT) clinic on

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outpatient basis before thyroidectomy were collected and those who were proven to have a VCP formed the population of this study. This study was approved by the Institutional Review Board. Access permit to the included patients' files was obtained from hospital ethical committees.

### Exclusion criteria's

Patients who had previous thyroidectomy or parathyroidectomy, Carotid endarterectomy, open laryngeal surgeries, anterior approach to the cervical spine, esophageal surgery, cardiothoracic surgery, skull-base surgery and other neck surgeries that have a risk of injuring the recurrent laryngeal nerve as well as those who had undergone radiotherapy to the neck were excluded. Patients with extension to overlying striated muscles, laryngotracheal structures or to esophagus necessitating a resection of these structures were also excluded.

### Variables

After reviewing the included patients' files, multiple variables were collected: age, gender, clinical presentation, type of imaging done to aid the diagnosis of the thyroid pathology (Ultrasound (US), MRI, CT scan), size of the largest nodule on imaging, TSH value, side of the paralyzed vocal cord on indirect laryngoscopy, surgical procedures, preservation or not of the recurrent laryngeal nerve, presence or absence of macroscopically enlarged lymph nodes, presence or absence of a nodule in the tracheoesophageal groove at the side of paralysis. Results of pathologic examinations were also reviewed. Invasion was assessed either preoperatively clinically, radiologically and macroscopically (by laryngoscopy) or postoperatively by pathologic examination.

### Surgical management

Iodine-free solutions (chlorhexidine) were used to swab the operative field. All surgeries were done under general anesthesia using horizontal cervical incision. The thyroidectomies were all performed in a similar fashion with careful dissection attempting to identify and preserve the parathyroid glands with their vascular supply, as well as the recurrent laryngeal nerves. The type of resection was chosen in the operating room depending on either the presence of macroscopic intraoperative findings of invasion of recurrent laryngeal nerve or on the result of the frozen section. All macroscopic tissue on the RLN was excised. More details of intervention and our attitude to cervical lymph nodes has been described before [14]. Valsalva maneuver was performed at the end of thyroidectomy in all patients to detect hemorrhage. Cervical wound was closed without drain tubes in all cases.

### Perioperative care and follow-up

Monitoring of the cervical wound was assessed closely in the postoperative period. The following parameters were queried: volume of the resected thyroid gland, presence of local complications (hemorrhage, hematoma, seroma) and time to hospital discharge. Postoperative complications, mainly vocal cord paralysis and temporary or permanent hypocalcaemia were recorded. The patient's condition to discharge was described before [14]. Transient postoperative hoarseness was defined as unilateral vocal cord paresis on laryngoscopic examination that resolved within 6 to 8 weeks after the operation. Permanent vocal cord paralysis was defined as unilateral paralysis at laryngoscopic examination performed 1 year after operation. Clinical follow-up ranged from 12 to 232 months.

### Post-operative variables

Include histologic results of the thyroid specimen, presence of

positive lymph nodes on pathology, duration and frequency of the follow up with the flexible laryngoscopy findings, and recuperation of the paralyzed vocal cords function 1 year after the surgery documented by flexible laryngoscopy. All the relevant clinical variables were analyzed including clinical presentation, pre and postoperative tumor histology.

### Statistical analysis

The data were plotted on Microsoft excel 2017 and analyzed with descriptive statistics using SPSS version 22. Continuous variables are reported as mean  $\pm$  standard deviation, and categorical variables are reported as number and percentage.

## Results

### Preoperative variables

From June 2000 to February 2020, 5,023 patients underwent thyroidectomy by one surgeon (BA). 18 patients satisfied inclusion criteria were included in this study. The population was equally divided between males and females and ranged in age between 43 and 81 with a mean of  $63.33 \pm 12.48$  SD. The thyroid function was normal in 15 patients (83%), while 1 patient (6%) were hyperthyroid and 2 patients (11%) were hypothyroid. Substernal thyroid extension was found in 3 patients (17%). All the patients 100% (n=18) had undergone an US of the thyroid, while 28% (n=5) and 23% (n=4) had undergone a CT scan and MRI of the neck respectively. The trachea was significantly deviated to the opposite side of the paralyzed vocal fold and/or had a narrowing lumen in 4 and 3 patients respectively. Imaging studies showed tracheo-esophageal separation by goiter in 2 patients. In one and two patients, cystic changes in the goiter produced a severe compression or stretching of the RLN by the tumor on image features respectively. Four patients had suspected malignant cervical lymph node enlargement. Flexible laryngoscopy has shown a right sided and a left one vocal cord paralysis in 61% (n=11) and 39% (n=7) of the cases respectively. VFP is unilateral and ipsilateral to major or malignant nodule in all cases (n=18). All of the included patients were euthyroid before the thyroidectomy.

The duration of symptoms before intervention ranged from 3 months to 8 years. Five patients presented with large low anterior cervical mass. In total, 11 patients had right VFP and 7 had left VFP. US guided FNAC was performed in 11 patients preoperatively. Seven patients had malignant result, three benign results and one patient had non-diagnostic result. All our patients underwent a bilateral thyroidectomy. Recurrent laryngeal nerves were identified in all the patients and preserved wherever possible. Frozen-section analysis was performed in seven patients and showing malignant results in five cases. One patient recovered vocal fold function at 6 months and one year after thyroidectomy. In this study, the overall recovery rate of vocal fold function after thyroidectomy for patients with VFP was 6%.

### Intraoperative variables

Total bilateral thyroidectomy was the surgical procedure performed on all our patients with unilateral VCP. The number of identified parathyroid glands was 4 in 15 patients (83%), three in 2 patients (11%), and two in one patient (6%). Recurrent laryngeal nerves were identified in all the patients. In 1 patient out of 18, the recurrent laryngeal nerve was sacrificed in the operation to reach an R0 oncologic resection of the tumor, this patient had a 5 cm malignant oncocytoma diagnosed on the final pathology of the left thyroid lobe. The mean of the size of the largest nodule was 3.5 cm

**Table 1:** List of the included patients and their characteristics.

Patients	Sex	Age	Side of paralysis	Size of the largest nodule (cm)	CLN and L RX	Nodule in the TEG	Section of the RLN	Final pathology	Recovery of VCP
1	M	53	R	2	No	No	No	PTC	No
2	M	56	R	6	No	No	No	PTC	No
3	F	43	L	3	No	No	No	PTC	No
4	F	78	R	6	No	No	No	MNG	No
5	F	81	R	2	No	Yes	No	PTC	No
6	M	51	L	3	Yes	No	No	PTC + MCLN	No
7	F	68	R	4	No	No	No	FTC	No
8	M	79	L	5	No	No	Yes	Oncocytoma	No
9	M	67	R	2	No	Yes	No	PTC	No
10	F	48	R	1	No	Yes	No	PTC	No
11	F	55	L	3	Yes	No	No	PTC + MCLN	No
12	M	63	R	2	Yes	No	No	PTC + MCLN	No
13	F	76	L	2	No	Yes	No	PTC	No
14	F	80	R	4	No	No	No	PTC	No
15	M	64	R	8	No	No	No	MNG	Yes
16	F	73	L	2	Yes	No	No	PTC	No
17	M	49	R	1	No	Yes	No	PTC + MCLN	No
18	M	56	L	7	No	No	No	MNG	No

**Abbreviations:** M: Male; F: Female; R: Right; L: Left; C LN and L on RX: Central and lateral lymph node on radiology; RLN: Recurrent Laryngeal Nerve; TEG: Tracheo-Esophageal Groove; PTC: Papillary Thyroid Carcinoma; MNG: Benign Multinodular Goiter; FTC: Follicular Thyroid Carcinoma; MCLN: Metastatic Central Lymph Node; Recovery of VCF: Recovery of Vocal Cord Paralysis after 6 months

**Table 2:** Results summary.

Variables	Results
Sex	50% M, 50% f
Age	43 to 81, mean = 63.33 ± 12.48 SD
Side of vocal cord paralysis	R: 61% L: 39%
Intraoperative section of the RLN	6%
Size of the largest nodule	1 cm to 8 cm, mean = 3.5 cm ± 2.09 cm Note: 61% of the included cases had a size of the largest nodule below 3.5 cm
Radiological evidence of suspicious LN	Yes=22% No=78%
Presence of the nodule in the TEG	Yes=28% No=72%
Anapath	PTC=72% MNG=16% FTC=6% Malignant oncocytoma=6% All the patients who had radiologically positive lymph nodes had a final pathology result compatible with the clinical findings (22%)
Recovery of the vocal cord function after 6 months	Only one patient (6%)

± 2.09 cm, 61% of the included cases had a size of the largest nodule below 3.5 cm. Lymph node dissection of the central compartment (level VI) and of the ipsilateral jugulocarotid chains (levels III and IV) was performed on 4 patients treated with total thyroidectomy. Two patients underwent total thyroidectomy with bilateral lymph node dissection of the jugulocarotid chains because of the involvement of both lobes of the thyroid gland by the cancer. Palpable lymph nodes or lymph nodes that were found highly suspicious for metastasis on

intraoperative findings outside the jugulocarotid chains were also dissected.

33% of the included patients (n=6) had radiologic or intraoperatively positive lymph nodes, all of them had papillary thyroid cancer diagnosed on the final pathology. In one patient, RLN was invaded by a metastatic ipsilateral lymph node and can be preserved after macroscopic resection of all pathologic tissue.

In 28% of the included patients (n=5), the suspicious nodule at the side of the recurrent laryngeal nerve paralysis was found in the tracheoesophageal groove, in all of these cases, the recurrent laryngeal nerve was preserved.

For all our patients (n=18), all macroscopic invaded structures was fully resected. Thus, the macroscopic invaded seen intraoperatively dictated the extension of local resection of the tumor. Postoperatively, oral hormone therapy with L thyroxine and adjuvant radioactive iodide were given to all our patients. Postoperative external radiation therapy was given to none of the patients in this series.

### Postoperative variables

**Bleeding and or seroma:** A total of 1 patient (6%) developed postoperative hematoma and/or seroma. There were no major bleeding, that is, the patient had minor bleeding or seroma not requiring surgical intervention. None developed a wound infection. Airway compromise caused by major bleeding did not occurred in this series.

**Postoperative length of stay:** The postoperative length of stay 1 day in 17 patients (94%), 2 days in one patient (6%). Asymptomatic hypocalcemic patients were discharged from the hospital the next day after operation. The incidence of permanent hypoparathyroidism in this series was 1%. So, during follow-up, 6 patients required Vitamin D and Calcium supplementation at 12 months postoperatively. No clinical symptoms of hypocalcemia was noted.

The pathological diagnoses of the resected tumors included benign multinodular goiters (n=3; 17%), and malignant thyroid neoplasms (n=15; 83%, papillary carcinomas 72%, follicular carcinoma 6%, oncocytoma 5%). Weight of the thyroid tissue averaged 83 g (53 g to 644 g). All the patients who had radiologic positive lymph nodes had a final pathology result compatible with the radiological findings (22%).

Only one patient (6%) recuperated a normal function of the vocal cords after 6 months and 1 year follow up, this patient had a benign multinodular goiter with the size of largest nodule compressing the nerve being 8 cm. In benign pathology recovery of a normal function of the vocal cords was seen in 33% (1/3) of cases in our series. No patients (0%) with malignant pathology recover a normal vocal function with nerve preservation in 14 of 15 malignant glands.

## Discussion

In our series the incidence of symptomatic unilateral vocal cord paralysis in primary thyroidectomy was 0.36% (ranging between 1 and 6.4% in the literature) [15]. The overall recovery rate of vocal fold function was 6%. In this study, the only patient (1/3) who recuperated a normal function of the vocal cords had a benign disease of the thyroid gland 33% (ranging between 25 and 100%) [11,12]. None of our 15 patients (14 with nerve preservation) with malignant result had vocal cord recovery (0%). This finding confirmed those of other authors [16,17]. According to some authors and our experience, intraoperative preservation of the RLN in a good condition is the prerequisite for vocal fold recovery [6,18,19].

Recurrent laryngeal nerve paralysis is rarely reported before primary thyroidectomy. Preoperative symptoms of VCP include inability to speak loudly, breathiness, hoarseness, dysphonia, dyspnea or loss of vocal pitch, or choking and coughing episodes and are reported by 39% of patients with VCP preoperatively in one study. 50% of patients were asymptomatic [4,12,15,20-23].

The etiology of RLN palsy in BT is secondary to many factors, including iatrogenic or non-iatrogenic trauma of the vagal or recurrent laryngeal nerve, neurologic disease, compression, stretching, infection, autoimmune and/or local inflammatory factors, idiopathic disease, drug induced, jugular vein thrombosis, cerebral vascular accident, diabetic neuropathy [4,5,24,25]. The RLN palsy may be progressive secondary to a slowly expanding multinodular goiter, or may occur rapidly, secondary to hemorrhagic cyst formation [2,4]. The prevalence of BT in patients with VFP varied in the literature from 0.69% to 4.3% [6,9,10]. Recovery of vocal fold motion after thyroidectomy in patients with BT accompanying VFP varied from 25% to 100% of cases [2,6,11,12].

In malignant disease, RLN paralysis can be caused by direct infiltration of the nerve sheath by malignant cells (from nodule or lymph nodes) or by nodular compression resulting in progressive fiber devitalization [4,26]. In previous research, the prevalence of VFP in thyroid cancer widely varied, from 1.7% to 9.6% [6,22,27]. The incidence of VCP varied from 8.04% to 11.36% in malignant thyroid disease [9,10]. In our study, 83% of the included patients had a final pathology reporting a malignant disease of the thyroid highlighting the much higher risk of having a VCP in patients with malignant disease of the thyroid as compared to patients with a benign one.

The American academy of otolaryngology head and neck surgery guidelines and the American thyroid association recommend a pre-operative screening of vocal cord mobility in all patients with impaired voice, and in all asymptomatic patients that have a thyroid malignancy with suspected extrathyroidal extension or an non anterior tumor, or having a history of neck surgery that increases the risk of laryngeal nerve injury (carotid endarterectomy, anterior approach to the cervical spine, cervical esophagectomy, and prior thyroid or parathyroid surgery) [17,28-35].

Vocal fold paralysis is usually unilateral and ipsilateral to thyroid pathology (all our patients), but a rare few cases of bilateral VFP was reported. VFP contralateral to the goiter was also described in rare cases [6,12]. Postoperative recovery of unilateral or bilateral vocal cord function was also reported in some cases of Hashimoto's thyroiditis or Graves' disease patient [6,36,37].

Preoperative imaging studies, especially, CT or MRI scan in patients with thyroid nodules and RLN palsies is important to delineate the anatomy of the mass, its location, its size, and its relationship to the RLN and adjacent structures. These images may demonstrated a possible mechanism of VFP and also allow to exclude the presence of extension of adjacent structures or the presence of lymph nodes [2,4,15].

To date, many authors have identified several risk factors for the presence of pre-operative vocal cord palsy in patients undergoing thyroidectomy (age, nodule size  $\geq 3.5$  cm, history of neck surgeries, and presence of voice symptoms or dyspnea [15,32,33]. In this study the mean of the size of the largest nodule on any type of imaging was  $3.5 \text{ cm} \pm 2.09 \text{ cm}$  but 61% of the included cases had a size of the largest nodule below 3.5 cm making this cutoff a probably poor predictor of vocal cord paralysis preoperatively.

Contralateral thyroidectomy should be performed with great care to preserve the recurrent nerve and the patient should be informed of the possibility of performing a tracheostomy if the contralateral RLN is injured during surgery [6]. The existing chances of recovery of the RLN palsy highlight the importance of preserving the affected RLN.

Intraoperative visual identification of the recurrent laryngeal nerve is still the gold standard of surgical practice. The surgeon can use IONM to early locate the RLN and avoid its injury [4,30,31,35].

Reversibility of vocal cord palsy after thyroidectomy depends largely on the cause of this palsy, where almost all patients with a malignant cause and half of those with a benign pathology did not recuperate a normal vocal cord function after thyroidectomy during follow up [16,18].

## Conclusion

In patients with thyroid disease, VFP is clearly more common in malignant pathologies as compared to benign ones. Routine preoperative evaluation of mobility of vocal cord in patients with clinically suspected palsies is mandatory. Preoperative imaging studies, especially, CT or MRI scan is justified to characterize the thyroid mass and its relationship to the RLN and adjacent structures. The existing chances of recovery of normal vocal function, especially in benign pathologies, highlight the importance of preserving the affected RLN.

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