

## Main Article

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# Patient-perceived dysphagia and voice change post thyroid surgery: a telephone questionnaire

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## Abstract

**Objective.** This study analyses the incidence of subjectively experienced dysphagia and voice change in post-thyroidectomy and parathyroidectomy patients without recurrent laryngeal nerve palsy.

**Methods.** A total of 400 patients were invited to participate in a telephone questionnaire based on the Dysphagia Handicap Index and Voice Handicap Index. At 6–24 months following surgery, participants were divided into: post-thyroid surgery (total, hemi-, parathyroidectomy) groups and controls (other ENT procedures). A total of 254 responses were received (127 following thyroid surgery, 127 controls).

**Results.** Twenty-two per cent of post-thyroidectomy patients had a Voice Handicap Index score of more than 3, compared to 15 per cent of parathyroid patients and 4 per cent of controls. The mean Dysphagia Handicap Index score for patients post thyroidectomy and hemithyroidectomy was 2.0. Parathyroidectomy patients had a mean Dysphagia Handicap Index score of 1.3, higher than controls at 1.0.

**Conclusion.** Dysphagia and voice alteration are common following thyroid surgery, even in the absence of recurrent laryngeal nerve injury. Both deficits occur more frequently following thyroid surgery than parathyroid surgery.

## Introduction

Voice alteration and swallowing deficits are known risks of thyroid and parathyroid surgery. Post-operative change in voice has been demonstrated objectively. Acoustic analysis performed pre-operatively, and at two, four and six months post-operatively, has shown measurable changes in fundamental frequency ( $F_0$ ) and shimmer values. These changes were identical in benign and malignant pathologies.<sup>1</sup>

Voice change is in part explained by injury to the recurrent laryngeal nerve (RLN) and superior laryngeal nerve, which run in close proximity to the thyroid gland. The RLN innervates four intrinsic muscles of the larynx. Injury leads to flaccidity of the ipsilateral vocal fold, with resultant loss of abduction and adduction. The effect varies, ranging from compensated mild dysphonia to complete paralytic aphonia. Protection of the airway becomes more difficult, causing an aspiration risk.<sup>2</sup>

The majority of post-operative palsies are transient.<sup>3</sup> The rate of permanent unilateral RLN palsy following thyroidectomy is 1.7–5 per cent, depending on the surgical indication. Operations for malignancy and revision procedures carry a higher risk.<sup>4</sup>

Routine identification of the RLN reduces the risk of permanent palsy. Hence, intra-operative nerve monitoring is now considered the standard of care.<sup>3</sup> Multivariate analysis has confirmed that intra-operative nerve monitoring reduces RLN palsy rates ( $p < 0.001$ ).<sup>5</sup> Even with intra-operative nerve monitoring, nerve injury remains an accepted part of practice and does not represent negligence.<sup>6</sup>

Unilateral RLN palsy has a detrimental impact on quality of life. Palsies can be treated efficiently by safe techniques such as vocal fold injections and nerve transfer, which should be offered to all symptomatic patients.<sup>7</sup> Bilateral surgery puts both RLNs at risk; bilateral vocal fold palsy can cause a fixed larynx and threatens the airway. Rarely, emergency tracheostomy is indicated.<sup>8</sup> Whilst preservation of the RLN makes up a critical component of pre-operative consent, it is understood that voice change occurs in the absence of RLN injury.

The importance of the superior laryngeal nerve is debated. The external branch of the superior laryngeal nerve runs close to the superior thyroid vessels, and is at risk during ligation. The nerve carries motor fibres to the cricothyroid muscle, the only tensor muscle of the larynx. It was historically thought that damage was important in post-operative voice change, especially in professional voice users. This was supported by a case series which showed that voice change following hemi-thyroidectomy reduced from 11 per cent to 5 per cent if the superior laryngeal nerve was formally identified.<sup>9</sup> However, recent data do not support this. A case series of 54 thyroidectomised patients showed that typical voice symptoms of easy fatigue and difficulties with singing voice were present even when superior laryngeal nerve palsy was excluded by electromyography testing of the cricothyroid muscle. The authors speculate that the cause of voice dysfunction is disturbance of the

extralaryngeal skeleton.<sup>10</sup> Similarly, another case series observed 47 female patients with confirmed preservation of the recurrent and superior laryngeal nerves. A mean decrease of the speaking fundamental frequency of 12 Hz was found on day 4. The range between the highest and lowest  $F_0$  during speech was diminished, and vocal jitter elevated.<sup>11</sup>

The strap muscles have been implicated in both voice change and dysphagia. The sternohyoid and sternothyroid overlie the thyroid gland, acting to depress the hyoid bone. They are routinely retracted during the surgical approach. In cases of goitre, they can be divided to improve access. However, a study analysing thyroidectomy data from two high-volume referral institutions has refuted any relationship between post-operative voice dysfunction and intra-operative division of the sternothyroid.<sup>12</sup> Similarly, a 44-patient case series reported that division of either strap muscle was not detrimental to voicing post-operatively.<sup>13</sup>

At least some of the voice change can be attributed to oropharyngeal intubation. One study compared vocal performance after thyroidectomy with a breast surgery control group. Subjects underwent acoustic analysis that showed significantly increased values in the voice turbulence index in both groups. Values were higher in the those undergoing thyroid surgery.<sup>14</sup> Even when neural and muscular damage are accounted for, there remains a cohort of patients with post-operative voice damage that is not easily explained.

Swallowing complaints following thyroid and parathyroid surgery are less well described. Again, they have been shown to cause psychological stress and reduce quality of life. Patients commonly describe a sensation of a lump, tightness, foreign body, difficulty or pain in swallowing.<sup>15</sup> The identification of post-operative swallowing problems is challenging as they often predate the surgery as a symptom of the thyroid disease. A recent systematic review showed a significant increase in swallowing impairment compared to baseline shortly after surgery. In the majority of patients, dysphagia reverted to pre-operative levels within two to three months of surgery. However, dysphagia persisted in a small proportion of patients at one year.<sup>16</sup> Another retrospective case series showed that subjective upper aerodigestive symptoms are present in 25 per cent of patients following total thyroidectomy at a mean of four years following surgery.<sup>17</sup>

The mechanisms underpinning post-operative dysphagia are similarly disputed. Damage to the RLN and superior laryngeal nerve again explains the cause in a subset of patients. The laryngeal protective role of the external branch of the superior laryngeal nerve has been established in porcine models.<sup>18</sup> The RLN has posterior branches that provide sensory innervation to the oesophagus as inferiorly as the cricopharyngeus. Hence, palsy of either nerve causes an aspiration risk, necessitating increased awareness of the upper oesophagus. Laryngopharyngeal reflux in the post-operative period is a contributing factor. Recent data have shown that symptoms diminish in patients given proton pump inhibitors in the first week post-operatively.<sup>19</sup> Other hypotheses include alteration in vascular supply, neurological damage to the sympathetic cervical chain, or damage to the extrinsic perithyroidal plexus which innervates the pharynx. The psychological response to the procedure has also been implicated. The phenomenon is likely multifactorial in origin, involving both physical and functional factors, given the variability in the symptoms experienced by patients.<sup>20,21</sup>

The operative factors influencing symptom severity are better understood. The Thyroidectomy-Related Voice

Questionnaire has been used to show greater symptomatology following total thyroidectomies. A concurrent neck dissection increased scores further.<sup>22</sup> The incidence of both voice and swallowing symptoms is reduced in video-assisted surgery.<sup>23</sup> Minimally invasive parathyroidectomy can be performed with no significant change in voice acoustic parameters.<sup>24</sup> A retrospective review has shown a positive correlation for voice and swallowing symptoms with age. Multivariate analysis established a 5 per cent increase in odds per year, up to the age of 50 years, after which the risk plateaued. There was no correlation with the Modified Frailty Index.<sup>25</sup>

This study independently assessed patients' subjective experience of dysphagia and voice change following thyroid or parathyroid surgery. Patients with operative complications including RLN injury were excluded. We focused on patients' experience of the symptomatology to assess the holistic impact of surgery.

## Materials and methods

A total of 400 patients were invited to participate in a telephone questionnaire; 254 responses were received. There were 127 cases of uncomplicated hemi-thyroidectomy, total thyroidectomy or parathyroid surgery. Comparison was made with 127 controls of uncomplicated ENT procedures, such as functional endoscopic sinus surgery and tonsillectomy. Data were collected at 6–24 months following surgery.

Patients who had complicated procedures, pre-existing vocal fold abnormalities, underlying neurological conditions, and pre- or intra-operative vocal fold paresis were excluded. Patients responded to questions regarding swallowing and voice difficulties based on the Dysphagia Handicap Index and Voice Handicap Index.

The Dysphagia Handicap Index consists of 25 questions, with each question scored individually between 1 and 7. The questionnaire is further subdivided into three subsections that separately assess the physical, functional and emotional aspects of swallowing. This gives an overall subjective experience for the patient (total Dysphagia Handicap Index score).

The Voice Handicap Index is a 10-point questionnaire, with each question scored between 0 and 4. Scores of greater than 3 are considered significant. Again, this is based on the patient's subjective assessment of their own vocal performance.

All patients underwent conventional surgery. Four-gland exploration was not performed during parathyroid surgery. The RLN was identified routinely during all procedures. Intra-operative intermittent nerve monitoring was routinely used. The external branch of the superior laryngeal nerve was not exposed routinely. All procedures were performed or supervised by experienced head and neck consultant surgeons.

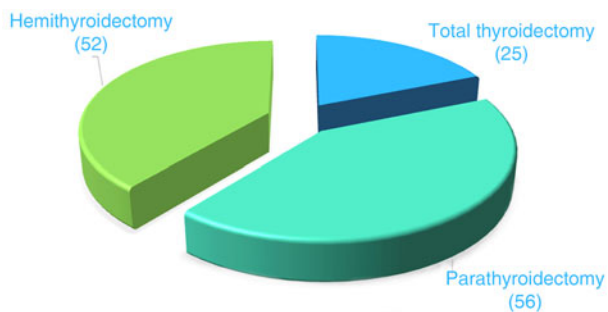
## Results

The demographic data are summarised in Table 1. Patients were surveyed at 6–19 months post-operatively (mean of 12 months, median of 10 months). The patients consisted of 200 females and 54 males, with a total mean age of 52.5 years and a range of 17–93 years. A surgical breakdown of the operations performed within the case group is shown in Figure 1.

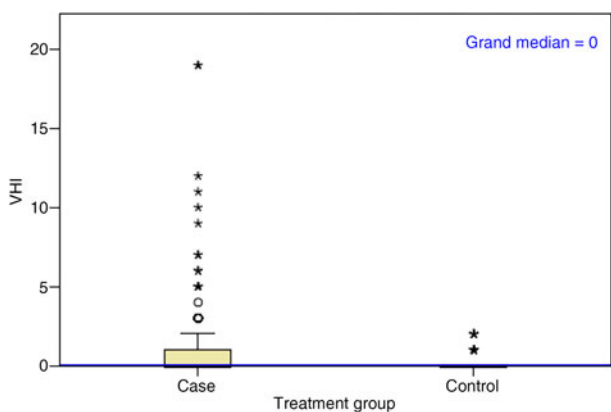
The Mann–Whitney test was used to compare the cases and the controls, as the data were non-parametric. A statistically significant difference ( $p < 0.001$ ) was found between the

**Table 1.** Demographic statistics for cases and controls

Parameter	Controls	Cases
Patients (n)	127	127
Age range (years)	20–93	17–86
Mean age (years)	51	54
Females (%)	79	78
Males (%)	21	22



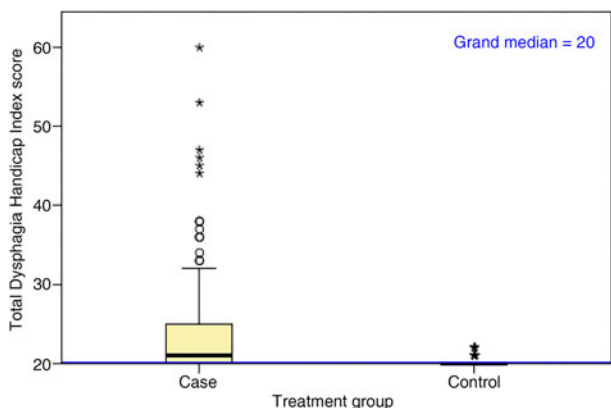
**Figure 1.** Breakdown of cases by operation performed.



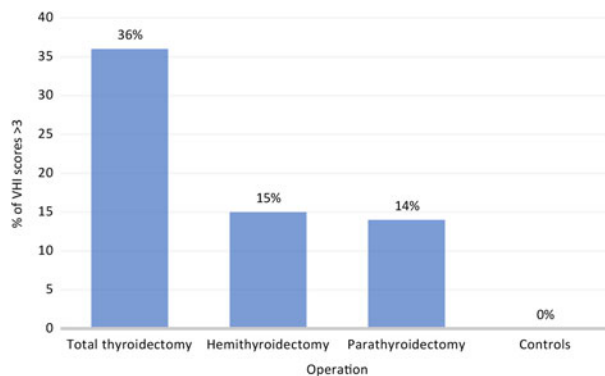
**Figure 2.** Box plot showing total Voice Handicap Index (VHI) scores for case and control groups.

total score of the case and control groups for both Voice Handicap Index and Dysphagia Handicap Index scores (Figures 2 and 3).

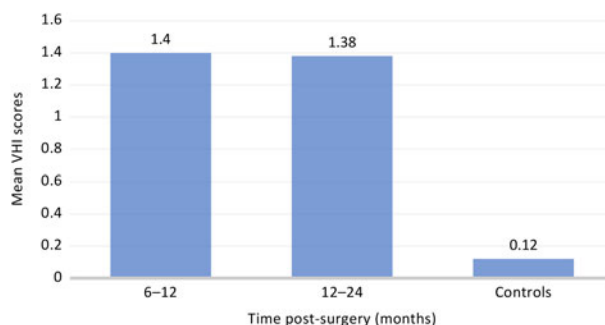
The mean Voice Handicap Index for the case group was 1.40, versus 0.12 in the control group ( $p < 0.001$ ). The mean



**Figure 3.** Box plot showing total Dysphagia Handicap Index scores for case and control groups.



**Figure 4.** Bar chart displaying Voice Handicap Index (VHI) scores of greater than 3 by operation.



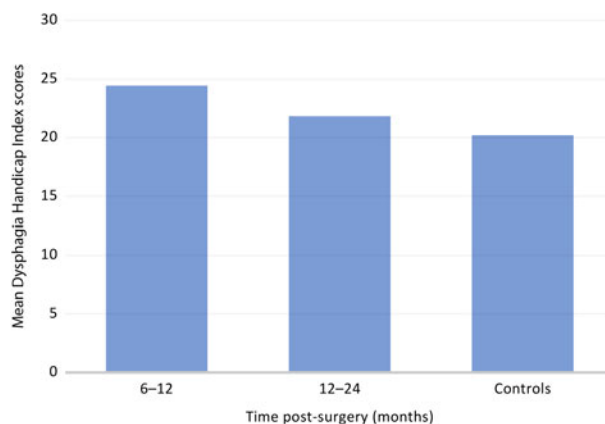
**Figure 5.** Mean Voice Handicap Index (VHI) scores over time post-surgery, with comparison against controls.

Dysphagia Handicap Index for the case group was 23.76, versus 20.20 in the control group ( $p < 0.001$ ). Figure 4 shows the percentage of patients by operation who had a Voice Handicap Index score of greater than 3 (considered significant scores), compared to controls.

Figure 5 displays the Voice Handicap Index scores at 6–12 months following the procedure versus those questioned at 12–14 months. Figure 6 displays the Dysphagia Handicap Index scores at 6–12 months and 12–24 months, with comparison with controls.

**Discussion**

The case group comprised 52 post-hemi-thyroidectomy patients, 25 post-total-thyroidectomy patients and 56 post-



**Figure 6.** Mean Dysphagia Handicap Index scores over time post-surgery, with comparison against controls.

parathyroidectomy patients. This is representative of the broader practice within the tertiary referral centre at the time of the study.

Patients who underwent total thyroidectomy had a higher total Dysphagia Handicap Index score compared to those who underwent hemi-thyroidectomy and parathyroidectomy. This was consistent through all the components of the Dysphagia Handicap Index, including the functional and emotional aspects. Dysphagia improved over time in the case group, with a reduction in total Dysphagia Handicap Index scores as well as individual component scores at 13–24 months compared to scores at 6–12 months.

Our results suggest that post-operative dysphagia is a transient phenomenon following thyroid surgery. Whether symptoms improve to the pre-operative baseline level is not clear. However, between 6–12 and 12–24 months, the difference between cases and controls reduced by at least 50 per cent for total Dysphagia Handicap Index scores and for each individual subsection. This has implications for the symptom aetiology. The improvement goes against a neural cause; if superior laryngeal nerve injury was critical, such a marked improvement would not be expected. Instead, direct trauma to the oesophagus during surgery is likely causative. With time, the impact lessens as the soft tissue recovers, and normal peristaltic motion returns.

- Dysphagia and voice change are common following thyroid and parathyroid surgery, even in the absence of recurrent laryngeal nerve palsy
- Symptoms are worse after total thyroidectomy, versus hemi-thyroidectomy or parathyroidectomy
- Dysphagia and voice change persist for at least two years following surgery
- There is greater improvement over time in post-operative dysphagia than voice change, although neither improve to baseline levels at two years post-surgery
- Both dysphagia and voice change should be considered as components of pre-operative consent

The mean Voice Handicap Index score for the case group was 1.40, versus 0.12 in the control group ( $p < 0.001$ ). Thirty-six per cent of patients in the total thyroidectomy group had scores of greater than 3, compared to 15 per cent and 14 per cent in the hemi-thyroidectomy and parathyroidectomy groups respectively. None of the patients in the control group scored greater than 3.

There was no significant improvement in Voice Handicap Index scores over time, with scores of 1.4 in patients interviewed at 6–12 months post-operatively, versus 1.38 in those interviewed at 13–24 months post-operatively. The control group had low Voice Handicap Index scores (mean of 0.12), suggesting that intubation is not relevant to vocal symptoms.

Patients who underwent total thyroidectomy had higher Voice Handicap Index scores compared to those who underwent hemi-thyroidectomy or parathyroidectomy. This replicates previous data on acoustic voice parameters after uncomplicated thyroidectomy.<sup>26</sup> The authors suggested that this phenomenon occurs because total thyroidectomy is generally associated with increased surgical dissection.

Our results reinforce previous studies showing that post-operative swallowing complaints exist despite uncomplicated surgery and in the absence of nerve injury.

The study has limitations. As the work was retrospective, pre-operative swallowing complaints were not disclosed.

Associated medical co-morbidities such as concurrent laryngopharyngeal reflux, were not considered. Within the procedure group, there were more females than males. This may have introduced bias, as subjective complaints of swallowing difficulties are rarer in men.<sup>27</sup> As the study depended on obtaining patient reports on voice and swallowing changes, recall bias should be considered.

## Conclusion

Dysphagia and voice change are common following thyroid and parathyroid surgery in the absence of laryngeal nerve injury. Both complaints are worse following total thyroidectomy. Complaints persist for at least two years post-surgery. Patients undergoing such procedures should be counselled on the potential risks of dysphagia and voice change, as part of pre-operative consent.

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**Competing interest.** None declared

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