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MAIN ARTICLE

Vocal fold paralysis in the presence of thyroid disease: management strategies

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Abstract

Background: The presentation of vocal fold palsy with associated goitre has historically been considered to be due to malignancy with recurrent laryngeal nerve involvement.

Method: In total, 830 consecutive patients who underwent thyroid surgery were reviewed. Patients with vocal fold paralysis and thyroid disease were examined to determine the aetiology of the paralysis.

Results: Nine patients were identified with new onset vocal fold paralysis prior to thyroid surgery. Six of the patients with recurrent laryngeal nerve paralysis had benign thyroid disease, and for three of the patients the paralysis was secondary to malignancy.

Conclusion: Recurrent laryngeal nerve paralysis in the presence of thyroid disease is not pathognomonic for malignancy. The current literature may underestimate the association between vocal fold paralysis and benign thyroid disease. The paper also highlights the importance of recurrent laryngeal nerve preservation in patients who present with palsy and thyroid disease; the relief of benign compression often leads to complete recovery of recurrent laryngeal nerve paralysis.

Key words: Recurrent Laryngeal Nerve; Thyroidectomy; Vocal Cord Paralysis

Introduction

Paralysis of the recurrent laryngeal nerve (RLN) in the presence of goitre is often considered to be due to a malignancy until proven otherwise. The incidence of RLN paralysis with thyroid disease is not well documented and the management principles are not well defined in the literature. The cause of RLN paralysis can be idiopathic, iatrogenic, trauma or malignancy. The incidence of idiopathic RLN paralysis has been reported to range between 13 and 27 per cent.[1,2] The literature describes the rate of vocal fold paralysis secondary to a neoplastic process as being between 12 and 38 per cent, with thyroid disease accounting for just 5–10 per cent of these.[3]

We undertook a retrospective analysis of a large cohort of patients admitted for thyroid surgery over an eight-year period. We aimed to assess the frequency of RLN paralysis with thyroid disease and identify the aetiologies in order to elucidate best management practice.

Materials and methods

A retrospective analysis of all thyroid surgery performed by the senior author in three centres between March 2002 and March 2010 was carried out. In total, 830 consecutive patients admitted for thyroid surgery were identified using a prospectively maintained thyroid surgery database and operating theatre log books. The study inclusion criteria were new onset thyroid disease and dysphonia secondary to vocal fold paralysis at presentation. All patients in the study had vocal fold paralysis, which was confirmed pre-operatively by direct fibre-optic visualisation.

The parameters reviewed included clinical, radiological, histological and operative findings. Symptoms at presentation were reviewed and the following aspects were noted: duration, pressure, globus, dyspnoea, cough, stridor, dysphonia, dysphagia, dyspepsia, pain and tenderness. The duration of hoarseness, previous surgery, past medical history and patient weight were also recorded.

A review of radiological investigations was conducted to identify cases with potential pathology that may have contributed to nerve compression, particularly retrosternal goitre. Operative histology findings including size, site, inflammation or invasion of goitre were examined in relation to the side and extent of vocal fold paralysis. Operative notes were reviewed for any intra-operatively identifiable pathology that may have contributed to vocal fold paralysis.

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Fibre-optic laryngoscopy and patient interviews were used to identify recovery or otherwise of dysphonia, including the extent of recovery and time taken to recover.

Results

Of the 830 patients with thyroid disease, 206 had malignant disease (24.8 per cent). Fourteen of these 830 patients (1.7 per cent) had a documented RLN paralysis prior to thyroid surgery. There was a 6:8 female to male ratio. Patients were aged between 25 and 81 years, with a median age of 62 years. Three distinct aetiologies of RLN paralysis were identified: benign, malignant and iatrogenic causes. Benign thyroid disease accounted for six cases, with malignancy causing three RLN palsies (Table I); the remaining five cases were attributable to iatrogenic causes.

Benign disease

Of the six patients with benign thyroid disease and RLN paralysis, one (patient 1) had idiopathic RLN palsy with the subsequent incidental identification of benign thyroid disease. The remaining five had compression or stretching of the RLN, which was causing ipsilateral vocal fold paralysis. The operative histology for patient 1 revealed a thyroid cyst with a single, left-sided, lower pole nodule. The nodule, which was 2×1 cm in size, was adherent to the oesophagus and not close to the RLN. Pre-operative computed tomography (CT) identified a 2×2 cm mass. Histology did not isolate any inflammatory pathology which may have contributed to the RLN paralysis (Table II). Patient 6 in the benign disease group had a large substernal cyst, which was capable of compressing the RLN; however, an idiopathic RLN paralysis could not be ruled out.

Four of the other six cases had a thyroid mass of sufficient size to cause tracheal deviation, with one patient requiring pre-operative tracheostomy. The histology for patient 3 revealed lymphocytic thyroiditis accompanying a multinodular goitre, which suggested that the RLN paralysis was attributable to either a compressive or inflammatory cause (Table II). All patients with RLN paralysis and benign thyroid disease recovered nerve function in a time frame ranging from two weeks to one year (Table I). The median recovery time was four months.

Iatrogenic disease

A cohort of five patients with an iatrogenic cause of RLN paralysis were identified, all of whom had undergone previous surgical intervention. Four of these patients had undergone previous thyroid surgery and the fifth had a mediastinoscopy. All patients reported dysphonia following the initial procedure.

Malignant disease

The other aetiology causing RLN paralysis with thyroid disease was frank malignant involvement.

TABLE I
COMPARISON OF OPERATIVE, HISTOLOGICAL AND CLINICAL HISTORY WITH NERVE RECOVERY*

Pt no	Malignancy	Palsy	Histology	Prev surg	RLN recovery time	Clinical & operative notes
1	Benign	L	Thyroid cyst	N	4 mth	Lower pole 2×1 cm nodule adherent to oesophagus not RLN
2	Benign	L	MNG	Y	6 mth	Previous R lobe disease, slight tracheal deviation to R
3	Benign	L	MNG, thyroiditis	N	12 mth	Retrosternal w/ trachea deviated to R
4	Benign	L	Benign goitre & fibrosis	N	4 mth	Stridor, pre-op tracheostomy required
5	Benign	L	Thyroid cyst; haemorrhagic	N	2 wks	Retrosternal cyst
6	Benign	L	Follicular adenoma & haemorrhagic cyst	N	3 mth	Trachea deviated to R
7	Malignant	L	Medullary ca	N	5 mth	Retrosternal, trachea deviated to R
8	Malignant	L	Lymphoma	N	None†	Lymphoma invading RLN, straps, oesophagus, IJV
9	Malignant	R	Papillary or follicular	N	None†	Malignancy involving RLN, trachea, oesophagus

This table refers to recurrent laryngeal nerve palsy secondary to thyroid disease, thus the five cases with iatrogenic causes are omitted. *In patients with thyroid disease and vocal fold paralysis. †Indicates no nerve recovery. Pt no = patient number; prev surg = previous surgery; RLN = recurrent laryngeal nerve; L = left; N = No; mth = months; MNG = multinodular goitre; Y = yes; R = right; w/ = with; pre-op = pre-operative; wks = weeks; ca = carcinoma; IJV = internal jugular vein

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TABLE II
HISTOLOGY FINDINGS*

Pt no	Weight (g)	Dimensions (cm)	Description
1	NR	5 × 3 × 1	L lobe: fibrous cyst w/ focal chronic inflammation
2	30	5.5 × 3.5 × 2	L lobe: diffusely nodular w/ some areas of haemorrhage
3	28.3	7 × 3.5 × 2.5	R lobe: w/ multinodular goitre & lymphocytic thyroiditis
4	64	7 × 3 × 1.5	L lobe: multiple hyperplastic nodules w/ fibrosis focal chronic inflammation & calcification
5	38	8 × 4 × 2	L lobe: colloid nodular goitre w/ cyst & evidence of old haemorrhage & lymphocytic infiltrate
6	NR	9 × 6.4 × 7	Total thyroidectomy: follicular lesion 7 cm in max dimension w/ haemorrhagic fluid & thickened regions; no invasion

*In patients with recurrent laryngeal nerve paralysis and benign thyroid disease. Pt no = patient number; NR = not recorded; L = left; w/ = with; R = right

This only accounted for three of the nine cases identified. Two of these patients had undergone both preoperative CT and fine needle aspiration cytology, neither of which was diagnostic for malignancy in either patient. One patient with malignant disease recovered RLN function within five months. The remaining two patients from the malignant group had extensive disease involving the RLN, which necessitated sacrifice of the RLN at operation (Table I).

Statistical analysis of RLN palsy as a predictor of malignancy was carried out using the Fisher exact test. No significant association was found between RLN palsy and thyroid malignancy, $p = 0.6975$. However, our analysis was underpowered; to assess the difference in palsy rates between benign and malignant disease would require a series in the region of 12 000 patients.

Discussion

Aetiology

The presentation of vocal fold palsy with associated thyroid disease has historically been considered to be due to malignancy. The aetiology of vocal fold paralysis has been reported at variable frequencies. This is partly because of the lack of uniformity in the definition of aetiologies. In essence, idiopathic and iatrogenic causes account for about half of all vocal fold paralysis cases.[1,2,4,5] Malignancy, including (in descending order of frequency) bronchial, oesophageal and thyroid disease, account for a further quarter, with thyroid disease accounting for just 5–10 per cent of such cases.[3] The causes in the remaining quarter of cases are non-surgical trauma, and inflammatory and neurological conditions.[1–6] The incidence of idiopathic RLN paralysis has previously been reported to range from 13 to 27 per cent.[1,2] In recent years, there has been a dramatic reduction, to less than 5 per cent, in the incidence of vocal fold paralysis secondary to thyroid surgery.[7]

Three distinct sub-groups of cases presenting with thyroid disease and vocal fold paralysis were identified. These were (in descending order of frequency): benign thyroid disease, previous iatrogenic causes and malignant thyroid disease. In the current study, six out of the nine patients with new onset palsy secondary to thyroid disease had benign disease with vocal fold paralysis, which suggests that the incidence of paralysis secondary to benign disease is higher than previously thought. In addition, in two of the benign thyroid cases (Table I: patients 1 and 6) in which thyroid disease was an incidental finding, an idiopathic cause of RLN paralysis could not be ruled out.

Pathophysiology

Slomka *et al.* (1989) reported that the most common benign thyroid lesion to cause RLN paralysis was a colloid goitre, followed by an adenoma, thyroiditis, a haemorrhagic cyst and finally a toxic multinodular goitre.[8] Several mechanisms have been postulated regarding how RLN paralysis might be caused by benign disease. Two of the most widely accepted theories are compression or stretching of the nerve and/or its blood supply by benign disease. This may be the result of a slowly expanding goitre, or it may occur rapidly, secondary to haemorrhagic cyst formation.[9,10] Judd *et al.* first proposed the pathological effect of stretching as early as 1918.[11] Compression of the nerve and/or its blood supply between the goitre and cervical spine or trachea could also induce nerve palsy. Perinodular inflammation has been suggested to induce direct nerve fibrosis as well as minute neurovascular thrombosis, causing nerve ischaemia.[9,10] This ischaemia may be irreversible or reversible depending on its extent and duration. Finally, Gani and Morrison suggested that expansion of a thyroid cyst may cause a pretracheal compartment syndrome leading to nerve compression.[12]

Examination of the operative and histological factors in the current study identified a more complex pathophysiology. Five patients had tracheal compression, and for four of those patients the compression occurred in conjunction with haemorrhagic cysts, inflammation or fibrosis (Tables I and II). These findings indicate that rather than the nerve being compromised by a single physiological insult, as suggested by Slomka *et al.*,[8] RLN compromise is more likely to be the ultimate result of a combination of several insults. These include a combination of frank malignant nerve involvement, inflammatory or fibrotic pathologies, and direct nerve injury secondary to large multinodular goitre or haemorrhagic cysts.

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Recurrent laryngeal nerve recovery rates

In this series, there were nine new presentations of vocal fold paralysis in the benign and malignant cases. The RLN recovered in seven out of the nine cases in a time frame ranging from two weeks to one year. Our RLN recovery rate is consistent with those of Rowe-Jones *et al.* who reported vocal fold movement recovery in 17 out of 19 patients. Earlier studies by Holl-Allen and McCall *et al.* reported 38 per cent and 60 per cent post-operative recovery rates respectively.[9,13] The improved trend in recovery in the more recent studies may be attributable to improved surgical technology and technique. In the study by MacLellan and Stephens, most RLN recoveries were reported to occur within four to six months, findings which are comparable to the current study.[14] The ability for the RLN to recover suggests that early intervention with thyroidectomy could aid the return of vocal fold function. This would be achieved by minimising the duration of the compressive nerve insult and thus optimising the potential for recovery.

Management: benign disease

Including this series, there are now a total of 76 cases of vocal fold paralysis secondary to benign thyroid disease reported in the literature. Our findings are consistent with previous work by Rowe-Jones *et al.* (1993).[3] In a series of 2453 patients, those authors identified 29 cases (1.2 per cent) of vocal fold paralysis associated with thyroid disease, which is comparable to our study which identified 1.7 per cent of such patients. Of those 29 patients, 22 had benign thyroid disease. Rowe-Jones *et al.* did not examine patients with previous thyroid surgery; a similar examination of our data identified six out of nine patients with benign disease. The findings that show benign thyroid disease causing RLN paralysis further support the management of thyroid disease with RLN paralysis wherein the aim is to preserve the RLN at the site of primary surgical intervention, which is the recommendation for the management of benign thyroid disease.[15]

Management: malignant disease

The preservation of the RLN in malignancy cases remains a contentious issue. Nishida *et al.* found that preserving the RLN, even if it was infiltrated by thyroid malignancy, preserved vocal fold function without affecting the incidence of local recurrence or prognosis.[16] The management of thyroid malignancy must always involve the excision of macroscopic disease. However, the existence of effective medical treatments for thyroid malignancy justifies the preservation of the RLN, with subsequent adjuvant management of the potential remaining malignant micro-deposits.

Management: idiopathic disease

Conclusive diagnosis of idiopathic RLN paralysis in the presence of thyroid disease depends on the operative findings of a RLN free from compression or stretching, supported by non-inflammatory operative histology. The diagnosis of idiopathic vocal fold paralysis has implications for prognosis. In a review of the literature, Sulica (2008) reported that most patients with idiopathic vocal fold paralysis recover well within a year.[17] In addition, a large patient study by Mehlum *et al.* (2009) revealed that the chances of recovery were greatest for idiopathic vocal fold paralysis or a palsy caused by neurological disease.[2] Thus, a diagnosis of idiopathic RLN paralysis is a positive prognostic indicator for which an examination should be carried out.

- **The incidence of thyroid disease with recurrent laryngeal nerve (RLN) palsy in this series was 1.7 per cent, comparable to other series at 1.2 per cent**
- **Malignant and benign thyroid disease present with RLN palsy**
- **If preserved at surgery, a significant number of RLNs will recover function**
- **Early surgical intervention may aid RLN recovery**

Management: iatrogenic disease

A comprehensive clinical history is essential when investigating cases of RLN paralysis with thyroid disease. The identification of previous iatrogenic injury to the RLN suggests an irreversible trauma to the nerve. In this context, the need to preserve the single functioning RLN is heightened, and advanced knowledge at the pre-operative stage is considerably beneficial in order to ensure an optimal surgical outcome.

Conclusion

This study of patients with vocal fold paralysis and thyroid disease highlights a number of key factors that are pertinent for disease management. Firstly, in the presence of thyroid disease, RLN paralysis is not always due to malignancy. Secondly, if the RLN is preserved at surgery, a significant number of patients will recover vocal fold function in the ensuing months. Finally, the features of thyroid disease associated with vocal fold paralysis suggest that early surgical intervention may aid RLN recovery.

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