A Prospective Evaluation of Recurrent Laryngeal Nerve Paralysis During Thyroidectomy

Chung-Yau Lo, FRCS(Edin); Ka-Fai Kwok, FRCS(Edin); Po-Wing Yuen, FRCS(Edin)

Hypothesis: Recurrent laryngeal nerve paralysis after thyroidectomy can be unrecognized without routine laryngoscopy, and patients have a good potential for recovery during follow-up.

Design: A prospective evaluation of vocal cord function before and after thyroidectomy. Periodic vocal cord assessment was performed until recovery of cord function. Persistent cord palsy for longer than 12 months after the operation was regarded as permanent.

Setting: A university hospital with about 150 thyroid operations performed by 1 surgical team per year.

Patients: From January 1, 1995, to April 30, 1998, 500 consecutive patients (84 males and 416 females) with documented normal cord function at the ipsilateral side of the thyroidectomy were studied.

Main Outcome Measures: Vocal cord paralysis after thyroidectomy.

Results: There were 213 unilateral and 287 bilateral procedures, with 787 nerves at risk of injury. Thirty-three patients (6.6%) developed postoperative unilateral cord paralysis, and 5 (1.0%) had recognizable nerve damage during the operations. Complete recovery of vocal cord function was documented in 26 (93%) of 28 patients. The incidence of temporary and permanent cord palsy was 5.2% and 1.4% (3.3% and 0.9% of nerves at risk), respectively. Among factors analyzed, surgery for malignant neoplasm and recurrent substernal goiter was associated with an increased risk of permanent nerve palsy. Primary operations for benign goiter were associated with a 5.3% and 0.3% incidence (3.4% and 0.2% of nerves at risk) of transient and permanent nerve palsy, respectively.

Conclusions: Unrecognized recurrent laryngeal nerve palsy occurred after thyroidectomy. Thyroid surgery for malignant neoplasms and recurrent substernal goiter was associated with an increased risk of permanent recurrent nerve damage. Postoperative vocal cord dysfunction recovered in most patients without documented nerve damage.

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Recurrent laryngeal nerve damage is a well-recognized morbidity after thyroidectomy and has been involved in most claims concerning complications of thyroid surgery. The reported incidence of permanent nerve palsy varies widely from 0% to 5.8% of patients after thyroid operations. However, the incidence of permanent recurrent nerve paralysis could be as high as 13% and 30% of patients during thyroid cancer operations and secondary thyroidectomy, respectively. It was suggested that complications after thyroid surgery were often underestimated because of reporting preference. Routine examination of the vocal cords perioperatively to document recurrent nerve damage was usually incomplete, and the reported incidence of nerve injury may be somewhat underestimated.

The incidence of nerve palsy was not usually reported according to the underlying disease, nerve at risk, or both, and comparison of treatment results was difficult. In addition, many reports were retrospective and included operations performed by many surgeons and extended during a long duration. The present prospective study documents the incidence of postoperative vocal cord palsy after thyroidectomy performed by 1 surgical team during a relatively short period, evaluates its recovery potential, and identifies potential risk factors for the development of permanent paralysis.

RESULTS

The operative procedure included unilateral lobectomy in 172, total or near total thyroidectomy in 156, bilateral subtotal thyroidectomy in 91, completion total thy-
PATIENTS AND METHODS

From January 1, 1995, to April 30, 1998, 501 consecutive patients underwent thyroidectomy for treatment of various thyroid diseases by a single surgeon (C.-Y.L.) or by surgical residents operating with supervision. One patient with preoperative unilateral cord paralysis secondary to malignant involvement of recurrent nerve was excluded from the analysis. There were 84 males and 416 females in the study (age range, 12-88 years; median age, 43 years). Routine identification of the recurrent laryngeal nerve was performed during all operative procedures. Indirect or flexible laryngoscopy was performed 48 hours before and was repeated within 2 weeks after the operations for all patients by trained endoscopists and otolaryngologists. Suspected nerve damage was documented during the operation. Postoperative voice disturbance was graded according to 4 grades: nil, mild, moderate, and significant.

Postoperative cord palsy was defined as the presence of an immobile vocal cord or the decreased movement of the vocal cord during phonation. Patients with recurrent nerve palsy underwent speech therapy and were followed up by an otolaryngologist (P.-W.Y.) with a periodic vocal cord examination until full recovery was documented. Recurrent nerve palsy was regarded as permanent if it persisted for more than 1 year after the operation. The incidence of postoperative transient and permanent cord palsy was calculated in relation to the number of patients and the number of nerves at risk of damage. Potential risk factors for recurrent nerve paralysis, including the underlying pathological characteristics, the weight of the gland resected, the extent of resection, surgery for substernal goiter, thyroid reoperations, surgery for recurrent substernal goiter, operating time, and estimated blood loss, were examined. Comparisons were based on the number of patients developing cord palsy rather than on the number of nerves at risk, except for comparison between lobectomy and subtotal resection. Statistical analysis was performed using the χ² or Fisher exact test (categorical variables) and the t test (continuous variables). P<.05 was considered as statistically significant.

<table>
<thead>
<tr>
<th>Type of Thyroidectomy</th>
<th>No. of Patients</th>
<th>No. of Nerves at Risk</th>
<th>No. (%) of Operations*</th>
<th>No. (%) of Nerves at Risk*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unilateral lobectomy</td>
<td>172</td>
<td>172</td>
<td>4 (2.3)/2 (1.2)</td>
<td>4 (2.3)/2 (1.2)</td>
</tr>
<tr>
<td>Total</td>
<td>156</td>
<td>312</td>
<td>10 (6.4)/4 (2.6)</td>
<td>10 (3.2)/4 (1.3)</td>
</tr>
<tr>
<td>Bilateral subtotal</td>
<td>91</td>
<td>182</td>
<td>8 (8.8)/1 (1.1)</td>
<td>8 (4.4)/1 (0.5)</td>
</tr>
<tr>
<td>Completion total</td>
<td>41</td>
<td>41</td>
<td>3 (7.3)/0 (0)</td>
<td>3 (7.3)/0 (0)</td>
</tr>
<tr>
<td>Lobectomy and</td>
<td>40</td>
<td>80</td>
<td>1 (2.5)/0 (0)</td>
<td>1 (1.3)/0 (0)</td>
</tr>
<tr>
<td>contralateral subtotal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>787</td>
<td>26 (5.2)/7 (1.4)</td>
<td>26 (3.3)/7 (0.9)</td>
</tr>
</tbody>
</table>

*Data are given as transient/permanent.
†Others included anaplastic carcinoma in 3, thyroid lymphoma in 2, and metastasis in 1 patient.

Table 1. Incidence of Recurrent Nerve Paralysis According to the Underlying Pathological Characteristics

Table 2. Incidence of Recurrent Nerve Paralysis According to the Type of Thyroidectomy

Table 3 shows the details of 7 patients with permanent cord palsy. Nerve damage was documented in 5 patients, including inadvertent transection (n = 3) and intentional sacrifice (n = 2), while 2 patients had extensive dissection of recurrent nerve from peritumor adhesion. Of the patients who had unexpected unilateral recurrent nerve palsy (n = 28), the recovery potential was 93%. Of the factors analyzed, surgery for a malignant neo-
plasm (4 of 76 patients) was associated with a higher risk of permanent recurrent nerve palsy compared with an operation for benign diseases (3 of 424 patients) (P = .01). Surgery for recurrent substernal goiter was associated with a higher risk of permanent nerve palsy compared with surgery for other goiter (2 of 12 vs 5 of 488 patients; P = .01). The weight of the thyroid lobe resected, reoperative thyroid surgery, surgery for substernal goiter, and surgery for thyrotoxicosis were not associated with an increased risk of transient or permanent nerve palsy. A longer operative time (156 vs 114 minutes; P = .007) and an increase in estimated blood loss (246 vs 97 mL; P = .01) were noted for patients who developed postoperative permanent cord palsy. Of those patients who developed postoperative cord paralysis (n = 33), surgery for the malignant neoplasm and for recurrent substernal goiter was associated with a statistically significant (P = .04 for both) increased risk of permanent nerve palsy. Four (50%) of the 8 patients who underwent thyroid cancer operations developed permanent cord palsy compared with 3 (12%) of the 25 patients who underwent thyroidectomy for benign thyroid diseases. The postoperative cord palsy in 2 patients (100%) who underwent thyroidectomy for recurrent substernal goiter became permanent compared with 5 (16%) of 31 patients who underwent thyroidectomy for other conditions.

## Table 3. Details of 7 Patients With Permanent Nerve Palsy*

<table>
<thead>
<tr>
<th>Patient No./Sex/Age, y</th>
<th>Pathological Characteristics</th>
<th>Type of Thyroidectomy</th>
<th>Operative Findings</th>
<th>Side</th>
<th>Hoarseness</th>
<th>Follow-up, mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/M/67</td>
<td>PTC</td>
<td>Total</td>
<td>Tumor adhesion</td>
<td>L</td>
<td>Significant</td>
<td>25</td>
</tr>
<tr>
<td>2/M/47</td>
<td>PTC</td>
<td>Total</td>
<td>Tumor encasement</td>
<td>R</td>
<td>Significant</td>
<td>29</td>
</tr>
<tr>
<td>3/F/63</td>
<td>PTC</td>
<td>Total</td>
<td>Tumor encasement</td>
<td>R</td>
<td>Moderate</td>
<td>40</td>
</tr>
<tr>
<td>4/F/69</td>
<td>ATC</td>
<td>Total</td>
<td>Tumor adhesion</td>
<td>R</td>
<td>Moderate</td>
<td>7 (Death)</td>
</tr>
<tr>
<td>5/M/48</td>
<td>Nodular hyperplasia</td>
<td>Unilateral lobectomy</td>
<td>Nonrecurrent nerve damage</td>
<td>R</td>
<td>Nil</td>
<td>24</td>
</tr>
<tr>
<td>6/F/45</td>
<td>Nodular hyperplasia</td>
<td>Bilateral subtotal†</td>
<td>Nerve damage</td>
<td>R</td>
<td>Moderate</td>
<td>33</td>
</tr>
<tr>
<td>7/R/77</td>
<td>Nodular hyperplasia</td>
<td>Unilateral lobectomy†</td>
<td>Nerve damage</td>
<td>L</td>
<td>Moderate</td>
<td>31</td>
</tr>
</tbody>
</table>

* PTC indicates papillary thyroid carcinoma; ATC, anaplastic thyroid carcinoma. †Recurrent substernal goiter.

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tine identification of recurrent nerve.4 Reeve et al12 reported no permanent nerve palsy in 115 primary total thyroidectomies, whereas the rate of permanent nerve palsy increased to 3.1% after secondary thyroidectomy for multinodular goiter in 258 patients. Our 4% (2 of 49 patients) incidence of permanent nerve paralysis (3.5% of nerves at risk) after secondary thyroidectomy is comparable with that of others13-17 but was significantly increased compared with that for primary operations. The incidence was even higher when the secondary thyroidectomy was performed for substernal goiter (16.7%). These results emphasize the need to provide the best possible therapy at the initial operation, when it can be performed with the least risk.18

Since the article published by Lahey20 in 1938, there remains controversy about the need for routine identification of recurrent nerve during thyroidectomy, but cumulative reports3,4,21 support this surgical approach. In patients undergoing total lobectomy, it has been reported that the permanent palsy rate increased from 3.8% to 7% when the nerve was not exposed or identified.3 An English-language only literature review of more than 12,000 documented thyroid resections has reported rates of the order of 1.2% or 3.2% of permanent nerve palsies depending on whether the nerve was exposed during surgery.3 There should be few, if any, instances in which the recurrent nerve cannot be identified.21 Inadvertent nerve damage could be easily recognized during the operation with routine identification of recurrent nerve.

Postoperative recurrent nerve palsy has the potential for recovery, with a recovery rate ranging from 50% to 88%.2,4,18 Our overall recovery rate of 79% was comparable with others. However, when inadvertent nerve injury recognized intraoperatively was excluded, the recovery potential for unsuspected nerve paralysis was nearly complete, except during thyroid cancer operations, in which the nerve was dissection from peritumor adhesion. Our policy for surgical treatment of a well-differentiated thyroid carcinoma is to preserve cord function by dissection of the recurrent nerve from the adjacent tumor unless in the presence of preoperative cord dysfunction or any definite evidence of nerve encasement by the tumor intraoperatively. Contrary to others, the nerve was sometimes reported as invaded by tumor or sacrificed and was not calculated as postoperative nerve palsy.11 This may partly attribute to the lower incidence of recurrent nerve damage during thyroid cancer operations in some reports. The nonrecurring recurrent laryngeal nerve on the right side of the neck is always a threat to inadvertent injury because of its rare occurrence.21

Unrecognized recurrent laryngeal nerve palsy can occur after thyroidectomy, and this complication may be underestimated without the use of routine laryngoscopy. With routine identification of recurrent nerve during thyroidectomy, postoperative cord palsy has a nearly complete recovery potential unless in the presence of recognized nerve damage or after extensive dissection from malignant tumors. Thyroid surgery for malignant neoplasms and recurrent substernal goiter was associated with an increased risk of permanent recurrent nerve damage.

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REFERENCES