

Outcome of vocal cord function after partial layer resection of the recurrent laryngeal nerve in patients with invasive papillary thyroid cancer

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Background. The recurrent laryngeal nerve (RLN) may be involved by thyroid cancer even in patients with functioning vocal cords preoperatively. In such cases, we try to preserve the nerve with sharp dissection. As a result of the dissection, the nerve may become thinner than its original thickness. Here we call this operative procedure “partial layer resection of the RLN,” if the thickness of the preserved nerve is less than half of its original size. However, there is no report on postoperative vocal cord function after this procedure.

Methods. We report on 4,585 patients with papillary thyroid cancer who underwent their initial surgery in Kuma Hospital. Among them, 18 patients underwent “partial layer resection of the RLN.” We also performed histologic examinations on the RLNs resected because of cancer invasion in 3 other patients.

Results. Postoperatively, 2 patients had functioning vocal cords, 13 had transient vocal cord paralysis, and the remaining 3 had permanent paralysis. Thus, 83% (15/18) of the present patients who underwent partial layer resection of the RLN had functioning vocal cords 1 year after surgery. In patients with transient paralysis, the phonation efficiency index (PEI) 1 year after operation recovered to normal range from the low PEI immediately after operation. Histologic examinations of resected RLN revealed that 78–82% of the cross-section of the nerve is composed of perineural connective tissue surrounding the nerve fibers.

Conclusion. An unexpectedly high proportion (83%) of the patients who underwent partial layer resection of the RLN achieved functioning vocal cords and nearly normal phonation postoperatively. (*Surgery* 2014;155:184-9.)

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THYROID CANCER is the most common malignancy in the endocrine organs. Papillary carcinoma is the representative pathologic type, constituting about 90% of thyroid cancer. Thyroid cancer often invades the recurrent laryngeal nerve (RLN), causing vocal cord paralysis. Even in patients with functioning vocal cords preoperatively, involvement of the RLN by the cancer may be detected during surgery. When the vocal cords are functioning preoperatively, we try to preserve the nerve with sharp dissection. As a result of the dissection, the diameter of the RLN may become thinner than

its original diameter. In the present paper, we call this procedure “partial layer resection of the RLN.” However, the outcome of vocal cord function after this procedure was not specifically reported. We experienced that a patient with extreme thinning of the preserved RLN shown in Fig 1 who achieved full recovery in her vocal cord function. This clinical experience prompted us to conduct the present study.

PATIENTS AND METHODS

Procedure. We tried to preserve the RLN involved by thyroid cancer in patients with functioning vocal cord preoperatively. We shaved the nerve off the tumor sharply with a scalpel under surgical loupes. We usually try to preserve the RLN in its intact status when possible. However, resection of a partial layer of the nerve, shaving tangentially off the tumor, may be necessary. In such cases, we tried to resect perineural tissue only,

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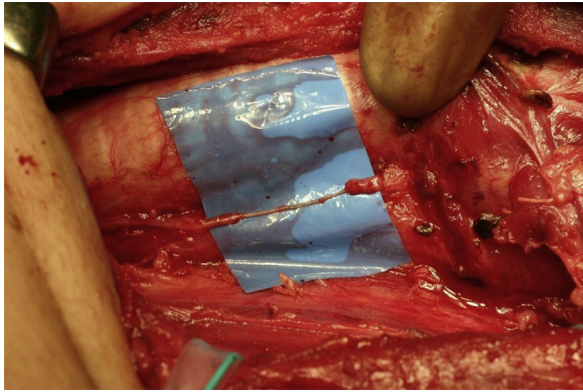


Fig 1. Recurrent laryngeal nerve after partial layer resection.

preserving the core portion of the nerve as much as possible. We could usually identify the core portion under the magnified view. The RLN was preserved if the nerve seemed to be free from cancer tissue under the magnified view. In the present paper, we call this operative procedure “partial layer resection of the RLN” if the thickness of the preserved nerve is less than half of its original size. If the RLN was resected, we reconstructed the nerve with several techniques immediately during the same operation.¹⁻³

Patients. From January 2007 to December 2011, 4,585 patients with papillary thyroid cancer underwent their initial surgery in Kuma Hospital. From their medical records, we identified 18 patients who underwent partial layer resection of the RLN for unilateral RLN involvement by the primary cancer itself. Histopathologic examination revealed well-differentiated papillary carcinomas in all patients. Table I shows the characteristics of these patients. There were 15 women and 3 men aged between 29 and 84 years (median, 59.9). All of these patients underwent total thyroidectomy and central compartment dissection. Modified radical neck dissection was also performed in six of them. The proportion of the thinnest diameter of the preserved RLN to its original size was described as 1/2 in 5 patients, 1/3 in 1, 1/4 in 1, and <1/4 in the remaining 11. The length of resected area ranged from 0.3 to 4 cm in 8 patients, and was not described in the remaining 10.

Assessment of outcomes. Laryngoscopic examinations were performed before and 2 or 3 days after operation. Preoperative laryngoscopy showed functioning vocal cords in all patients. When vocal cord paralysis was identified postoperatively, these patients were followed every 1–3 months until the vocal cord paralysis resolved. Patients who had vocal cord paralysis ≥ 1 year after surgery were considered to have permanent paralysis.

Maximum phonation time (MPT) measurement was performed periodically after operation, and MPT 1 year after operation was used to evaluate the outcome. MPT is the length of sustained phonation of the vowel “a” at the loudness of usual conversation voice after maximum inspiration at a sitting position.¹ Vital capacity was measured before operation. The MPT/vital capacity ratio was calculated, which should indicate vocal cord function of converting a unit volume of exhaled air to a certain length of phonation. This value is called the phonation efficiency index (PEI). Although MPTs were significantly longer in male than female subjects, gender difference disappeared when PEIs were calculated.² Thus, the PEIs are suitable to evaluate vocal cord function regardless of gender, and the minimum value of the PEI in normal subjects was 4 sec/L.²

Anatomy. Because the majority of the present patients achieved recovery in vocal cord function as described in Results, we studied the structure of cross-sections of the RLNs resected because of thyroid cancer invasion in 3 other patients. Specimens taken from the nearly normal central portion of the nerve were stained with hematoxylin and eosin, and were also immunostained for S-100 protein. The immunohistochemical staining for S-100 protein reveals perineurium cells (Schwann cells). We measured the area of nerve fiber cells stained for S-100 protein and the entire area of the cross-section of the RLN.

Statistical analysis. The Mann–Whitney *U* and Wilcoxon signed-rank tests were used to compare the clinical data. Values are given as mean \pm standard deviation.

RESULTS

Outcomes were shown in Table I. Immediately after surgery, 16 patients (89%) had vocal cord paralysis on the side of the partial layer resection of the RLN, whereas the remaining 2 patients (11%) had functioning vocal cords. Periodical laryngoscopic examinations showed full recovery in vocal cord motions in 13 of the 16 patients with vocal cord paralysis and no recovery in the remaining 3 patients for >1 year postoperatively. The periods for the recovery ranged from 1 to 9 months (median, 5). As the result, the overall incidences of no paralysis, temporary and permanent vocal cord paralysis were 11% (2/18), 72% (13/18), and 17% (3/18), respectively.

The extent of thinning of the reserved RLN might have some influence on the outcome. The present patients were divided into 2 groups according to the ratio of the diameter of the

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