Causes of recurrent laryngeal nerve paralysis

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Abstract

Objective: Persistent hoarseness due to recurrent laryngeal nerve paralysis (RLNP) reduces the quality of life unless it is adequately treated. This study examined the indications for phonosurgical intervention in patients with RLNP. Materials and methods: The medical records of the Ehime University Hospital, Ehime, Japan, from October 1976 until December 1997 were reviewed retrospectively to identify patients with RLNP. The data collected included age, gender, paralyzed side, and cause of paralysis. Results: Four hundred and sixty-six patients with RLNP were identified: 262 males and 204 females. Unilateral RLNP was present in 422 patients, while 44 presented with bilateral RLNP. The incidence was relatively high in the 7th and 8th decades, and was twice as high in male patients as in female patients. The 466 patients were divided into 2 groups: Group 1 included 225 patients seen before January 1987, and Group 2 included 241 patients seen after this date. The number of patients with postoperative RLNP was significantly higher in Group 2 (124 of 239 patients) than in Group 1 (65 of 227 patients) (P < 0.05). Surgery for cardiovascular disease, esophageal cancer, and skull base and thyroid gland tumors contributed to this increased incidence of postoperative RLNP. Conclusions: Patients with persistent unilateral RLNP require appropriate treatment for hoarseness, regardless of its cause. Since the incidence of RLNP related to surgery was significantly increased in Group 2, phonosurgery has become more important for improving the quality of life of these patients. © 2002 Elsevier Science Ireland Ltd.

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1. Introduction

The larynx plays an important role in respiration, deglutition, and phonation. The recurrent laryngeal nerve (RLN) innervates all the intrinsic laryngeal muscles, except the cricothyroid muscle, and thereby regulates coordinated movements of the vocal fold. Patients with unilateral RLN paralysis (RLNP) complain of hoarseness and occasional liquid aspiration. As reported by several authors, [1–3] persistent hoarseness due to unilateral RLNP adversely affects a patient’s quality of life. Since Isshiki et al. [4,5] reported thyroplastic procedures for treating hoarseness due to unilateral RLNP, a great deal of effort has been devoted to increasing the efficacy of phonosurgery [6,7]. Type I thyroplasty and its various modifications, and arytenoid adduction are now widely accepted treatment methods. Other surgical methods for treating unilateral RLNP include intracordal injection of various biocompatible materials [8,9]. Re-innervation procedures, such as anastomosis of the ansa cervicalis to the RLN and ansa cervicalis neuromuscular pedicle implantation into the thyroarytenoid and lateral cricoarytenoid muscles, have also been reported [10,11].

Recent advances in, and the widespread use of, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonic echography have increased the ability to correctly diagnose otherwise hidden causes of RLNP. In the last two decades, progress in vascular and reconstruction surgery together with advances in imaging techniques for correct diagnosis have facilitated the surgical treatment of patients with previously inoperable conditions, such as aortic aneurysm, skull base tumors, esophageal cancer, and other life-threatening diseases. However, RLNP sometimes persists following surgery. Thus, phonosurgical management of
patients with unilateral RLNP is important to improve their quality of life after treatment of the primary disease.

Although risk factors for RLN injury during thyroid operations have been reported [12,13], there have been very few reports over the last 10 years on the causes of RLNP [14,15]. This study examined the causes of RLNP and their frequency. To outline the indications for phonosurgical intervention to treat patients with unilateral RLNP, we retrospectively examined the causes of RLNP in 466 patients who had visited the Department of Otolaryngology-Head and Neck Surgery, Ehime University Hospital, Ehime, Japan. Furthermore, we examined the change in the frequencies of the causes of RLNP in the period from October 1976 to 1986 and in the following 11 years.

2. Materials and methods

We retrospectively reviewed the medical records of 466 patients with RLNP seen by members of the Department of Otolaryngology-Head and Neck Surgery, Ehime University Hospital, Ehime, Japan, between October 1976, when Ehime University Hospital was founded, and December 1997. Patients with vocal fold fixation due to cancer of the larynx or hypopharynx were excluded. The data collected included age, gender, side of paralysis, and cause of paralysis. In addition to noting the history, all patients underwent a physical examination and fiberscopy of the head and neck region. Other examinations, such as chest radiography, ultrasonic echography of the neck, and CT or MRI from the skull base to the mediastinum, were performed when indicated. When these examinations failed to detect a cause of RLNP, the patient was followed up for at least 3 months and examinations were repeated. The diagnosis of ‘idiopathic’ was made when the underlying cause of RLNP was not clear after the follow-up period.

The patients were divided into 2 groups: Group 1 included 225 patients seen between October 1976 and December 1986, and Group 2 included 241 patients seen between January 1987 and December 1997. The causes of RLNP were summarized for each group, to determine whether there were any differences between the two groups. Statistical analysis was performed using the $\chi^2$-test. Differences were considered significant when the $P < 0.05$.

3. Results

The patients included 262 males and 204 females, ranging in age from 2 months to 87 years, with a mean of 56.0 years. The mean age of the male patients (57.8 years) was significantly higher than that of the female patients (53.6 years). The number of male patients was greatest in the 7th decade and that of female patients was greatest in the 6th decade. Table 1 shows the incidence of RLNP for each decade per 10 million people, normalized according to the Japanese population in 1994. The incidence of RLNP was relatively high in the 7th and 8th decades for both male and female patients, and the incidence in male patients in each of these decades was more than twice that in female patients. Unilateral RLNP was seen in 422 patients, while 44 presented with bilateral RLNP. Of the 422 patients with unilateral RLNP, 283 had paralysis on the left side and 139 on the right: the incidence of RLNP on the left side was twice that on the right.

Table 1 shows the incidence of recurrent laryngeal nerve paralysis per 10 million people normalized according to the age-matched Japanese population.
52 (21.8%) of 239 patients in Group 2. Thus, the incidence of RLNP after thyroid surgery was significantly increased in Group 2. Surgical intervention for the treatment of cardiovascular diseases, esophageal cancer, and skull base tumors also contributed to an increased incidence of RLNP after surgery. In Group 1, there were no cases of RLNP following surgery for skull base tumor or aortic arch aneurysm. In addition, a significant increase in the incidence of RLNP related to surgical procedures was observed in patients with neck diseases, thorax diseases, thyroid cancer, and benign thyroid tumor.
4. Discussion

Recurrent laryngeal nerve paralysis (RLNP) is frequently encountered by otolaryngologists. Many disease entities in the head, neck, and thorax regions can cause RLNP, including inflammatory, neoplastic, cerebrovascular, heart, degenerative, and other diseases. Of these, malignant tumors and trauma including surgery are reported to be the most frequent causes of RLNP [14–22]. Idiopathic RLNP also occurs at a significant frequency, ranging between 1.5 and 41.3%. In the English literature, the incidence of idiopathic RLNP is reported to range between 1.5 and 14.0% [14,16–18,20], while the range in the Japanese literature is reported to be between 25.9 and 41.3% [19,21,22]. The difference may be partly ascribed to the criteria used for diagnosis. In our series, 101 (21.7%) of 466 patients had idiopathic RLNP. We labeled RLNP as idiopathic after a battery of thorough examinations failed to detect a cause of RLNP. Viral infections have long been postulated to be a cause of RLNP or vagal nerve paralysis. Bachor et al. [23] reported a rare case with unilateral vocal fold paralysis, in which antibodies to type I herpes simplex virus (HSV-I) were found by immunofluorescence analysis in a smear taken from a mucosal ulcer on the arytenoids. However, it was not possible to confirm a direct relationship between HSV-I reactivation and paralysis of the nerve, because biopsy of the nerve or ganglion causes permanent damage to the nerve. We did not diagnose viral infection as a cause of RLNP unless obvious signs of viral infection, such as vesicles in the throat or elevation of serum antibody titer, appeared near the onset of RLNP. The presence of common cold symptoms preceding the occurrence of RLNP without the aforementioned findings did not lead to a diagnosis of viral origin. Therefore, a significant number of patients may have been classified as idiopathic in our series. Thanks to recent advances in diagnostic instruments, the proportion of cases diagnosed as idiopathic RLNP decreased from 26.0% in Group 1 to 17.6% in Group 2, although this decrease was not statistically significant.

As shown in Table 1, the incidence of RLNP was relatively high in the 7th and 8th decades for both male and female patients. This elevated incidence seemed to reflect an increased rate of malignancy other than thyroid cancer. Other factors may include an increased incidence of cerebrovascular accident or heart disease, etc. There are no other reports in which incidence of RLNP was normalized with an age-matched population, from Japan or any other country, with which to compare our results.

Recently, thyroid surgery has been reported to be the cause of less than 10% of all cases of RLNP [14,18,20]. Thyroid surgery was a cause of RLNP in 16.3% of all patients in our series. Since more than half of these patients had thyroid cancer, their RLNs were sacrificed to extirpate the cancer. Excluding the 42 patients with thyroid cancer, RLNP occurred in 34 patients (7.3% of the 466 patients) after other types of thyroid surgery. The incidence was comparable to that reported in the English literature. However, the incidence of post-thyroidectomy RLNP for benign tumors was not reduced in Group 2 as compared with Group 1. Although the difference was not significant, the incidence actually increased from 4.8% (11/227) in Group 1 to 9.6% (23/239) in Group 2. Surgeons should have sufficient knowledge of the anatomical relationship between the thyroid gland and the RLN, and should take great care in manipulating tissue during surgery. Based on dissection of 25 cadavers, Sasou et al. [24] reported that the RLN never penetrated the suspensory ligament of Berry, and that the nerve always ran lateral to the ligament. They recommended separating the suspensory ligament close to the thyroid gland to avoid injury to the nerve. Wagner suggested complete exposure of the RLN to prevent permanent damage to the nerve during total lobectomy [13].

Post-intubation RLNP is known to have a favorable prognosis, and Yamada et al. [21] reported recovery of vocal fold mobility in 13 (68.4%) of 19 patients. On the other hand, Yamada et al. [21] and Kawamura et al. [22] reported that RLNP of unknown cause had a less favorable prognosis with recovery rates of 29.5% (18 of 61 patients) and 37.5% (12 of 32 patients), respectively. Yamada et al. [21] also reported that vocal fold movement recovered completely in 36 (6.4%) of 564 patients with RLNP of various causes who were followed up over 6 months after onset. Kawamura et al. [22] reported that 37 (33.3%) of 111 patients who were followed up over 6 months showed a certain degree of improvement in vocal fold movement within 3 months. Nevertheless, the rest of the patients with unilateral RLNP require appropriate treatment for hoarseness. As shown in Table 3, the incidence of RLNP related to surgery was significantly increased in Group 2. This increase seemed to be the result of recent improvements in diagnostic and operative capabilities. In our series, none of the patients in Group 1 had RLNP after surgical intervention for skull base tumors or aortic arch aneurysm, while 3 and 6 patients in Group 2 had these causes of RLNP, respectively. Furthermore, the number of patients with RLNP after surgery for esophageal cancer increased from 5 in Group 1 to 10 in Group 2, and the number after surgery for heart disease increased from 1 in Group 1 to 8 in Group 2. Although the original diseases in these patients were successfully treated, their quality of life after surgery was reduced, owing to RLNP.

Smith et al. [1] examined the outcome of voice problems in work-related functioning in patients with
RLNP, and found that RLNP significantly disrupts socioeconomic outcome. Benninger et al. [2] also reported that patients with RLNP had a higher level of disability, as measured on both the Voice Handicap Index and Medical Outcomes Trust 36-Item short form, compared with that in dysphonic patients with benign vocal fold masses or vocal fold edema. Baba et al. [3] evaluated whether hoarseness due to persistent RLNP after esophagectomy for carcinoma influenced patients’ quality of life compared with patients without RLNP. They found that hoarse patients showed debilitation in performance status, ability to climb stairs, and in swallowing and concluded that persistent RLNP adversely affects quality of life until it is adequately treated. Therefore, as the number of patients with RLNP related to surgery increases, phonosurgical intervention to improve the postoperative quality of life in these patients should be indicated more frequently.

References