

# Risk factors for recurrent laryngeal nerve palsy after thyroidectomy

Research Article

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**Abstract:** This study investigates the incidence of temporary and permanent recurrent laryngeal nerve palsy (RLNP) and possible risk factors for patients with different types of thyroid gland diseases. 1224 consecutive patients who underwent thyroidectomy for treatment of various thyroid diseases between the years 2001-2005. The rates of RLNP were evaluated. The surgeon and type of thyroid gland disorder were recognised as possible risk factors for RLNP. The incidence of temporary/permanent RLNP for the whole group was 4.5/0.8%. The rates of temporary RLNP for groups, classified as multinodular goitre, Graves' disease, thyroid cancer or Hashimoto's disease were 4.3%, 4.3%, 5.2% and 5.7%, respectively. The rates of permanent RLNP for the same groups were 0.4%, 0.9%, 1.6% and 1.9%, respectively. The frequency of temporary RLNP for individual surgeons ranges from 2.8 to 7.0% and the rates of permanent RLNP is between 0-3.1%. There was no relationship between the surgeon's experience (the number of procedures performed) and RLNP rates. Total thyroidectomy is a safe procedure associated with a low incidence of RLNP not only for benign multinodular goitre, but also for Graves' disease, thyroid cancer and Hashimoto's disease. The rates of RLNP among individual surgeons are acceptable with small inter-individual differences.

**Keywords:** *Thyroid gland surgery • Recurrent laryngeal nerve palsy*

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## 1. Introduction

Recurrent laryngeal nerve palsy (RLNP) is a relatively frequent complication of thyroid gland surgery. The reported incidence of temporary RLNP ranges from 1.3 to 20%, while the incidence of permanent RLNP varies from 0 to 9%. These percentages are dependent on the type of surgery and thyroid gland disease [1-4]. Some authors stress that there is a higher risk for RLNP in operations involving thyroid gland carcinomas and Graves' disease. Reoperations and inexperienced surgeons can also be considered possible risk factors [5-8].

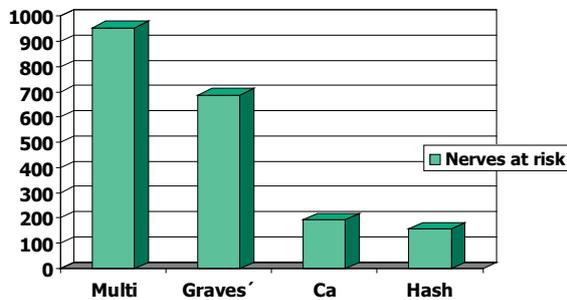
Routine visual identification of the nerve by meticulous dissection is the best method to avoid injury of the RLN. However, unexpected RLN palsy still occurs,

even though the visual integrity was assured [9,10]. Intraoperative neuromonitoring is a relatively new method which decreases the incidence of transient (but not permanent) RLNP compared with visualisation alone, particularly in high-risk patients [11]. The most frequent published mechanism of RLN injury is overstretching of the nerve at the region of Berry's ligament, clamping or transecting of the nerve [10].

The aim of our study was to determine the incidence of temporary and permanent RLNP in our workplace and to find possible risk factors. The surgeon and type of thyroid gland disorder were recognised as possible risk factors for RLNP.

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**Figure 1.** The nerves at risk according to the thyroid gland disease.



The most frequent indication for surgery was multinodular goitre and Graves' disease, followed by thyroid gland carcinomas and Hashimoto's thyroiditis.

## 2. Material and Methods

There were 1991 nerves at risk in 1224 consecutive patients enrolled in the retrospective case-control study. The patients underwent thyroidectomy for treatment of various thyroid diseases between the years 2001-2005. Patients with preoperative RLNP were excluded.

During the assessed time period, 767 total thyroidectomies (1534 nerves at risk) and 457 hemithyroidectomies (457 nerves at risk) were performed. Substernal spread of thyroid tissue was identified in 120 patients (10% of our group). The most frequent indications for surgery were the multinodular goitre and Graves' disease, followed by thyroid gland carcinomas and Hashimoto's thyroiditis (Figure 1).

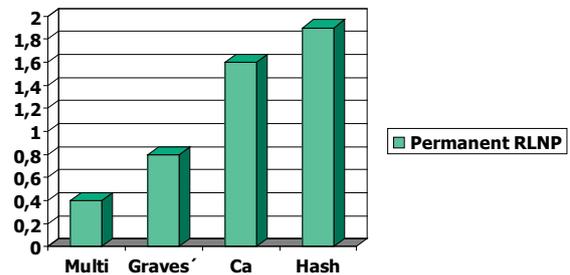
The surgery was performed using a horizontal skin incision between the cricoid cartilage and sternum. After the elevation of skin flaps, the strap muscles were identified and separated in midline, exposing the isthmus of the thyroid gland. The identification and ligation of the middle thyroid vein was followed by mobilization of the lateral border of the thyroid gland. The superior pole of the thyroid was then isolated and the ligation of the superior thyroid artery and vein was performed. The RLN was identified in the tracheoesophageal groove. Once the parathyroid glands and RLN had been identified, ligation of the inferior thyroid artery and associated veins was performed. The thyroid lobe was elevated anteriorly and the Berry ligament was divided. When performing total thyroidectomy, the same procedure was applied for the second lobe. The identification and visualization of recurrent laryngeal nerve (RLN) was done during the procedure in all patients, without the use of electrostimulation.

Indirect laryngoscopy was performed preoperatively and a repeated laryngoscopic investigation was performed in the postoperative period between the 2<sup>nd</sup> and 7<sup>th</sup> postoperative day. The patients with

**Table 1.** The rates of RLNP for different thyroid gland diseases.

| Diagnosis           | Number of RLN at risk | Temporary RLNP (%) | Permanent RLNP (%) |
|---------------------|-----------------------|--------------------|--------------------|
| Multinodular goitre | 955                   | 4,3%               | 0,4%               |
| Graves' disease     | 687                   | 4,3%               | 0,9%               |
| Thyroid cancer      | 192                   | 5,2%               | 1,6%               |
| Hashimotos' disease | 157                   | 5,7%               | 1,9%               |
| Whole group         | 1991                  | 4,5%               | 0,8%               |

**Figure 2.** Permanent RLNP according to the thyroid gland disease (%).



The operations for Graves' disease, thyroid cancer and Hashimoto's disease demonstrated some tendency for higher RLNP rates than multinodular goitre, but this difference wasn't statistically significant ( $P > 0.05$ ).

postoperative RLNP were treated with vitamins and corticosteroids in the early postoperative period. If there was no improvement of the RLN function within two weeks of the surgery, 10 days of electrostimulation therapy were given. The patients subsequently had a long term follow-up with repeated indirect laryngoscopy - minimally until the recovery of vocal cord movement.

The surgeon as well as the type of thyroid gland disorder was both recognised as possible risk factors for RLNP.

### 2.1. Ethical consideration

Ethical approval was not considered necessary as the patients data were collected retrospectively and thyroid gland surgery is a standard procedure.

### 2.2. Statistics

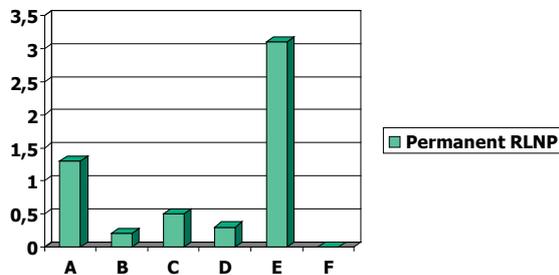
All statistical analyses were performed using the program NCSS 2007. Fisher's two proportions test and a value of  $P < 0.05$  were used to establish the statistical significance.

## 3. Results

Our set of postoperative complications consisted of 106 RLNP in 102 persons (4 bilateral palsy), which represents 5.3% of enrolled nerves at risk. The function of RLN recovered during the follow-up period in 90

**Table 2.** The rates of RLNP for individual surgeons.

| Surgeon     | Number of RLN at risk | Temporary RLNP | Permanent RLNP |
|-------------|-----------------------|----------------|----------------|
| A           | 754                   | 2,8%           | 1,3%           |
| B           | 416                   | 5,5%           | 0,2%           |
| C           | 399                   | 7,0%           | 0,5%           |
| D           | 349                   | 3,7%           | 0,3%           |
| E           | 65                    | 3,1%           | 3,1%           |
| F           | 55                    | 5,4%           | 0%             |
| Whole group | 1991                  | 4,5%           | 0,8%           |

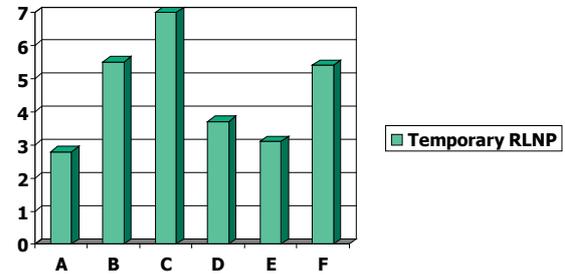
**Figure 4.** The rates of permanent RLNP for individual surgeons (%).

Surgeon E had a significantly higher permanent RLNP rate than surgeon B ( $P < 0.05$ ).

patients, hence the incidence of temporary RLNP was 4.5% and the permanent RLNP rate was 0.8%. There was successful recovery of RLN function in all patients with bilateral palsy, so there was no permanent bilateral RLNP in our set.

The postoperative rate of RLNP concerning thyroid gland disease is summarised in Table 1 and Figure 2. The rates of temporary RLNP for groups classified as multinodular goitre, Graves' disease, thyroid cancer and Hashimoto's disease were 4.3%, 4.3%, 5.2% and 5.7%, respectively. The rates of permanent RLNP for the same groups were 0.4%, 0.9%, 1.6% and 1.9%, respectively. The operations for Graves' disease, thyroid cancer and Hashimoto's disease demonstrated some tendency for higher RLNP rates than multinodular goitre, but this difference was not statistically significant ( $P > 0.05$ ). The results of Fisher's two proportion test for the groups, classified as multinodular goitre: Graves' disease; multinodular goitre: thyroid cancer; and multinodular goitre: Hashimoto's disease, were  $P = 0.336$ ,  $P = 0.096$  and  $P = 0.062$ , respectively.

Table 2 and Figures 3 and 4 evaluate the incidence of RLNP for individual surgeons. The rates of RLNP were compared with the number of thyroid gland operations performed by each surgeon during a given period. The frequency of temporary RLNP for individual surgeons ranges from 2.8 to 7.0% and rates of permanent RLNP between 0–3.1%. Surgeons B and C had a significantly higher incidence of temporary RLNP than surgeon

**Figure 3.** The rates of temporary RLNP for individual surgeons (%).

Surgeons B and C had significantly higher incidences of temporary RLNP than surgeon A ( $P < 0.05$ ).

A ( $P = 0.023$  and  $P = 0.001$ ), and surgeon E had a significantly higher permanent RLNP rate than surgeon B ( $P = 0.049$ ). Other differences between the surgeons were not significant ( $P > 0.05$ ). There was no relationship between the surgeon's experience (the number of procedures performed) and RLNP rates.

## 4. Discussion

The rate of temporary and permanent RLNP after thyroid gland surgery varies considerably in the literature, not only according to different authors, but also according to the different types of thyroid gland surgery (total or subtotal thyroidectomy). While some authors achieve very good results, with the incidence of permanent RLNP below 1% [1,2,4], others have a higher percentage of complications. Jeannon [3] performed a systematic review of literature, which included 27 articles and studies involving around 25,000 patients after thyroid gland surgery. The average incidence of temporary RLNP was 9.8% and the average rate of permanent RLNP was 2.3%. Aytac [12] analyzed 418 patients after thyroid gland surgery. The rates of temporary and permanent RLNP for the whole group were 3.8% and 1.2%, respectively. While transient/permanent RLNP rates were 2.0/0.03% for bilateral subtotal thyroidectomies, the ratio for bilateral total thyroidectomy was 13.6/9%. The author advises carrying out a subtotal surgery, especially if RLN fails to be identified. In our group of patients, only total thyroidectomies or total lobectomies were carried out. No subtotal thyroidectomies were performed during these last 10 years. In spite of this fact, the rates of temporary/permanent RLNP (4.5/0.8%) in our set is acceptable and comparable with the literature.

According to the literature, some diseases of thyroid gland may be considered as risk factors for postoperative RLNP [5–8]. Chiang [5] evaluated a group of 521 patients with different thyroid gland diseases. The overall incidence of temporary and permanent

RLNP was 5.1% and 0.9%, respectively. The rates of temporary/permanent RLNP were 4.0/0.2% for benign thyroid disease, 2.0/0.7% for thyroid cancer, 12.0/1.1% for Graves' disease and 10.8/8.1% for recurrent goitre. The author concluded that operations for thyroid cancer, Graves' disease and recurrent goitre demonstrated significantly higher RLNP rates. A large set of 3250 thyroid gland operations for various diagnoses was published by Erbil [7]. The rates of complications were significantly higher in patients who had an extended thyroidectomy, identification of RLN during surgery, repeated surgery and in patients older than 50 years. Sevim [8] evaluated 290 consecutive patients after thyroidectomy for thyroid malignancy. Patients with preoperative RLNP were excluded. Permanent RLNP developed in 9% of the patients. Transient/permanent RLNP rates for total or subtotal thyroidectomy, completion thyroidectomy and neck dissection groups were 5/3%, 7/3% and 24/17%, respectively. The author considered the type of surgery, extrathyroidal soft tissue invasion and the number of metastatic nodes to be risk factors for RLNP. In our set, there were higher rates of permanent RLNP for patients with Graves' diseases (0.9%), thyroid cancer (1.6%) and Hashimoto's disease (1.9%) than for multinodular goitre (0.4%), but these differences were not statistically significant.

A few studies compare the complication rates of thyroid surgery performed by residents (or newly-established surgeons) with operations performed by specialist surgeons [4,7,13]. Emre [13] found similar

complication rates for total thyroidectomy performed by residents and specialist surgeons. Also Erbil [7] compared the rate of RLNP in 3,250 patients after thyroid surgery. The author concluded that complications were not more common in operations performed by trainees than by experienced surgeons. However, the above mentioned authors evaluated average percentage of RLNP in both groups. In our set, we have found some differences in occurrence of temporary and permanent RLNP among the surgeons, but there was no relationship between the experience of surgeon (number of procedures performed) and RLNP rates.

One possibility for improving the rate of RLNP in thyroid surgery is to use intraoperative neuromonitoring [9-11]. Barczynsky compared the results of visualisation versus neuromonitoring of the recurrent laryngeal nerves during thyroidectomy. The monitoring of the nerve decreased the incidence of transient but not permanent RLNP compared with visualization alone.

## 5. Conclusion

Total thyroidectomy is a safe procedure associated with a low incidence of RLNP not only for benign multinodular goitre, but also for Graves' disease, thyroid cancer and Hashimoto's disease (there is no significant difference of RLNP rates among the diseases). The rates of RLNP among individual surgeons are acceptable with small inter-individual differences.

## References

- [1] Altorjay Á., Tihanyi Z., Luka F., Juhász A., Bencsik Z, Rüll M. et al., Place and value of the Recurrent Laryngeal Nerve (RLN) palpatory method in preventing RLN palsy during thyroid surgery, *Head and Neck* 2009, 31, 538-647
- [2] Efremidou E.I., Papageorgiou M.S., Liratzopoulos N. Manolas K.J., The efficacy and safety of total thyroidectomy in the management of benign thyroid disease: A review of 932 cases, *Can. J. Surgery*, 2009, 52, 39-44
- [3] Jeannon J.P., Orabi A.A., Bruch G.A., Abdalsalam H.A., Simo R., Diagnosis of recurrent laryngeal nerve palsy after thyroidectomy: A systematic review, *Int. J. Clin. Pract.* 2009, 63, 634-629
- [4] Sywak M.S., Yeh M.W., Sidhu S.B., Barraclough B.H., Delbridge L.W., New surgical consultants: Is there a learning curve?, *Aust. NZ. J. Surgery*, 2006, 76, 1081-1084
- [5] Chiang F.Y., Wang L.F., Huang Y.F., Lee K.W., Kuo W.R., Recurrent laryngeal nerve palsy after thyroidectomy with routine identification of the recurrent laryngeal nerve, *Surgery*, 2005, 137, 342-347
- [6] Chiang F.Y., Lin J.C., Wu C.W., Lee K.W., Lu S.P., Kuo W.R. et al., Morbidity after total thyroidectomy for benign thyroid disease: Comparison of Graves' disease and non-Graves' disease, *Kaohsiung J. Med. Sci.*, 2006, 22, 554-559
- [7] Erbil Y., Barbaros U., Issever H., Borucu I., Salmasliolu A., Mete O., et al., Predictive factors for recurrent laryngeal nerve palsy and hypoparathyroidism after thyroid surgery, *Clin. Otolaryngol.*, 2007, 32, 32-37
- [8] Sevim T., Risk factors for permanent laryngeal nerve paralysis in patients with thyroid carcinoma, *Clin. Otolaryngol.*, 2007, 32, 378-383.
- [9] Atallah I., Dupret A., Carpentier A.S., Weingertner A.S., Volkmar P.P., Rodier J.F., Role of intraoperative neuromonitoring of the recurrent laryngeal nerve in high-risk thyroid surgery, *J. Laryngol. Head Neck Surg.*, 2009, 38, 613-618

- [10] Chiang F.Y., Lu I.C., Kuo W.R., Lee K.W., Chang N.C., Wu C.W., The mechanism of recurrent laryngeal nerve injury during thyroid surgery – the application of intraoperative neuromonitoring, *Surgery*, 2008, 143, 743-749
- [11] Barczynsky M., Konturek A., Cichon S., Randomized clinical trial of visualization versus neuromonitoring of recurrent laryngeal nerves during thyroidectomy, *Br. J. Surg.*, 2009, 96, 240-246
- [12] Aytac B., Karamercan A., Recurrent laryngeal nerve injury and preservation in thyroidectomy, *Saudi Med. J.*, 2005, 26, 1746-1749
- [13] Emre A.U., Cakmak G.K., Tascilar O., Ucan B.H., Irkorucu O., Karakaya K. et al., Complications of total thyroidectomy performed by surgical residents versus specialist surgeons, *Surg. Today*, 2008, 38, 879-885