

The Efficacy of Intraoperative Corticosteroids in Recurrent Laryngeal Nerve Palsy after Thyroid Surgery

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Abstract

Background: Recurrent laryngeal nerve palsy (RLNP) is one of the most common complications after thyroidectomy. We aim to evaluate the role of intraoperative corticosteroids in preventing or treating postoperative RLNP.

Materials and Methods: We conducted a prospective study of 295 patients who underwent either total lobectomy or total thyroidectomy with or without using intraoperative corticosteroids. All cases were operated on by the same surgeon. Measurement of the RLNP rate was based on the number of nerves at risk. Data were analyzed for differences in postoperative temporary or permanent RLNP rate and recovery days.

Result: The rate of temporary/permanent RLNP was 5.7% (11 out of 194)/0.52% (1 out of 194) and 6.9% (12 out of 173)/0.58% (1 out of 173) according to groups with and without corticosteroids. This difference did not reach statistical significance. Among those 23 patients who recovered from RLNP, the mean time to recovery was significantly shorter for patients receiving intraoperative steroids (28.6 vs. 40.5 days, $P = 0.045$).

Conclusion: A single dose of intraoperative corticosteroids did not produce any benefit in terms of reducing the postoperative temporary/permanent RLNP rate, but it did shorten the recovery time for patients suffering from temporary RLNP.

One of the most common serious and unpleasant complications of thyroid surgery is iatrogenic recurrent laryngeal nerve palsy (RLNP). The resulting hoarseness is not only a terrible complication for patients who rely on their voice professionally, but it also leads to dyspnea and life-threatening glottal obstruction when bilateral recurrent laryngeal nerves (RLNs) have

been jeopardized. Therefore, strategies that prevent RLNP are of great interest. One way is to ensure the integrity of the nerves with routine identification of RLN, which is proposed by most surgeons today. However, RLNP may result from direct mechanical damage without disruption. This disparity between anatomic neural integrity and actual RLN function probably results from trauma to the intact nerve. Nerve manipulation during thyroid surgery may cause neural edema and consequent dysfunction, resulting in anything from neurapraxia to axonotmesis.

There are both experimental and clinical data supporting the notion that the administration of steroids may prevent or reduce neural edema.¹⁻³ Patients with idiopathic facial palsy have shown improved facial nerve function after an empiric course of corticosteroids.^{4,5} To date, only Lore *et al.*⁶ in their book have mentioned the benefit of intraoperative steroids in thyroid surgery. In order to elucidate the role of intraoperative corticosteroids in ameliorating postoperative nerve paresis by reducing the neural edema accompanying the inevitable nerve manipulation during nerve identification, as well as to promote recovery of nerve function when paresis occurs, we conducted a prospective, case-controlled study of patients undergoing either total thyroidectomy or total lobectomy, with routine identification of RLN, with or without a single, intraoperative dose of corticosteroids to verify the therapeutic value of this strategy and its associated complications.

MATERIALS AND METHODS

Patients

We designed a prospective, case-controlled clinical trial to evaluate the efficacy of systemic corticosteroids with regard to RLNP following total thyroidectomy or lobectomy running from January 1997 to August 2004. All patients enrolled were operated on by the same surgeon (Dr. Chiang). Routine identification of RLN was performed during all operative procedures. The surgical procedure for identification of RLN was similar to that described in 1986 by Harness *et al.*⁷ RLN was not identified early in the operative procedure. When dissection proceeded to the area of Berry's ligament, RLN was identified where it coursed through the ligament or close to it. Where a large thyroid mass or substernal goiter was encountered RLN was identified and traced from the recurrent nerve triangle, as advocated by Lore.⁸

In the first half of this period (experimental group), all patients received a single intravenous dose of 100 mg hydrocortisone (Solucortef, Pharmacia-Upjohn). The steroids were given just before we began to identify RLN. In the second half of this period (control group), no steroids were administered. All patients received preoperative and postoperative flexible laryngoscopic examinations of the vocal cords. When vocal cord palsy was identified, follow-up was weekly initially and then every 3-4 weeks thereafter until recovery was achieved, with the dysfunction considered permanent if it still per-

sisted after 6 months. Patients were excluded from the study if they had preoperative RLNP or nerves encased by cancer, in which intentional sacrifice was necessary.

Data Analysis

In this study, the rate of RLNP was calculated based on the number of nerves at risk. In order to investigate the effect of intraoperative steroid on RLNP in patients with different underlying diseases, we further divided our patients into four groups:

1. Primary benign thyroid disease
2. Thyroid cancer
3. Graves' disease
4. Reoperation

Patients undergoing a first operation for a nodular goiter, adenoma or thyroiditis were included in the primary benign thyroid disease category. Individuals diagnosed with thyroid carcinoma from histopathology, or those who underwent completion thyroidectomy for cancer were grouped with the thyroid cancer cases. Patients who had thyrotoxicosis, a diffuse goiter or ophthalmopathy clinically were included in the Graves' disease category, with 6 of these associated with thyroid cancer. Patients who had previously undergone thyroid surgery were included in the reoperation group. Of these, 1 was recurrent Graves' disease, 3 thyroid cancer, and 5 were recurrent goiter. To test the effects of intraoperative steroids on RLN outcome and complications, inter-group differences were assessed using the appropriate Chi-squared or Fisher exact tests for categorical data. Mann-Whitney *U* tests were used to verify the differences in recovery days between patients with or without the use of intraoperative steroids. *P* values of 0.05 or less were considered significant.

RESULTS

The details of this study are shown in Table 1. There were 143 (194 nerves at risk) and 152 (173 nerves at risk) patients in the experimental and control groups respectively. The integrity of all RLNs (367 nerves at risk) was ensured at the end of surgery. The overall risk of temporary/permanent RLNP was 6.3% (23 out of 367)/0.54% (2 out of 367). The risk of temporary/permanent RLNP in patients with or without the use of intraoperative steroids was 5.7% (11 out of 194)/0.52% (1 out of 194) and 6.9% (12 out of 173)/0.58% (1 out of 173) respectively. It

Table 1.
Demographic data of patients as a function of steroid use

	(+) Steroid (n = 143)	(-) Steroid (n = 152)	P value
Age, years (range)	47.8 (16–82)	47.4 (12–80)	
Sex			
Male	43	33	
Female	100	119	
Nerves at risk	194	173	
Total lobectomy	86	123	
Total thyroidectomy	54	25	
Vocal palsy			
Temporary	11	12	0.49
Permanent	1	1	0.72
Recovery days	28.6 (10–36)	37.4 (14–61)	0.045*

*Mann–Whitney *U*-test $P < 0.05$ indicates statistical significance.

seemed that the rate of postoperative RLNP increased without the use of intraoperative steroids, although the difference did not reach statistical significance (temporary/permanent RLNP, $P = 0.49/0.53$). Among the 23 patients who had temporary RLNP, the recovery times ranged from 10 to 36 days and 14 to 61 days for patients with or without intraoperative steroids respectively. The mean recovery time for temporary RLNP was 28.6/40.5 days for patients with/without intraoperative steroids and the difference was statistically significant ($P = 0.045$). Table 2 showed the effect of intraoperative steroids on RLNP in patients with different underlying diseases. No statistical significance was found among the groups when they used or did not use intraoperative steroids. None of these patients reported complications associated with the use of intraoperative steroids.

DISCUSSION

Identification of RLN has been advocated as a standard procedure in thyroid surgery.^{9–11} Although RLN can be safely dissected and preserved by a skillful surgeon, postoperative nerve paralysis, usually temporary, will still occur in as many as 3%–4% of patients who have benign thyroid disease undergoing thyroid surgery.^{9,10,12} The incidence may be triple or more for patients having a thyroid operation for Graves' disease^{13–15} or thyroid cancer.^{16,17} Empirically, some surgeons use steroids during thyroid operations in an attempt to reduce postoperative neural edema resulting from inevitable nerve manipulation during identification of RLN, as well as to promote recovery of nerve function when nerve paralysis occurs. However, there have only been few published data concerning the efficacy of intraoperative steroids in

the management or prevention of nerve dysfunction resulting from operation.

Buchman *et al.*¹⁸ used a single dose of intraoperative corticosteroids in patients receiving surgery for acoustic neuroma, showing no apparent benefit from intraoperative steroid use in terms of preventing or treating postoperative facial nerve palsy. Lee *et al.*¹⁹ used perioperative corticosteroids in an attempt to ameliorate facial nerve palsy after parotidectomy, showing no benefit in the controlled trial. On the contrary, Lore *et al.*⁶ said that the rate of temporary RLNP can be reduced from 9 to 2.6% with the use of preoperative or/and intraoperative steroids. In addition, the use of steroids reduces the longest duration of temporary vocal cord paralysis from 9 to 2 months. Given the above observations, we conducted a prospective study to evaluate the role of intraoperative corticosteroids in the prevention or management of RLNP resulting from thyroid surgery.

We routinely identify RLN in every case when performing thyroidectomy. There will be RLN dysfunction after thyroid surgery relating to axonal discontinuity, functional impairment of the intact nerve, or a combination of these factors resulting from nerve manipulation. In this study, the integrity of all RLNs was ensured after operation. However, there were still 2 patients (1 control subject and 1 subject from the experimental group) who had permanent RLNP in our study. This study showed that a single dose of intraoperative steroids was not effective in preventing RLNP during thyroid operation. Although the rate of RLNP did not decrease to a statistically significant amount, the number of days to recovery for patients using intraoperative steroids was significantly lower (28.6 vs. 40.5 days, $P = 0.045$). The reason may have been that steroids decrease the chance of traumatic edema or vasospasm, which might have led to neurapraxia.

Table 2. Incidence of recurrent laryngeal nerve palsy (RLNP) according to the underlying disease

	Recurrent laryngeal nerve palsy					
	(+) Steroid			(-) Steroid		
	Number of nerves (patients) at risk	Temporary	Permanent	Number of nerves (patients) at risk	Temporary	Permanent
Benign thyroid disease	119 (98)	3	1	125 (112)	10	0
Thyroid cancer	54 (33)	6	0	42 (34)	2	1
Graves' disease	24 (12)	2	0	6 (3)	0	0
Reoperation	3 (3)	0	0	6 (6)	0	0
Total	194 (143)	11	1	173 (152)	12	1

Six patients with Graves' disease were associated with thyroid cancers (3 patients in each group).

Hydrocortisone sodium succinate was chosen as the experimental drug in this study because it is a potent glucocorticoid agonist with rapid metabolism. No complications occurred as a result of the use of steroids, including brief behavior changes, such as euphoria or psychosis, electrolyte imbalance, increased susceptibility to infection, and hypersensitivity response.

The controversy surrounding this study may contribute to the lack of randomization. In the first half of the study period, all participants in the experimental group received a single intravenous dose of 100 mg of hydrocortisone (Solucortef) during operation. The steroids were given just before we began to identify RLN. In the second half of the study period, no steroids were administered to the control group. Some may conclude that surgical experience may obscure the use of steroids. However, we considered that this factor could be neglected if all the procedures were performed by the same experienced thyroid surgeon, who had performed thyroid surgery for more than 20 years.

CONCLUSION

Although we were unable to demonstrate any benefit in terms of reducing the rate of RLNP, we demonstrated that the duration of temporary RLNP can be reduced with the use of a single dose of intraoperative steroids in a prospective study. We think that this is important, not only to the patients, but also to the physicians caring for them. In the absence of increased morbidity from the single dose of steroids, it may be efficacious to consider using the steroids, particularly in patients where difficult dissection around the nerves is anticipated, such as those with locally advanced cancers, Graves' disease, and patients undergoing reoperation.¹² We expect that increasing our sample size or extending the steroid dosing scheme will result in a treatment advantage for patients who receive steroids while undergoing thyroidectomy.

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