

Surgical Technique for the Functional Preservation of the Inferior Parathyroid Glands

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Background and Objectives: The inferior parathyroid glands receive their blood supply from the inferior thyroid artery. The anatomic relationship of this artery and the recurrent laryngeal nerve can assume three different patterns. To maintain the vascular supply of the inferior parathyroid glands during central neck dissection, we considered the anatomic relationship of these structures in our surgical approach. **Materials and Methods:** Fibrofatty tissue in the central neck compartment was removed by dissection proceeding along the recurrent laryngeal nerve. During the dissection, care was taken not to injure the vascular supply of the inferior parathyroid gland. **Results:** For an inferior parathyroid gland that receives its blood supply from the posterolateral vascular pedicle, preservation is achieved by performing the dissection along the recurrence laryngeal nerve on the gland's medial side. In patients in whom the inferior thyroid artery travels deep to the right recurrent laryngeal nerve, such that the right parathyroid gland receives its blood supply from the posteromedial vascular pedicle, central neck dissection should be performed carefully along the lateral side of the gland to preserve the pedicle. **Conclusion:** Preservation of inferior parathyroid gland function requires a detailed understanding of the anatomic relationship between the inferior thyroid artery and recurrent laryngeal nerve. The direction of the dissection along the nerve should be adjusted according to its anatomic relationship to the inferior thyroid artery.

Key Words: Parathyroid gland, Hypoparathyroidism, Neck dissection

Introduction

The clinical significance of prophylactic central neck dissection (CND) in the treatment of thyroid papillary carcinoma remains a subject of debate. According to its supporters, prophylactic CND has several advantages, including reduction in the likelihood of disease recurrence and improved pathologic staging.¹⁻³⁾ Moreover, since patients undergoing re-operation for the removal of recurrent disease are at higher risk of complications such as recurrent laryngeal nerve (RLN) injury and hypoparathyroidism, prophylactic CND can

facilitate the surgical procedure, with fewer resulting complications. However, opponents of prophylactic CND argue that there is no definitive evidence of its positive effect on reducing recurrence or improving survival. They also claim that prophylactic CND itself can increase the risk of postoperative complications, especially hypoparathyroidism.⁴⁾

The reported incidence of temporary and permanent hypoparathyroidism after total thyroidectomy is 1-50% and 2.5%, respectively.⁵⁻¹⁰⁾ To prevent either of these complications, accidentally removed parathyroid glands should be re-implanted. However, the most important consideration is the preservation of the blood

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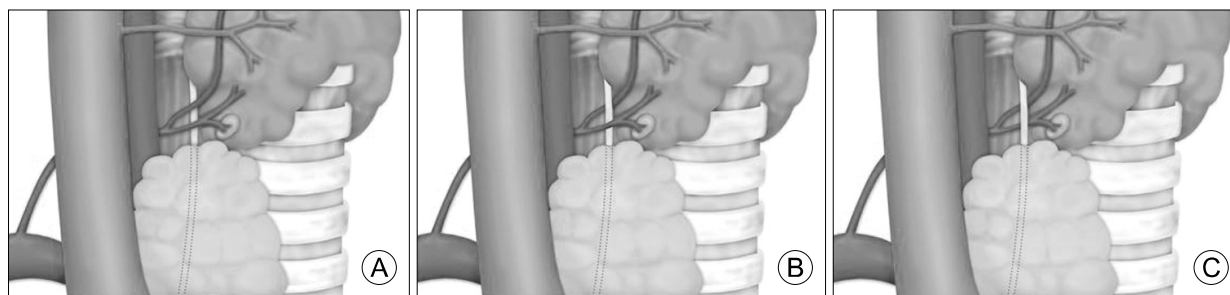


Fig. 1. (A–C) The inferior parathyroid glands receive their blood supply from the inferior thyroid artery. The anatomical relationship of the inferior thyroid artery and the recurrent laryngeal nerve can assume three different patterns.

supply of the parathyroid glands, which is essential to maintain their function. Bliss et al.¹¹⁾ emphasized the need to preserve the posterolateral vascular pedicle of the inferior parathyroid gland to maintain its blood supply. Lee et al.⁵⁾ reported that preservation of the inferior thyroidal vein can reduce the development of post-thyroidectomy hypocalcemia and promote faster recovery following thyroidectomy.

In this study, preservation of the vascular pedicle of the inferior parathyroid gland was achieved by focusing on the anatomic relationship between the inferior thyroid artery and recurrent laryngeal nerve on the left and right sides of the body. The inferior parathyroid glands receive their blood supply from the respective inferior thyroid arteries. The anatomic relationship between the inferior thyroid artery and RLN can assume three different patterns (Fig. 1). To maintain the vascular supply of the inferior parathyroid gland during CND, we reconsidered the anatomic relationship of these structures in our surgical approach.

Materials and Methods

Total thyroidectomy with bilateral CND was performed in patients with papillary thyroid carcinoma. To reduce the occurrence of post-thyroidectomy hypocalcemia, the parathyroid glands should be identified and preserved during surgery. Therefore, in this study, we sought to preserve vascular pedicle of the inferior parathyroid glands based on anatomic relationships among the RLN, inferior thyroid artery, and inferior parathyroid glands on the left and right sides of the body.

Results

Surgical technique. The right RLN ascends obliquely along the tracheoesophageal groove and is usually positioned superficially compared with the left RLN. Therefore, in most people, the right RLN also lies more superficially to the inferior thyroid artery (Fig. 1C). However, because the left RLN travels deeply, in most people, the left inferior thyroid artery will lie superficially to the left RLN, in contrast to the relationship of these structures on the right side (Fig. 1A).

The superior boundary of the central neck compartment is the hyoid bone, the lateral boundary is the carotid artery, and the inferior boundary is the line extending horizontally toward the left side from the right innominate artery. To remove the fibrofatty tissue in the central neck compartment, the dissection should initially proceed along the RLN, with the surgeon being careful to avoid injury of the nerve or the inferior parathyroid gland.

On the left side, to preserve the function of the inferior parathyroid gland, dissection should proceed along the RLN on the medial side of the inferior parathyroid gland, because in most cases, glands on the left side receive their blood supply from the posterolateral vascular pedicle (Fig. 2).

On the right side, as the right inferior thyroid artery typically travels deep to the right RLN, after total thyroidectomy, the vascular pedicle of the right inferior parathyroid gland will be located on the medial side of the RLN. Accordingly, if a right-sided CND is carried out along the medial side of the inferior para-

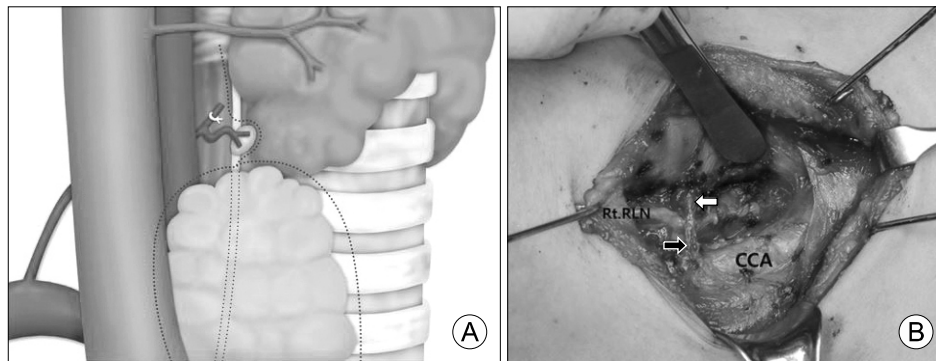


Fig. 2. A schematic drawing (A) and photograph (B) of a central neck dissection (CND) on the left side. To preserve the function of the inferior parathyroid gland, if the gland receives its blood supply from the posterolateral vascular pedicle, the dissection should proceed along the RLN on the medial side of the inferior parathyroid gland (dotted line: extent of CND, CCA: common carotid artery, RLN: recurrent laryngeal nerve, black arrow: inferior thyroid artery, white arrow: parathyroid gland).

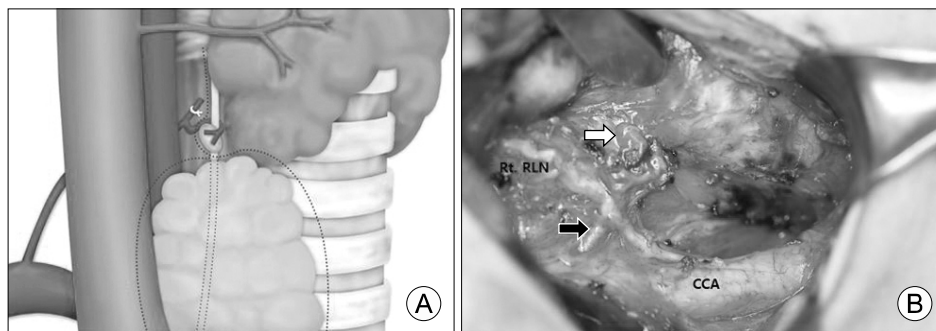


Fig. 3. A schematic drawing (A) and photograph (B) of a CND on the right side. If the inferior thyroid artery travels deep to the right RLN and the right parathyroid gland receives its blood supply from the posteromedial vascular pedicle, the CND should be performed carefully along the lateral side of the gland to preserve the posteromedial vascular pedicle (dotted line: extent of the CND, CCA: common carotid artery, RLN: recurrent laryngeal nerve, black arrow: inferior thyroid artery, white arrow: parathyroid gland).

thyroid gland, as recommended for the left side, the vascular pedicle located on the medial side of RLN could be cut. Instead, in patients with the typical anatomy, in which the right inferior thyroid artery travels deep to the right RLN and the right parathyroid gland receives its blood supply from the posteromedial vascular pedicle, CND should be carefully performed along the lateral side of the gland and proceed along the right RLN. This allows the identification and preservation of the posteromedial vascular pedicle (Fig. 3).

Discussion

One of the most common reasons why surgeons object to prophylactic CND is the risk that patients will develop postoperative hypoparathyroidism. According

to literature reports, the incidence of transient and permanent hypoparathyroidism after thyroidectomy is 1–50% and 2.5%, respectively. 5–10 Patients with transient hypoparathyroidism should take calcium and vitamin D supplements during the recovery period; most will eventually recover parathyroid function. However, the small proportion of thyroidectomy patients with permanent symptoms of hypoparathyroidism may experience a deterioration in the quality of life. To prevent postoperative hypoparathyroidism, the parathyroid glands should be implanted into the sternocleidomastoid muscle or other sites to avoid the risk of their accidental removal. However, because re-implantation does not always guarantee functional recovery, it is crucial to avoid the accidental removal of the inferior parathyroid glands during thyroidectomy.

Cocchiara et al.¹²⁾ stated that distal ligation (not understood) of the inferior thyroidal artery is essential to prevent transient hypoparathyroidism. To preserve the blood supply of the inferior parathyroid gland originating from the inferior thyroid artery, the anatomic relationship between the RLN and the inferior thyroid artery must be maintained. However, because CND proceeds along the RLN, the vascular pedicle crossing the nerve can be disrupted easily, especially since the course of the terminal branch of the inferior thyroid artery with respect to the RLN differs on the left and right sides of the body.

Preservation of the arterial blood supply of the inferior parathyroid gland, which is almost entirely from the inferior thyroid artery, requires a detailed understanding of the anatomic relationship between these structures and their relationships to the RLN, especially when a CND proceeds along the nerve. On the right side, the inferior thyroid artery typically courses under the RLN and then turns back into the gland. Accordingly, a dissection should be performed along the lateral side of the inferior parathyroid gland to preserve the posteromedial vascular pedicle. On the left side, as the inferior thyroid artery usually travels over the RLN, dissection should proceed along the medial side of the gland, easily allowing preservation of the posterolateral vascular pedicle.

Nonetheless, the degree to which preservation of the blood supply of the inferior parathyroid gland can prevent its functional deterioration and that of the parathyroid gland overall has not been determined. However, adequate preservation of the blood supply of one parathyroid gland may be sufficient to reduce the incidence of postoperative hypoparathyroidism.

A final consideration is that the anatomic relationship between the inferior thyroid artery and RLN cannot always be established clearly. In such cases, if the vessels are found to cross the RLN horizontally during the operation, they should be preserved to maintain the postoperative function of the inferior parathyroid gland.

In conclusion, to preserve the function of the inferior parathyroid gland during CND, the anatomic relationship between the inferior thyroid artery and RLN must be respected. The direction of dissection along the

RLN should take into account the anatomic relationship of these two structures.

Conflict of Interest

All authors have no conflicts of interest to declare.

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