



Removal of thyroid remnant for cancer in the previously operated central neck



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 RLN;
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Reoperative central neck dissection requires a concise set of steps to complete a comprehensive dissection of recurrent lymphadenopathy seen in thyroid cancer. The main considerations take into account the recurrent laryngeal nerve and the parathyroid glands. This chapter specifies those steps from a preoperative evaluation to the pearls during dissection to ensure a complete reoperative dissection that removes all residual thyroid tissue and lymphadenopathy while ensuring the best outcomes.

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Introduction

Remnant thyroid tissue in the form of residual cancer left behind after an initial thyroidectomy can be a potential target in reoperative central neck dissection. The incidence of remnant thyroid tissue cancer persistence/recurrence (P/R) as compared to central neck P/R in the form of lymphadenopathy has not been well defined. In benign disease, the rates of P/R retrospectively evaluated have ranged from 8.4%-33% when comparing total vs subtotal thyroidectomy.^{1,2} In patients with papillary thyroid carcinoma, P/R rates over a lifetime can range from 20%-30%.² The rate of recurrence in medullary thyroid carcinoma is 5.4%-50%.^{3,4} For thyroid malignancies, recurrences localized to the cervical LN in 60%-70% cases with the central compartment being the most frequently involved site.⁵ Local or thyroid parenchymal recurrence is most often at Berry ligament where the surgeon may leave apparently normal thyroid tissue at risk for malignant transformation or frank cancer to preserve the recurrent laryngeal nerve (RLN).⁶

Kim et al reported common recurrence after incomplete resection of the thyroid gland with local recurrence in remnant thyroid tissue/bed.⁷ This P/R may harbor tumor or represent normal thyroid tissue.

Reoperative central neck dissection with a focused effort on removal of remaining thyroid remnant confers a high risk for RLN injury or resection.⁶ This morbidity alone can lead to vocal cord paralysis which confers dysphonia and possible dysphagia. Tumor persistence in this area can also lead to airway invasion and esophageal invasion, given the proximity of remnant thyroid tissue to the aerodigestive tract. Involvement of tumor at or near the cricothyroid insertion point of the RLN can also lead to vocal fold paralysis.

This article is designed to address the indications for removal of (P/R). It will outline the indications and considerations for reoperative surgery for local recurrence as well as guided surgical technique for this portion of a reoperative surgery. Our goal is to highlight this crucial component in reoperative central neck dissection and highlight the importance of complete gross resection especially when cancer is present.

Reoperation for persistence/recurrence (P/R)

The reoperative field for central neck dissection is anatomically identical in terms of boundaries. The central

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neck as defined by the American Thyroid Association (ATA) is bordered superiorly by the hyoid bone, inferiorly by the sternal notch, and laterally by the common carotid arteries on either side⁸ (Figure 1). The central neck can be divided up into the right and left central neck with the tracheal skeleton midline. Reoperative surgery in the central neck is largely focused on removing lymphadenopathy that is contained within this compartment with a focused effort on removing high-volume disease to prevent continued persistence or demonstrated growth that threatens vital structures.⁵ The indications for reoperative surgery in the central compartment are: clinically detectable lymph node metastasis > 8 mm, concern for aerodigestive invasion, and high-volume residual disease.⁹

According to the ATA guidelines if there is nodal recurrence in the central neck greater than 8 mm with fine-needle aspiration proof or if there is a suspicious nodule increasing in size, coinciding with uptrend in thyroglobulin levels, consideration can be made for reoperative surgery.⁹ Steward et al discussed the role of therapeutic secondary nodal surgery as being either curative or palliative but the utility should not be measured by disease free status but rather the prevention of complications of disease progression and resultant morbidity or mortality that may be significant, especially in regard to airway.¹⁰ This same approach can be applied to P/R at Berry ligament. Lin et al discussed the importance of controlling progressive disease early as it has a worse outcome than stable disease or late recurrence.¹¹ Location of remnant tissue specifically if in close proximity to or with possible invasion of trachea, esophagus, or cricoid, should be removed. The prelaryngeal

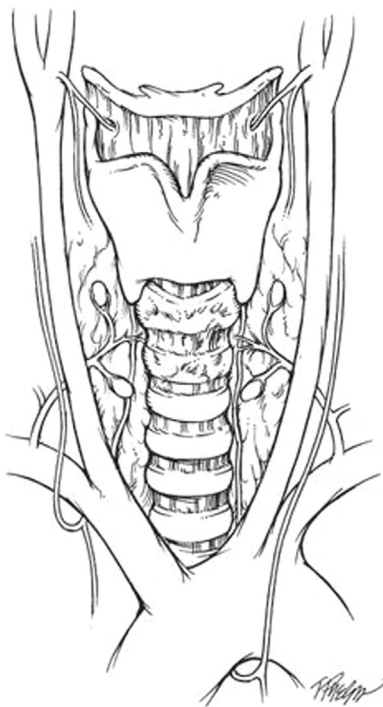


Figure 1 Boundaries of the (reoperative) central neck for dissection. (Adapted with permission from Tufano and Pai.⁵ © 2008 S. Karger AG, Basel)

(Delphian) lymph node is included in this. Remnant thyroid tissue should be considered separate than lymphatic tissue if there is evidence of disease at the cricothyroid joint. An essential part of the preoperative evaluation is a surgeon-performed ultrasound. Visualization of P/R is feasible and differentiated from nodal tissue because remnant thyroid parenchyma will appear heterogeneous as compared to a cystic or irregular lymph node. Computed tomography (CT) with contrast is also very helpful to discern nodal disease from thyroid remnant. Being able to differentiate this preoperatively allows for surgical planning if this is the only tissue involved or associated with other lymphadenopathy that needs to be addressed. This allows for appropriate patient counseling in regard to location of the remnant tissue, in relationship to the trachea, esophagus, or cricoid, as well as its proximity to the RLN.

Anatomical considerations

Surgical technique for P/R takes into consideration the integrity of the RLN and vocal cord mobility as well as superior parathyroid gland tissue if present. The RLN in the reoperative setting can be displaced from the normal position secondary to scar or encasement of the nerve itself in scar or remnant thyroid tissue. The range of permanent RLN injury is 1%-12%⁶ in reoperative central neck dissection but with rates much higher for P/R in thyroid remnant compared to nodal disease. Intraoperative nerve monitoring (IONM) is essential in testing the integrity of the RLN throughout the dissection as well as assisting in identification of the nerve's course. IONM has been strongly suggested as an important adjunct in the reoperative scenario.¹² The second consideration of the superior parathyroid glands is important because these are anatomically located cephalad to the inferior thyroid artery, typically near the cricothyroid joint.¹³ Dissection around the insertion point of the RLN may compromise the integrity of parathyroid tissue encased in scar or the inferior thyroid artery which often serves as the main vascular supply to the tissue.⁶ Therefore, consideration must be made to preserve the inferior thyroid artery and its superior terminal branches when possible.

Preoperative considerations

In the preoperative workup of a patient for reoperative central neck surgery, the most important tool for an endocrine surgeon is the in-office ultrasound. Preoperative surgeon-performed ultrasonography is crucial in differentiating remnant thyroid tissue from lymph node tissue in the central neck. The appearance of lymph node tissue as compared to remnant thyroid as well as the location of P/R is imperative to surgical planning. This also allows the surgeon to localize the P/R and its proximity to the trachea, esophagus, and its approximation to the cricoid cartilage. It can allow the surgeon to determine if the remnant tissue is

near the cricothyroid junction, which is the insertion point of the RLN. Preoperative counseling is therefore enhanced when the surgeon performs the ultrasound for planning purposes. Any disease that is considered P/R should undergo a fine-needle aspiration for tissue diagnosis when possible. As guidelines according to the ATA and AHNS indicate, all patients should undergo flexible laryngoscopy before reoperative surgery to determine the integrity of motion of bilateral true vocal cords.^{9,14} Strongly advocated in the literature for reoperative surgery when the RLN is in the dissection field, IONM is helpful in not only guiding identification of the nerve, but in preserving the neurophysiological integrity of the nerve during dissection.¹² A preoperative parathyroid hormone (PTH) and serum calcium should also be ordered to determine the baseline parathyroid functional status. And finally, along with a formal ultrasound of the neck to determine extent of recurrence, at our institution we order a CT scan with IV contrast in all patients to help further delineate P/R vs nodal disease, delineate volume of disease in the neck, the presence of aerodigestive invasion, and if any retropharyngeal/parapharyngeal or mediastinal nodal disease is present before surgery.⁹

Surgical technique

Our surgical technique for reoperative P/R involves gaining exposure to the central neck, dissecting the RLN in its entirety from where it enters the central neck at the innominate, subclavian, and common carotid artery junction to Berry ligament systematically, and protecting and preserving the superior parathyroid tissue if possible. Tufano et al⁶ previously described appropriate exposure of the reoperative central neck compartment. Technical considerations for reoperative central neck dissection include wide exposure by transecting the sternothyroid and if disease necessitates sternohyoid muscles, and identifying any fibrofatty tissue posterior to the strap musculature that could be considered pretracheal lymphatic tissue⁶ (Figure 2). Transection of the sternothyroid muscles is necessary to identify the lateral boundaries of the carotid artery and the superior and inferior boundaries of the cricoid and sternal notch. If the strap musculature is viable without excessive scarring, reapproximation of the muscles at the end of the case is feasible with 2-0 silk sutures.⁶

Reoperative resection of local P/R coincides with our systematic identification and dissection of the RLN. For all thyroid and parathyroid cases that are reoperative, we use IONM. IONM is important not only for its utility in stimulation of the nerve, but in the ability to follow amplitude progression of the vagus and recurrent nerve throughout the case, to prognosticate the integrity of neurophysiological function. The goal is to get rid of the residual tissue while preserving the integrity of the RLN (Figures 3 and 4). The morbidity associated with vocal cord palsy is significant and should not be underestimated. Given that P/R is usually at Berry ligament, it is important to carefully manage the nerve at the insertion point (crico-



Figure 2 Transection of strap muscles for reoperative central neck dissection. (Adapted with permission from Tufano and Pai.⁵ © 2008 S. Karger AG, Basel)

tracheal joint). We prescribe the following algorithm for nerve dissection beginning with a few principles:

- (A) Prevent the use of cautery when dissecting near or around the presumed location of the nerve. Any bleeding during nerve dissection should be tempered with a Kittner or gauze pad.
- (B) Reoperative surgery should include the use of IONM, with an established and functional circuit at the beginning of the case by The International Neural Monitoring Study Group criteria. It is important to stimulate and assess amplitude intermittently throughout the case. One may also consider continuous vagal nerve monitoring.
- (C) Use fine tip blunt dissection over the course of the RLN, such as with a mosquito clamp, with as little tension and traction as possible.
- (D) It is important to dissect directly over the nerve, and separate scar tissue from the nerve to follow it safely. We typically find it at the junction of the carotid, innominate,

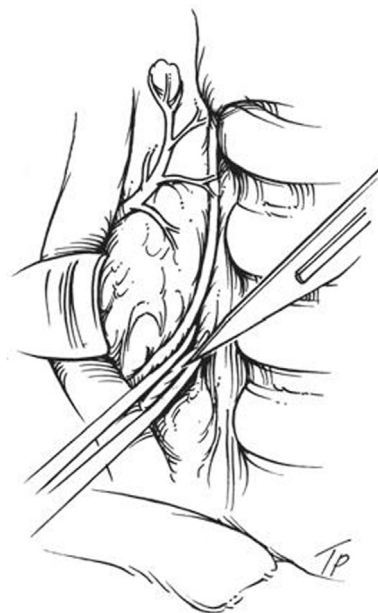


Figure 3 Dissection of the central neck lymph node along the right recurrent laryngeal nerve. (Adapted with permission from Tufano and Pai.⁵ © 2008 S. Karger AG, Basel)

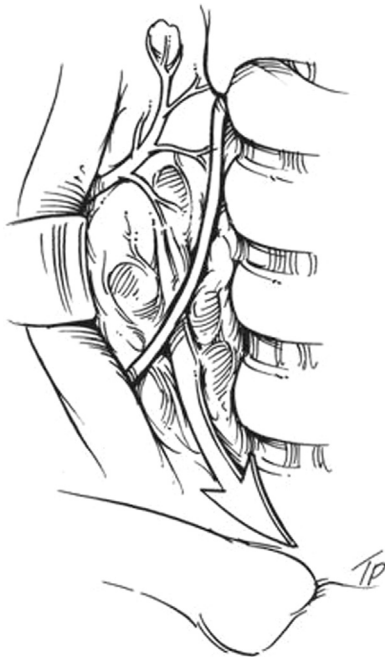


Figure 4 Transposition of lymph nodes deep to right recurrent laryngeal nerve (common area for recurrence). (Adapted with permission from Tufano and Pai.⁵ © 2008 S. Karger AG, Basel)

and subclavian arteries or down low in the central neck where previous surgical dissection was unlikely to be performed (Figure 4). We begin by dissecting superiorly over the nerve to follow the RLN to the region of the P/R. As we proceed distally we note that the nerve is more difficult to dissect from surrounding tissue and ultimately the remnant as it often courses over it.

- (E) If there is scar or P/R that appears to be encasing a working nerve, it is important to switch to fine tip dissection with little traction over the nerve. If it appears that the epineurium is involved, it is possible to shave up to 50% of the nerve without transecting it with the remnant tissue as a margin.^{15,16} Anecdotally we can confirm that having up to 50% of the nerve can still allow for integrity and stimulation with recovery of vocal cord mobility.¹⁵ If there is evidence of tumor involving more than the epineurium and the integrity of the neural bundle is effaced by tumor then the nerve must be sacrificed.
- (F) If there is branching of the RLN usually toward the insertion point, then it is important to use IONM to identify the motor branches. The anterior branch, typically the predominant motor branch, which should be preserved. If scar or tumor is involving the posterior branch then this usually can be sacrificed without compromise of vocal fold motion. It is important to use IONM at the lowest threshold stimulus (0.5 mA) to determine integrity of the both branches. If P/R is invasive and appears to involve the cricoid or trachea then it is important to consider cartilage resection. It is sometimes possible to complete a shave resection of the cartilage rather than a segmental resection based upon involvement.

(G) Consideration for a larger resection should be determined with a laryngoscopy, bronchoscopy, or esophagoscopy before surgery. If there is greater than 180° of cricoid involvement (especially posteriorly) or there is concern for immobility of bilateral vocal cords, the patient should be counseled on the possibility of a total laryngectomy.

- (i) The need for a larger resection can also be ascertained at the time of preoperative CT imaging, and an in-office laryngoscopy and bronchoscopy. These details should be discussed with the patient beforehand.

A second aspect to consider is the protection of superior parathyroid glands during reoperative resection. According to Tufano et al the rates of hypoparathyroidism after reoperative central neck dissection can be 0.3%-15% temporarily and 0%-3.5% permanently secondary to parathyroid gland residence within scar tissue or fibrosis within the thyroid bed.⁶ Therefore, it is important to have a systematic approach to the parathyroid tissue, namely the superior parathyroid glands, during remnant resection. Important steps in the preservation of the superior parathyroid tissue include preservation of the vascular supply to those glands, which may be displaced by scar, fibrosis at the cricoid region. It is important to preserve the inferior thyroid artery that is the cephalad extent of dissection in reoperative central neck dissection for nodal disease only as this is the main trunk to the parathyroid tissue.⁶ The superior parathyroid glands are most commonly located in the posterolateral aspect of the superior pole of the thyroid gland at the cricothyroidal cartilage junction. They are most commonly found 1 cm above the intersection of the inferior thyroid artery and the RLN and lie just dorsal to the nerve¹³ (Figure 5). This anatomical relationship may be distorted by scar and displaced so it is important to use blunt fine tip dissection

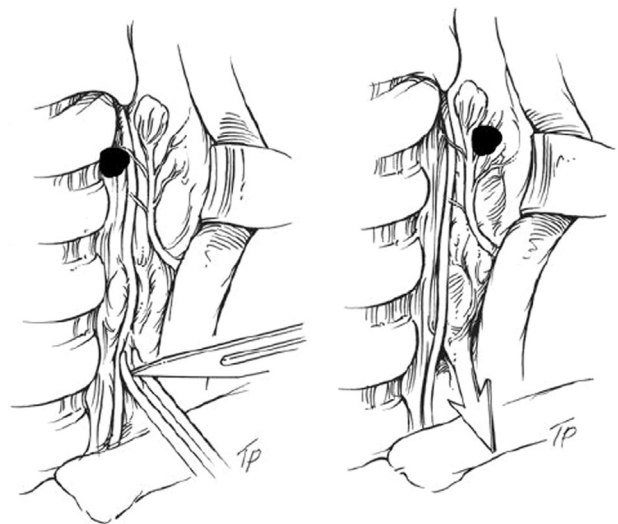


Figure 5 Possible location of superior parathyroid glands in relationship to left recurrent laryngeal nerve in reoperative central neck dissection. (Adapted with permission from Tufano and Pai.⁵ © 2008 S. Karger AG, Basel)

when identifying the superior parathyroid tissue. Furthermore, there is higher risk for devascularization⁶ so if the parathyroid tissue itself is visualized and its integrity is questionable, then it is important to plan for reimplantation at the end of the case. We reimplant in the unilateral sternocleidomastoid muscle by creating a muscle pocket with blunt dissection and Bovie cautery, placing the minced parathyroid tissue in full into the pocket, and use clips for identification of the tissue if needed in the future. The variability in location of the inferior parathyroid glands makes it difficult to assume integrity of these glands during reoperative surgery, so it is important to check a preoperative PTH and postoperative PTH if there is manipulation of the superior parathyroid glands during reoperative P/R resection.

Conclusion

Reoperative surgery for P/R is different than a compartmentalized resection for central neck lymphadenopathy in thyroid cancer. It is a focused approach to removal of residual disease along the midline structures including the trachea, cricoid, and esophagus in close proximity to the RLN and superior parathyroid tissue. Our surgical technique to this part of reoperative surgery outlines the steps involved in managing the nerve and parathyroid tissue with fine detail during resection. We offer a detailed approach to reoperative surgery to decrease morbidity and improve oncologic outcome.

Disclosure

The authors report no proprietary or commercial interest in any product mentioned or concept discussed in this article.

References

1. Cirocchi R, Trastulli S, Randolph J: Total or near-total thyroidectomy versus subtotal thyroidectomy for multinodular goiters in adults. *Cochrane Database Syst Rev* 8(7):D010370, 2015
2. D'Andrea V, Cantisani V, Catania A: Thyroid tissue remnants after "total thyroidectomy". *G Chir* 30(8-9):339-344, 2009
3. Machens A, Hofmann C, Hauptmann S, et al: Locoregional recurrence and death from medullary thyroid carcinoma in a contemporaneous series: 5-year results. *Eur J Endocrinol* 157(1):85-93, 2007
4. de Groot JWB, Plukker JTM, Wolffenbuttel BHR, et al: Determinants of life expectancy in medullary thyroid cancer: Age does not matter. *Clin Endocrinol* 65(1):729-736, 2009
5. Tufano RP, Pai SI: Reoperation for recurrent/persistent well-differentiated thyroid cancer. *Otolaryngol Clin North Am* 43(2):353-363, 2010
6. Tufano RP, Bishop J, Wu G: Reoperative central compartment dissection for patients with recurrent/persistent thyroid cancer: Efficacy, safety and association of the BRAF mutation. *Laryngoscope* 122(7):1634-1640, 2012
7. Kim JW, Roh JL, Gong G: Treatment outcomes and risk factors for recurrence after definitive surgery for well-differentiated papillary thyroid carcinoma. *Thyroid* 26(2):262-270, 2016
8. S.E. Carty, Cooper DS, Doherty GM: Consensus statement on the terminology and classification of central neck dissection for thyroid cancer. *Thyroid* 19(11):1153-1158, 2009
9. Haugen BR, Alexander EK, Bible KC, et al: 2015 American Thyroid Association Management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer: The American Thyroid Association Guidelines Task Force on thyroid nodules and differentiated thyroid cancer. *Thyroid* 26(1):1-133, 2016
10. Steward DL, et al: Update in utility of secondary node dissection for papillary thyroid cancer. *J Clin Endocrinol Metab* 97(10):3393-3398, 2012
11. Lin JD, Hsueh C, Chao TC: Early recurrence of papillary and follicular thyroid carcinoma predicts a worse outcome. *Thyroid* 19(10):1053-1059, 2009
12. Randolph GW, Dralle H, Abdullah H: Electrophysiologic recurrent laryngeal nerve monitoring during thyroid and parathyroid surgery: International standards guideline statement. *Laryngoscope* 121(1 Suppl):S1-S16, 2011
13. Randolph GW: *Surgery of the Thyroid and Parathyroid Glands*. Philadelphia, PA: Elsevier; 2017
14. Sinclair CF, Bumpous JM, Haugen BR: Laryngeal examination in thyroid and parathyroid surgery: An American Head and Neck Society consensus statement: AHNS consensus statement. *Head Neck* 38(6):811-819, 2016
15. Kihara M, Miyauchi A, Yabuta T: Outcome of vocal cord function after partial layer resection of the recurrent laryngeal nerve in patients with invasive papillary thyroid cancer. *Surgery* 155(1):184-189, 2014
16. Lee HS, Kim SW, Park T: Papillary thyroid carcinoma with exclusive involvement of a functioning recurrent laryngeal nerve may be treated with shaving technique. *World J Surg* 39(4):969-974, 2015