Lymph Node Dissection in Papillary Thyroid Carcinoma

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The management of papillary thyroid carcinoma continues to evolve. Although the debate over the extent of thyroidectomy has largely faded, the role of elective neck dissection in the surgical management of papillary thyroid cancer has become a topic of contention. The current standard of care for patients with papillary thyroid cancer includes total thyroidectomy and a therapeutic lymph node dissection for patients presenting with clinically evident nodal disease. However, many surgeons advocate prophylactic central neck lymph node dissections in patients who present with no clinical or radiographic evidence of lymph node involvement. Proponents of prophylactic central compartment neck dissection argue that the incidence of central neck metastases is high and the sensitivity of preoperative ultrasound is low. Furthermore, central neck dissection advocates argue that clearing the central neck at the initial operation improves staging accuracy, assists in deciding on postoperative radioactive iodine treatment, and potentially avoids a higher-risk reoperative central neck dissection. Selective lateral neck dissections, as well as modified radical neck dissections, are accepted as necessary therapy in patients with clinically or radiographically positive lateral compartment disease. An essential component of any discussion on the extent of lymphadenectomy is whether patients derive any additional benefit from having a lymphadenectomy with total thyroidectomy and whether this can be done without significantly increasing the morbidity of the operation. Here we discuss the surgical options for approaching lymphadenectomy in patients presenting with papillary thyroid carcinoma.

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Papillary thyroid cancer accounts for approximately 90% of thyroid malignancies and continues to have an excellent prognosis, despite increasing in incidence during the past decade. However, lymph node metastases are common and have been reported in up to 90% of patients with papillary thyroid carcinoma. Many patients will present with subclinical nodal disease that is not detectable by ultrasonography or physical examination, and the sensitivity of preoperative ultrasound for central neck lymph node metastases is reported as low as 10%. In the past, it was believed that there was no prognostic significance to lymph node involvement. However, more recent evidence demonstrates that the presence of lymph node metastases is associated with an increased risk of locoregional recurrence, and in older patients may be associated with a greater risk of death from thyroid cancer. As such, the necessity for and extent of lymph node dissection have emerged as a controversial topic.

It is widely accepted that current surgical therapy for papillary thyroid carcinoma should include total thyroidectomy and therapeutic central neck dissection (CND) in those patients who present with clinically evident positive lymph nodes (Fig. 1). In these cases the level VI lymph nodes are removed. The dissection is carried out from the hyoid bone superiorly to the suprasternal notch inferiorly and is bordered laterally by the carotid sheaths and dorsally by the prevertebral fascia. This generally encompasses the area of initial spread of metastases through draining lymphatic channels of the thyroid. There have been reports of skip metastases—that is direct metastases to the lateral neck—however, this is probably rare and usually associated with carcinomas arising in the superior poles. Prophylactic dissections of the central neck—that is routine CND in patients without clinically evident signs of nodal disease by physical examination or preoperative imaging—is more controversial because CND is not without morbidity. Within this compartment lies the parathyroid glands and the recurrent laryngeal nerves, and the added dissection potentially increases the possibility of hypoparathyroidism or recurrent nerve injury when performing a total thyroidectomy with CND vs. thyroidectomy alone.
The surgical management of papillary thyroid carcinoma now focuses on the prevention of locoregional recurrence as well as on long-term survival. Proponents of prophylactic central compartment dissection argue that in addition to potentially avoiding the morbidity of a reoperation, prophylactic dissections provide more accurate staging which facilitates decisions regarding postoperative radioactive iodine treatment, as well as long term follow-up with thyroglobulin levels. Recent American Thyroid Association guidelines advocate the consideration of prophylactic central neck lymph node dissection in patients with papillary thyroid carcinoma and more so in patients with T3 or T4 primary lesions.11

**Therapeutic Central Neck Lymph Node Dissection**

In patients who present with clinically evident disease, the standard of care is to perform a therapeutic neck dissection, which entails the systematic removal of the lymph nodes in the central compartment (level VI). It is thought that this reduces rates of lymph node recurrence as it has been shown that a large number of nodal recurrences occur in the central neck.12,13 It is widely accepted that a “berry-picking” approach to clinically positive lymph nodes is not an acceptable approach and results in high rates of locoregional recurrence.14,15 Davidson et al.15 in a review of one institution’s experience, examined 183 patients treated for papillary thyroid carcinoma with thyroidectomy and various methods of lymphadenectomy. In this study population there was a recurrence rate of 33%, and the authors found that the greatest rates of recurrence were among those patients who had had a berry-picking approach to cervical lymphadenectomy. In addition, we now know that routine CND can be performed safely with low rates of permanent hypoparathyroidism as well as recurrent laryngeal nerve injury.12,16 Although the authors of previous studies quoted high rates of hypoparathyroidism as well as recurrent laryngeal nerve injury, more recent data has demonstrated that central neck lymph node dissections can be done with minimal morbidity. Grant et al examined a series of 420 patients with papillary thyroid carcinoma who underwent thyroidectomy with CND and reported a 1.2% incidence of hypoparathyroidism and only 1 case of recurrent laryngeal nerve injury.10,12

**Prophylactic Central Neck Lymph Node Dissection**

Although there are no prospective randomized controlled studies demonstrating the efficacy of prophylactic central neck lymph node dissection, in many centers it is performed routinely. The rationale is that it reduces the morbidity associated with a potential reoperation, reduces the risk of central neck lymph node recurrence, provides more accurate information for staging, and facilitates postoperative radioactive iodine administration as well as long term follow-up. At the heart of the controversy is the fact that central neck lymph node metastases are common in papillary thyroid cancer. In tumors that are >1 cm, central neck lymph node metastases are found in 40 to almost 90% of cases. Even in papillary microcarcinoma the rate of lymph node metastases has been reported in 25%-45% of cases.17,18 Bonnet et al19 recently examined the importance of the status of the central neck lymph nodes to postoperative management, even in small PTC. Bonnet retrospectively reviewed 115 patients with papillary thyroid carcinoma and a tumor size <2 cm without ultrasonographic evidence of lymph node metastases preoperatively who underwent prophylactic CND. Information provided by knowing the pathologic stage of the central neck lymph nodes changed the staging for 30% of patients initially staged as T1N0, and ultimately modified the indication for radioactive iodine ablation in these patients.

Opponents of prophylactic CND argue that the presence of positive lymph nodes does not affect prognosis and survival in papillary thyroid carcinoma.20-22 For example, Shaha et al21 performed a retrospective review of 810 patients looking at prognostic factors, and found that while female sex, young age, extracapsular extension and low grade histology were favorable prognosticators, the presence of positive lymph nodes had no effect on prognosis. Although the authors of many older studies demonstrated that survival was not affected by the presence of metastatic lymph nodes, nodal disease has been associated with a significantly increased recurrence in more recent studies. Hughes et al23 performed a matched-pair analysis of 100 patients with previously untreated papillary thyroid carcinoma with and without lymph node involvement. In this study he looked at the significance
of nodal disease in patients with otherwise equivalent prognostic factors and found that while there was no difference in survival, patients with nodal involvement did have a higher rate of recurrence, and in patients over 45 years this difference was statistically significant. Additional studies also support the findings of Hughes, et al that lymph node metastasis increases the rate of locoregional recurrence. Nevertheless, recent evidence from examination of a large database indicates that lymph node metastasis can be associated with a negative impact on survival. Lundgren, et al performed a nested-case control study and looked at 5123 patients diagnosed with differentiated thyroid cancer. The authors report that patients with lymph node metastases had a significantly higher mortality than those without.

There is also emerging evidence that prophylactic CND may lead to reduced central neck recurrence. Grant et al reviewed 420 patients who had undergone an “optimized” surgical approach to papillary thyroid carcinoma. These patients all had preoperative ultrasounds to specifically assess for central and lateral compartment lymph node involvement and then underwent bilateral thyroidectomy, routine central neck lymph node dissection and selective lateral neck dissection (compartment III, IV, and V) in those patients with positive lymph nodes detected by ultrasonography or palpation preoperatively. The authors reported a locoregional recurrence rate of only 5% in the previously operated field. Similarly, data from our own institution corroborates these findings. We performed a retrospective review of 81 patients presenting with papillary thyroid cancer without clinical evidence of nodal disease. Thirty-seven of these patients underwent thyroidectomy alone whereas 45 underwent thyroidectomy with prophylactic lymph node dissection. Our results demonstrated a 4.4% locoregional recurrence rate in patients who had a prophylactic CND compared with 16.7% recurrence rate for patients undergoing thyroidectomy alone. These data, however, have yet to be supported by prospective trials.

Operative morbidity is a major concern in proposing more widespread adoption of routine prophylactic neck dissection. Though in experienced hands CND has low rates of both permanent hypoparathyroidism and permanent recurrent laryngeal nerve injury, there are clearly higher rates of temporary hypoparathyroidism and recurrent laryngeal nerve injury. In our experience with patients undergoing total thyroidectomy with prophylactic CND vs. total thyroidectomy alone, there was a significantly higher rate of temporary hypoparathyroidism in those patients who had CND, 31% versus 5% (P = 0.001; Fig. 2). Because most thyroid surgery in the United States is performed by surgeons who do fewer than 10 thyroidectomies per year, there is considerable concern that in the hands of less-experienced surgeons, the incidence of permanent hypoparathyroidism or injury to the recurrent laryngeal nerves would increase substantially. Nevertheless, proponents of prophylactic CND point to the greater risks of hypoparathyroidism and recurrent laryngeal nerve injury in reoperative central neck surgery as a justification for attempting to clear central neck disease at the initial operation.

In an effort to minimize the potential morbidity of a CND, there have been studies looking into the efficacy of a CND carried out only on the side of the tumor. Data from our institution and others demonstrate that tumors <1 cm rarely metastasize to the contralateral central neck lymph nodes. We performed a prospective study of central neck lymph dissection in 116 patients. In patients with tumors <1 cm compared with those with tumors >1 cm, there was 0% versus 31% (P = 0.02) incidence of bilateral lymph node metastasis. In the subset of patients with tumors <1 cm, an ipsilateral CND may be a viable alternative and should provide the additional information gained from staging the central neck lymph nodes, while at the same time reducing the additional risk of CND.

**Selective Lateral Neck and Modified Radical Neck Dissection**

A selective lateral neck dissection includes the lymph nodes of levels III, IV, and V. However, this dissection usually does not extend posterior to the sternocleidomastoid muscle and to the border of the trapezius. It is generally agreed that this should be performed in the presence of clinically apparent disease and in conjunction with a central compartment dissection (Fig. 3). Patients who present with clinically positive lateral lymph nodes by examination or ultrasound are also likely to have central compartment disease. Pereira, et al found that patients with positive lateral neck lymph nodes had at least 6 positive central neck nodes at lymphadenectomy. There appears to be no role for prophylactic lateral neck dissections as the lateral compartment is not usually entered during thyroidectomy and can be operated on without greater morbidity if necessary in the future. Vergez et al retrospectively looked at 90 patients who had undergone prophylactic central and lateral neck dissection at the time of thyroidectomy to determine pattern of lymph node involvement. They found that 62/90 patients who had lateral neck dissection had no lymph node involvement, and all patients with positive lateral neck lymph nodes also had positive cen-
of disease in compartment III.  

When there is extensive nodal disease in compartment III, it is not necessary to perform a modified radical neck dissection.  

Carcinoma of the thyroid.  

Although there is current data of disease resection and can provide important information regarding tumor staging, thus facilitating postoperative management and long-term follow up.  

Selective lateral neck dissection and modified radical neck dissections should be performed when there is clinical evidence of nodal disease in the lateral neck compartments.

Modified radical neck dissection usually includes a dissection of lymph nodes in compartments II through V. In contrast to a radical neck dissection, the sternocleidomastoid muscle, spinal accessory nerve and internal jugular vein are preserved. Even so, the morbidity of this operation is high, with rates of shoulder dysfunction secondary to spinal accessory nerve injury reported in up to 30%.  

Although some centers advocate full modified radical neck dissection when there is any evidence for involvement of the lateral neck lymph nodes, there is evidence to suggest that metastases to compartment II are rare in the absence of clinical disease at level II.  

Caron et al reviewed 104 pt who underwent modified radical neck dissection, including compartments I, II, and V, and found no statistically significant difference in recurrence at level II when the compartment had been dissected vs. when it had not been dissected. They concluded, on the basis of this relatively small sample size, that this compartment should only be dissected when there is clinically evident disease, when there are signs of aggressive disease or when there is extensive nodal disease in compartment III.  

Future controversy is likely to revolve around the use of lateral compartment neck dissections in patients with subclinical lymph node metastases in the lateral neck. This population of patients is likely to increase in size as preoperative lateral neck ultrasonography becomes more widely employed in the initial evaluation of patients with papillary thyroid cancer.

Conclusions  

Decisions regarding lymphadenectomy in papillary thyroid carcinoma remain controversial. This is especially the case in patients presenting with no clinical evidence for lymph node metastases by physical examination or preoperative ultrasound. Therapeutic CNDs are performed routinely with minimal morbidity in the hands of experienced surgeons. Although there is a current paucity of data demonstrating a clear decrease in recurrence for prophylactic CND, it should be considered in all patients presenting for treatment of papillary thyroid carcinoma. Perhaps an ipsilateral CND may be sufficient in patients with papillary microcarcinomas. The addition of central neck dissection to thyroidectomy is beneficial for achieving completeness of disease resection and can provide important information regarding tumor staging, thus facilitating postoperative management and long-term follow up. Selective lateral neck dissection and modified radical neck dissections should be performed when there is clinical evidence of nodal disease in the lateral neck compartments.

References  