Lymph Node Surgery in Papillary Thyroid Carcinoma

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Papillary thyroid carcinoma is the most common type of thyroid cancer, and cervical lymph node metastasis of the disease is high. Lymph node surgery of the papillary thyroid carcinoma is controversial because of the good prognosis of the disease. Although controversy continues on prophylactic lymph node dissection, therapeutic lymph node dissection is recommended in all guidelines for patients who have known lymph node metastases.

Key words: Papillary thyroid carcinoma – Lymph node – Surgery

Papillary thyroid carcinoma is the most common type of thyroid cancer. It represents 75% of all thyroid malignancies and more than 90% of differentiated thyroid cancers. An increase in the incidence of papillary thyroid carcinoma during past decades has increased interest in the disease. Management of the papillary thyroid carcinoma is controversial because of the lack of prospective randomized studies and the excellent prognosis of the disease. The cause-specific 10-year survival rate for papillary thyroid carcinoma is 95%. Despite slow tumor growth and a good prognosis, the major challenge involves controlling locoregional recurrence. This is why lymph node surgery is considered important in the treatment of papillary thyroid carcinoma.

The incidence of cervical lymph node metastasis is high in papillary thyroid carcinoma. Clinically detectable lymph node metastasis occurs in around 15% to 30% of cases. Occult lymph node metastasis is reported as high as 90%. Lymph node metastasis in clinically node-negative patients is 50%, and lymph node metastasis in papillary thyroid microcarcinoma, which is defined as papillary thyroid carcinoma 10 mm or less in diameter, occurs at 15% to 50%.

Effects of Lymph Node Metastases on Recurrence and Survival

Patients who have lymph node metastases at presentation have a higher incidence of recurrent disease in the cervical region. The presence of metastatic nodes at the time of initial examination is associated with a 10-fold increase in the risk of developing a nodal recurrence.
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Rene is seen in 20% of patients with low-risk papillary thyroid carcinoma and in 60% of those with high-risk disease. Extrathyroidal extension of the tumor, male gender, and older age are among the factors that contribute to recurrence of the disease in the presence of nodal metastases. Residual metastatic lymph nodes that remain after initial therapy are the most common cause of subsequent recurrence.

It remains controversial whether the presence of lymph node metastases, either overt or occult, has an impact on prognosis. Traditionally, it has been suggested that the presence of regional metastases has no effect on survival. However, studies have reported that lymph node metastases decrease survival, and this is even prominent among elderly patients.

Pattern of Lymph Node Metastases

The thyroid gland is located in the central neck, and lymphatic drainage follows venous drainage of the gland, so the estimated lymphatic drainage of thyroid carcinoma is central cervical compartment metastasis followed by lateral cervical compartment metastasis. However, the metastatic pathways may be unpredictable, and skip metastasis may occur.

For papillary thyroid carcinoma, central nodal metastasis was found to be 76%, lateral nodal metastasis was found to be 65%, and skip metastasis was found to occur at 7%. Contralateral metastasis rates were reportedly 13% and 3% for central and lateral compartments, and contralateral involvement was found to be increased with an increase in primary tumor size. For papillary thyroid microcarcinoma, central and lateral nodal metastases were found in 64% and 45%, respectively, with a 5% skip metastasis rate. Contralateral central lymph node metastasis is 5% to 19%. Bilateral lymph node metastasis may be seen in 30% of patients.

For central lymph node metastasis, pretracheal lymph node metastasis is more frequent than paratracheal lymph node metastasis, and for lateral lymph node metastasis, mid–lower level nodes are more frequent than upper level ones. Tumor position within the thyroid gland may affect the position of the metastatic spread. Tumors in the isthmus, middle, and lower parts of the gland metastasize most often to the central nodes, and tumors in other parts of the gland metastasize most often to the ipsilateral lateral nodes.

Retropharyngeal nodes represent a rare site of nodal metastasis in thyroid cancer. Few cases are reported in the literature. In most cases, retropharyngeal metastasis is associated with other cervical metastases, likely representing alteration of the normal pattern of lymph flow secondary to these other metastases.

Predictive Factors for Lymph Node Metastases

Age, sex, tumor size, and histopathologic properties of the tumor are among the most studied parameters predicting lymph node involvement of the papillary thyroid carcinoma. Although age younger than 20 years and older than 45 years, male gender, and increasing tumor size are proposed to predict lymph node metastasis, absence of the tumor capsule and perithyroidal extension are believed to be more important. For papillary thyroid microcarcinoma, no clinicopathologic parameter is found to be predictive of lymph node metastasis.

Surgical Anatomy of Cervical Lymph Node Compartments

The most widely used cervical lymph node classification system is based on recommendations by the American Joint Committee on Cancer and the American Academy of Otolaryngology and Head and Neck Surgery:

Level I: Submental and submandibular lymph nodes.
Level II: Lymph nodes that are located above the level of the hyoid bone to the base of the skull. This level is the upper jugular region.
Level IIA: Lymph nodes that are located medial to the spinal accessory nerve.
Level IIB: Lymph nodes that are located lateral to the spinal accessory nerve.
Level III: Lymph nodes that are located between the levels of the hyoid bone and the cricoid cartilage. This level is the middle jugular region.
Level IV: Lymph nodes that are located between the levels of the hyoid bone and the clavicle. This is the lower jugular region.
Level V: Lymph nodes that are located in the posterior triangle. This level also includes the supraclavicular lymph nodes.
Level VI: Lymph nodes that are located in the central area, posterior and inferior to the thyroid gland and adjacent to the
trachea and esophagus. This compartment includes the pretracheal nodes, paratracheal nodes, precricoid node (Delphian), perithyroidal nodes, and lymph nodes along the recurrent laryngeal nerve.

Level VII: These are the superior mediastinal lymph nodes.

Central Compartment: Includes level VI lymph nodes.

Lateral Compartment: Includes level II to level IV lymph nodes.

Types of Cervical Lymph Node Dissection

Radical Neck Dissection: Includes the removal of all lymph nodes in the neck. During the procedure, the sternocleidomastoid muscle, the internal jugular vein, and the spinal accessory nerve are removed. This procedure was first described in 1906; later it was modified because of the unwanted cosmetic results and shoulder dysfunction caused by sacrifice of the spinal accessory nerve.

Modified Radical Neck Dissection: Is also called functional neck dissection. In this procedure, the sternocleidomastoid muscle, internal jugular vein, carotid artery, vagus, phrenic and spinal accessory nerves, and submandibular salivary glands are preserved to decrease the morbidity of the radical neck dissection.

Type I: Preservation of the spinal accessory nerve.

Type II: Preservation of the spinal accessory nerve and internal jugular vein.

Type III: Preservation of the spinal accessory nerve, internal jugular vein, and sternocleidomastoid muscle.

Selective Neck Dissection: Preserves some lymph node groups. The procedure has 2 subgroups for the treatment of papillary thyroid carcinoma.

Central Compartment Lymph Node Dissection: In this procedure, the lymph nodes and the soft tissues in level VI are removed. During the procedure, the recurrent laryngeal nerve is preserved.

Lateral Compartment Lymph Node Dissection: In this procedure, the lymph nodes and the soft tissues from the lateral wall of the carotid sheath to the trapezius muscle and from the subclavian vein inferiorly to the hypoglossal nerve superiorly are excised. During the procedure, levels IIA, III, IV, and V are removed. In patients with obvious metastatic disease at level VI, levels VI and VII can also be removed.

Berry Picking: In this procedure, only suspicious and enlarged lymph nodes are removed. This procedure has lost its popularity.

Newer surgical approaches

Sentinel Lymph Node Biopsy: The sentinel lymph node is defined as the first lymph node draining a tumor. Sentinel lymph node biopsy, which is used frequently for breast cancer and melanoma, has been tried for papillary thyroid cancer. Methylene blue, isosulfan blue, patent blue, or radiocolloid may be used to perform the procedure. When positive, sentinel lymph node biopsy can guide compartment-oriented cervical lymph node dissection.

Video-Assisted Cervical Lymph Node Dissection: This technique has been proposed for better cosmetic outcome. However, experience with this procedure is very limited, and the oncologic outcome is controversial. New data are needed for long-term results of this procedure.

Surgical Strategy

Prophylactic lymph node dissection

Prophylactic lymph node dissection is dissection of the cervical lymph nodes with no evidence of lymph node metastasis. The role of prophylactic lymph node dissection in the management of papillary thyroid carcinoma is highly controversial because the effect of lymphatic metastasis on survival is controversial, and potential surgical complications are not few.

Prophylactic lymph node dissection may not be preferred because the nodal recurrence rate may not be different between the lymph node dissection and no-dissection groups. On the other hand, prophylactic central cervical lymph node dissection is advised by the European Thyroid Association, the British Thyroid Association, and the American Thyroid Association. One potential benefit of routine central cervical lymph node dissection may be the accurate staging of the tumor, which may guide subsequent treatment and follow-up. The procedure may decrease the recurrence of papillary thyroid carcinoma, improve disease-specific survival, and significantly reduce levels of serum thyroglobulin, increasing the rate of athyreoglobulinemia. However, it should be remembered that the rate of permanent hypothyroidism and unintentional permanent nerve injury is higher when cervical lymph node dissection is performed with total thyroidectomy than with total thyroidectomy alone.
In the process of surgical decision making, possible benefits should always be weighed against potential morbidity. Because survival is favorable for papillary thyroid carcinoma, local recurrence is considered an important parameter for long-term follow-up. The impact of central compartment recurrence differs from that of the lateral compartment. Reoperation for recurrence in the lateral compartment can be performed more easily than that for recurrence in the central compartment, where more critical structures are located. Reoperation in the central neck compartment for recurrent papillary thyroid carcinoma may increase the risk of hypoparathyroidism and unintentional nerve injury when compared with total thyroidectomy with or without cervical lymph node dissection. Therefore, because metastases in the central compartment are very common, and given that surgery for recurrence in the central compartment may be a complicated procedure, prophylactic central cervical lymph node dissection during the initial thyroid surgery may be a logical surgical option.

Prophylactic lymph node dissection may be indicated for papillary thyroid microcarcinoma when the disease is multifocal, has extrathyroidal extension, and is greater than 5 mm. Sentinel lymph node biopsy may also be used for these patients.

Prophylactic lateral neck dissection is not recommended for patients with papillary thyroid carcinoma.

Therapeutic lymph node dissection

Therapeutic lymph node dissection is dissection of the cervical lymph nodes when cervical lymph node metastasis is suspected or shown intraoperatively or preoperatively by clinical or radiologic examination. Performance of a therapeutic cervical lymph node dissection is based on the fact that regional disease control is necessary to prevent morbidity from local tumor growth, to maintain quality of life, and to maximize disease-free and possibly overall survival. This concept is well accepted in the treatment of papillary thyroid carcinoma. Compartment-oriented lymph node dissections are recommended in all guidelines for patients with known lymph node metastases.

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