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Review

The role of sentinel lymph node biopsy in patients with differentiated thyroid carcinoma

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Abstract

Aim: To evaluate the ''state of art'' of clinical role of sentinel lymph node (SLN) biopsy procedure in patients affected by differentiated thyroid carcinoma.
Methods: All papers cited on PubMed/MEDLINE until June 2005, published in English, and referred to the key words ''sentinel lymph node biopsy'' AND ''thyroid carcinoma'' OR ''thyroid cancer'' were reviewed for the purpose of the present study.
Results: The first method used for SLN biopsy in thyroid carcinoma patients was the vital blue dye technique. This technique had some disadvantages as: (a) risk of disruption of the lymphatic channels deriving from the thyroid cancer; (b) difficulty in disclosing SLN lying outside the central compartment; (c) parathyroid glands can take up blue dye and, thus, can be misinterpreted as lymph nodes. Some of the above cited disadvantages were overcome by using the lymphoscintigraphy and intraoperative gamma probe technique. A combination of the blue dye and gamma probe technique has also been proposed with synergic results.
Conclusion: The reported advantages of the SLN biopsy in small differentiated thyroid carcinoma patients can be resumed as follows: (a) better selection of patients who would benefit from compartment oriented nodal dissection; (b) more accurate lymph node staging; (c) better selection of patients who can require ^{131}I treatment after surgery (SLN positive for metastasis); (d) better identification of SLN located out of the central compartment.

Keywords: Thyroid carcinoma; Sentinel lymph node biopsy; Clinical role; Patient's management

Introduction

The standard therapeutic approach to differentiated thyroid carcinoma (DTC) includes total or near-total thyroidectomy combined with loco-regional lymphoadenectomy, Iodine-131 (^{131}I) treatment, and life-long TSH-suppressive thyroid hormone replacement. The development of new surgical techniques (keyhole surgery and intraoperative gamma

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probe), advanced cross-sectional imaging and refined histopathological and immunohistochemical analysis requires equal development in preoperative and intraoperative diagnostic procedures that can localize actively involved lymph nodes and residual disease in the thyroid bed for optimal surgical resection. One of the recent developments in this respect is the detection of sentinel lymph nodes (SLN).

In this review, we examine the various experiences reported in the literature on SLN biopsy technique in DTC and assess its possible role in clinical practice.

The concept of sentinel lymph node

The concept of SLN is based on the fact that the first lymph node in a lymphatic chain (the sentinel node) will be the first affected by metastasis, and if it can be shown to be negative, it is highly unlikely that other nodes are affected.[1–3]

The SLN technique is nowadays largely used to aid surgery for melanoma and breast cancer but its use is increasing in other types of solid tumours[1,3–7] including DTC.[8–10]

One of the complicating aspect in neck surgery, and specifically the thyroid, is that the lymphatic drainage pathways are quite intricate. The lymph vessels usually accompany blood vessels and nerves[11] in directions that are not always predictable. Those draining the thyroid intraglandular capillaries drain into lymph vessels associated with the capsule and may cross-communicate with the isthmus and the opposite lobe.

Usually, the *superior lymph vessels* drain the isthmus and the medial superior portion of the thyroid lobes, ascending in front of the larynx and terminating in the subdigastric lymph nodes of the internal jugular chain. The *median inferior lymph vessels* descend with the inferior vein to the pretracheal nodes. The *lateral collecting vessels* drain superiorly to the anterior and superior nodes of the jugular chain and inferiorly to the lateral and inferior nodes of the internal jugular vein.

Numerous classifications have been proposed to describe the location and the anatomic boundaries of lymph node groups in the neck, the most commonly used is that of the American Joint Committee on Cancer (AJCC) and the American Academy of Otolaryngology–Head and Neck Surgery (AAO–HNS).[12,13]

Characteristics of lymph node metastases in differentiated thyroid cancer (DTC)

The majority of patients with papillary DTC have lymph node metastases at the time of initial diagnosis and less frequently during successive follow-up. The highest incidence of nodal metastasis of up to 80% is found in children, who have excellent prognosis demonstrating that the age at initial diagnosis is one of the most important prognostic factors.[14–16]

Incidence of metastasis is less in adults (15–50%), but microscopic metastases have been found in up to 80% of adult patients with DTC.[14] The central compartment (level VI) is involved in approximately 90% of cases.[17]

The lateral lymph node involvement varies between 51 and 100% in different series,[17–19] with the caudal compartments involved more frequently than the cranial compartments.[20]

Supra-clavicular lymph nodes are the third site involved in terms of frequency, with a reported rate ranging from 10 to 52%.[17,19]

Contralateral lymph node involvement is not rare with an incidence of up to 18.4% for papillary DTC.[17,18] Mediastinal lymph node involvement, mostly the antero-superior mediastinal nodes, is less frequent at 1.9–15%.[17–19]

The distribution of loco-regional lymph node involvement is poorly related to the site of the primary thyroid tumour.[17] Even when the tumour is located in the upper third of the thyroid lobes, the subdigastric lymph nodes are often involved,[17] whereas tumours arising in the isthmus may cause bilateral cervical metastases[18] with major risk of nodal recurrence on the contralateral neck side.[21] The size of the primary tumour seems to play some role: lymph node metastases with carcinomas < 10 mm are usually found in the paratracheal area and rarely in the jugular nodes.[18]

Prognostic significance of lymph node metastases in differentiated thyroid cancer (DTC)

Loco-regional lymph node metastases of DTC carry a worse prognosis and extensive resection can improve the outcome of these patients.[22–24] However, nodal involvement has little influence on long-term survival of patients with papillary DTC[14] but the presence of extracapsular invasion of lymph node metastases has been reported to be an indicator of distant metastases and poor prognosis.[25]

Surgical techniques for neck dissection in differentiated thyroid cancer (DTC)

Currently, the extent of lymph node dissection is based predominantly on histological type, stage of the primary tumour, and the preoperative knowledge of nodal involvement.

In the presence of gross lymph node involvement, there is no debate about the need and prognostic benefit of a neck dissection in addition to total thyroidectomy.[26] On the other hand, the management of clinically N0 lymph nodes is generally much more conservative. In the absence of evidence in favour of routine prophylactic neck dissection, some surgeons do ‘‘node picking’’, or lymphadenectomy of the ipsilateral central compartments.[13] More aggressive approaches suggest routine prophylactic neck dissection in clinically N0 DTC due to high rate of occult lymph node metastasis of up to 82% of cases[18,27] with higher