PREVALENCE OF LYMPH NODES IN THE APEX OF LEVEL V:
A PLEA AGAINST THE NECESSITY TO DISSECT THE
APEX OF LEVEL V IN MUCOSAL HEAD AND NECK CANCER

Marc Hamoir, MD,1 Jatin P. Shah, MD, MS,2 Gauthier Desuter, MD,1 Vincent Grégoire, MD, PhD,1
Stéphane Ledeghen, MD,1 Isabelle Plouin-Gaudon, MD,1 Philippe Rombaux, MD,1
Birgit Weynand, MD,1 Benoît Lengelé, MD, PhD1

1 Departments of Head and Neck Surgery, Radiation Oncology, Pathology, Plastic and Reconstructive Surgery,
and Human Anatomy Unit, Head and Neck Oncology Program, St Luc University Hospital and Cancer Center,
10, Hippocrate Avenue, 1200 Brussels, Belgium. E-mail: hamoir@orlo.ucl.ac.be
2 Head and Neck Service, Memorial Sloan-Kettering Cancer Center, New York, New York

Accepted 16 April 2005
Published online 1 September 2005 in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/hed.20264

Abstract: Background. We assessed the prevalence of histologically proven normal or invaded lymph nodes in the apex of level V.

Methods. Seventy neck dissections were performed in 41 patients with mucosal head and neck squamous cell carcinoma (SCC). Fifty-one neck dissections were performed in 30 previously untreated patients (group 1); 19 neck dissections were carried out in 11 patients previously irradiated (group 2).

Results. Pathologic analysis was unable to identify any lymph node in 70% of the apex specimens. In group 1, no lymph nodes were detected in 63%, whereas one or more non-invaded lymph nodes were present in 37%; in group 2, no lymph nodes were identified in 89%, whereas one or more normal lymph nodes were found in 11% (p = .03). Metastatic lymph nodes were never identified.

Conclusions. The prevalence of lymph nodes in the apex was 30%. No invaded lymph nodes were identified. In addition to anatomic evidence, these results suggest that dissection of the apex is not necessary in mucosal head and neck SCC.

Keywords: head and neck cancer; lymph nodes; neck dissection; squamous cell carcinoma; neck metastases

The presence of regional metastases continues to significantly affect the probability of regional control and survival of patients with head and neck squamous cell carcinoma (SCC). Consequently, adequate treatment of lymphatics remains a critical issue in the comprehensive management of patients with early, as well as advanced, head and neck cancer.

Radical neck dissection (RND) remains a necessary surgical procedure for advanced lymph node metastases of cancers of the head and neck. However, the wish to reduce the morbidity associated with RND, in particular regarding shoulder disability, gave impulse toward modifications of the RND.

Correspondence to: M. Hamoir
Presented as oral presentation at the 6th International Conference on Head and Neck Cancer, August 10, 2004, Washington, DC.

HEAD & NECK November 2005 963
A few decades ago, functional neck dissection introduced a new concept of neck dissection.\textsuperscript{1,2} In this procedure, the spinal accessory nerve (SAN), the internal jugular vein (IJV), and the sternocleidomastoid muscle (SCM) were preserved, whereas all the lymphatic structures routinely cleared during RND (the submandibular region excepted) were resected. Later, modifications to RND (MRND) were reported, and the concept of selective neck dissection (SND) was proposed.\textsuperscript{3–5} All these modifications were based on the same philosophy: to improve the functional outcome without jeopardizing the oncologic control.

In an attempt to respond to the need for uniformity, Robbins et al, for the Committee for Head and Neck Surgery and Head and Neck Oncology of the American Academy of Otolaryngology–Head and Neck Surgery, proposed in 1991 guidelines for standardization of neck dissection.\textsuperscript{6} Since then, revisions have recently been proposed, and the current neck dissection terminology and definitions are summarized in Table 1.\textsuperscript{7–10}

As a second objective, the Academy’s Committee wanted to define the lymphatic structures and other nonlymphatic structures removed or spared by each procedure, to standardize the terminology used to describe the lymphatic structures of the neck, particularly lymph node groups at risk for tumor metastases, and to define the boundaries of each of the lymph node groups removed in the different types of neck dissection.

The classification of lymph nodes was based on the level system as described by the Memorial Sloan-Kettering Cancer Center, dividing the neck into six levels.\textsuperscript{11}

This classification has been recently updated, introducing the use of anatomic structures depicted radiologically to better define boundaries between various neck levels.\textsuperscript{7–10}

Level V was subdivided into two subgroups, allowing distinction of lymph node involvement of the lower part of the SAN chain (level Va) from involvement of the transverse cervical artery chain (level Vb).\textsuperscript{7–10} The border between these two compartments was defined by a horizontal plane defined by the lower border of the cricoid cartilage. The anatomic boundaries of level Va were defined as follow: 1° superiorly, the apex of the convergence of the SCM and trapezius muscles; 2° inferiorly, the horizontal plane defined by the lower border of the cricoid cartilage; 3° anteriorly, the posterior border of the SCM muscle; and 4° posteriorly, the anterior border of the trapezius muscle (Figure 1A).\textsuperscript{10}

Recently, we advocated that the upper limit of level Va should be questioned.\textsuperscript{12} On the basis of anatomic evidence and surgical experience, we argued that level Va should be subdivided in two sections: the apex of level V or level Vas (superior) and level Vai (inferior). The border between level Vas and level Vai should be the lower two thirds of the SAN (Figure 1B).

Looking for more evidence against the necessity to clear the apex of level V in mucosal head and neck SCC, we are now reporting the results of a prospective study on neck dissection pathologic specimens, individualizing the upper part of

<table>
<thead>
<tr>
<th>Table 1. Updated classification of neck dissection. Definition and terminology.*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of neck dissection</strong></td>
</tr>
<tr>
<td>1. Radical neck dissection</td>
</tr>
<tr>
<td>2. Modified radical neck dissection</td>
</tr>
<tr>
<td>3. Selective neck dissection</td>
</tr>
<tr>
<td>4. Extended neck dissection</td>
</tr>
</tbody>
</table>

*Abbreviations: SCM, sternocleidomastoid muscle; IJV, internal jugular vein; SAN, spinal accessory nerve; SND, selective neck dissection.

Data from Robbins et al.\textsuperscript{10}
level Va for potential identification of normal or invaded lymph nodes.

PATIENTS AND METHODS

We prospectively analyzed the neck dissection specimens from a consecutive series of patients with mucosal head and neck SCC who received their initial treatment at St Luc University Hospital and Cancer Center, Brussels, from April 2001 through July 2003. The clinical nodal status of the neck was staged according to the American Joint Committee on Cancer (AJCC) TNM staging system. All patients had unilateral or bilateral neck dissections according to the neck dissection classification update proposed by Robbins et al: RND and MRND (levels I–V) and the following types of selective neck dissections: SND: (II–V); (II–IV) and (I–III) or (I–IV) were carried on. When dissection of level V was not planned (ie, SNDs [II–IV], [I–III], and [I–IV]), at the end of the neck dissection, after elevation of the upper posterior skin and identification of the posterior border of the SCM muscle, the anterior border of the trapezius muscle and the lower part of the SAN, the fibroadipose tissue was resected from the lower SAN up to the mastoid process. When performed on both sides, the procedure required approximately 20 minutes of additional operative time. When dissection of level V was part of neck dissection (ie, RND, MRND, SND [II–V]), the apex was dissected exactly like the first procedure but, once dissected, separated from the remaining level V. Once individualized, the apex of level Va was labeled by the surgeon to be processed separately for pathologic analysis. In case of bilateral neck dissection, each neck dissection specimen and each apex specimen was considered separately. Besides, the neck dissection specimen was divided in the different resected levels by the surgeon and fixed by formalin. All specimens were submitted to the same pathologist (BW) for permanent histopathologic analysis, looking for the presence of lymph nodes in the apex. When identified, the number of lymph nodes was noted, as well as the result of the pathologic analysis of the lymph node (normal or metastatic). In addition, the divided neck dissection specimens were analyzed routinely. The total number of lymph nodes harvested and their location and the number of pathologically positive nodes for each nodal level were determined. Histologic differentiation, presence of extracapsular spread, and presence of perineural and vascular invasion were also documented.

To avoid heterogeneity in interpreting the results, we separated the neck dissection specimens in two subgroups: group 1 included neck

---

**FIGURE 1.** (A) Subdivision of level V according to the last update of the neck dissection classification. Level V is subdivided in level Va and level Vb. The boundary between level Va and level Vb is the lower border of the cricoid cartilage. (B) Proposal for subdivision of level Va in two sections: the apex of level V or level Vas (superior) and level Vai (inferior). The lower two thirds of the SAN provides a landmark to subdivide level Va into level Vas and level Vai. SAN, spinal accessory nerve.
dissections performed in previously untreated patients, and group 2 included neck dissections carried out in patients who previously had had external radiation therapy. In this last situation, neck dissection was considered as part of salvage surgery for local or locoregional failure or was planned after definitive radiotherapy or chemoradiotherapy for patients who had a complete clinical response at the primary site.

Data were analyzed using Statistical Analysis Software version 6.0 (SAS Institute Inc, Cary, NC). The comparison of proportion was tested by the chi-square test. Because the number of lymph nodes did not present a normal distribution, the analysis was made on the ranks. A two-way analysis of variance was used to test the effect of radiotherapy and anatomic localization. A \( p \) value of .05 or less was considered statistically significant.

RESULTS

Forty-one consecutive patients with head and neck SCC had 70 neck dissections. Primary tumors were in the following subsites: oral cavity, three; oropharynx, 13; hypopharynx, eight; larynx, 15; unknown, two. Clinical staging of the neck was as follows: N0, 22; N1, seven; N2a, four; N2b, one; N2c, six; N3, one. Pathologic N staging was: N0, 18; N1, six; N2a, six; N2b, three; N2c, seven; N3, one.

All patients had one or a combination of the following neck dissections: comprehensive neck dissections: RND, four; MRND, 12; and selective neck dissections: SND (II–V), 3; SND (II–IV), 42; SND (I–III) or (I–IV), nine. Fifty-one neck dissections were performed in 30 previously untreated patients belonging to group 1. Group 2 included 19 neck dissections carried out in 11 patients who had previously had external radiation therapy.

The mean total nodal recovery on the different types of neck dissection specimens was as follows: (1) group 1: comprehensive (radical + modified), 30.1 (range, 9–51); selective (II–V), 28 (range, 24–32); selective (II–IV), 24.4 (range, 8–50), selective (I–III, I–IV), 20.7 (range, 14–34); (2) group 2: comprehensive (radical + modified), 18 (range, 4–29), selective (II–IV), 14.2 (range, 6–28); selective (I–III, I–IV), 9.3 (range, 3–17). Preoperative radiotherapy very significantly decreased the mean total nodal yield from 25.2 in group 1 to 14.6 in group 2, including all types of dissection (\( p = .0007 \)).

Overall, pathologic analysis of the apex of level V was unable to identify any lymph nodes in 70% (49 of 70) of the specimens. Consequently, the prevalence of lymph nodes in the apex was 30%. In group 1, no lymph nodes were detected in 63% (32 of 51) of the specimens, whereas non-invaded lymph node(s) were found in 37% (19 of 51); one normal lymph node was identified in 14 specimens, whereas two lymph nodes, three lymph nodes, four lymph nodes, and five lymph nodes were identified in one, one, and two apex specimens, respectively. In group 2, no lymph nodes were identified in 89% (17 of 19), whereas one or more than one normal lymph node was reported in 11% (two of 19). The difference between group 1 and group 2 was statistically significant (\( p = .03 \)). In all cases, metastatic lymph nodes were never identified.

DISCUSSION

In 2002, the Academy’s Committee proposed that level V should be subdivided into levels Va and Vb, allowing distinction of lymph nodes of the lower part of the SAN chain (level Va) from the nodes of the transverse cervical artery chain (level Vb). The boundary between these two compartments was defined by a horizontal plane defined by the lower border of the cricoid cartilage. The anatomic boundaries of level Va were defined as follows: 1° superiority, the apex of the convergence of the SCM and trapezius muscles; 2° inferiorly, the horizontal plane defined by the lower border of the cricoid cartilage; 3° anteriorly, the posterior border of the SCM muscle; and 4° posteriorly, the anterior border of the trapezius muscle (Figure 1A).

As advocated in a preliminary study, we believe that subdividing level Va in two sections relates better to anatomic reality. According to the anatomic works of Rouvière, the upper part of level Va contains only superficial suprafascial occipital lymph nodes and, inconstantly, subfascial and submuscular lymph nodes located close to the occipital attachment of the SCM muscle. This narrow apical part belongs to the superficial occipital group of the lymphatic system of the head, contains very few superficial supra-SAN lymph nodes connected to the mastoid and occipital skin, and would be level Vas (superior), whereas the main lower portion, which belongs to the deep lateral system of the neck region and includes lymph nodes around the lower part of the SAN in relation to the drainage of the upper
aerodigestive tract, would be level Vai (inferior) (Figure 1). The anatomic border between level Vas and level Vai should the lower two thirds of the SAN. From a radiologic point of view, a horizontal plane defined by the upper edge of the body of the hyoid bone seems to be a reliable landmark to separate the two sections.

Collecting the lymphatic vessels arising from the occipital scalp and the postauricular and nuchal regions, the lymph nodes of the apex drain into the middle third of the SAN chain but are obviously not at risk of metastases in head and neck SCC, except in cases of skin cancer of the posterior scalp and posterior face. In these particular situations, the procedure of choice is SND (II–V, mastoid, occipital), meaning that neck dissection should not be limited to the lymph nodes routinely removed from level II to V (including the apex of level V), but extended toward the midline and the occiput, along the occipital vessels, and in the postauricular area.

Despite more acceptances to use the system of division of lymph nodes by levels and sublevels, some confusion still exists not only with regard to the terminology but also to the accurate boundaries of these levels and sublevels. Recently, an overall prevalence of 6.5% of lymph node metastases in the posterior triangle apex was reported in head and neck SCC, except in cases of skin cancer of the posterior scalp and posterior face. In these particular situations, the procedure of choice is SND (II–V, mastoid, occipital), meaning that neck dissection should not be limited to the lymph nodes routinely removed from level II to V (including the apex of level V), but extended toward the midline and the occiput, along the occipital vessels, and in the postauricular area.

The purpose and potential benefit of not dissecting the apex of level V are clearly focused on a reduced morbidity regarding shoulder function after MRND procedures. Extending the dissection into level V is known to have a detrimental effect on health-related quality of life as a consequence of shoulder dysfunction. In those situations in which the nerve is anatomically preserved, shoulder complaints nevertheless are reported in up to 75% of the patients. This is theoretically due to ischemic injury to the nerve, by stripping on its full length during dissection. Using the lower two thirds of the SAN as the upper boundary of dissection of level V would likely reduce devascularization of the SAN, because avoiding dissection of the apex, most of the SAN may be left in situ, in its fascial tissue plane, retaining its blood supply. Future studies of shoulder function in patients with preservation of the apex and comparison with those who have undergone MRND with dissection of the entire level V should be able to generate data to support this hypothesis.

CONCLUSIONS

The prevalence of lymph nodes in the apex of level Va is 30%. We have given arguments supporting that level Va itself should be subdivided into sublevel Vai and sublevel Vas (the apex) and
that dissection of the apex seems not required in mucosal head and neck SCC. It should only be considered in skin cancer of the posterior scalp and posterior neck. In these specific situations, the targeted lymph nodes are not limited to the apex but extend toward the midline and occiput along the occipital vessels and along the vessels in the mastoid area. Over the past few years, the concept of limited treatment in the neck has gained more acceptance for limited stage tumors.20–22 Worldwide application of this concept received a major impulse with the recommendations of the Committee for Head and Neck Surgery and Oncology of the American Academy of Otolaryngology–Head and Neck Surgery.6,10 In the wake of these recommendations proposed for head and neck surgeons, several groups have translated the anatomic boundaries of the various lymph node levels on CT scans or MRI.9,19,23 Recently, a proposal of a common set of recommendations for accurate delineation of neck node levels was proposed by the Brussels and Rotterdam groups.24 Major cooperative groups in Europe (DAHANCA, EORTC, GORTEC) and in North America (NCIC, RTOG) have now endorsed them. In these imaging-based consensus guidelines, the cranial limit of level V is the cranial edge of the body of the hyoid bone, because it is a reliable landmark of the junction between the upper one third and the lower two thirds of the SAN.25 Aware of the uselessness in treating the uppermost part of level V in mucosal head and neck cancer, the radiation oncologist community has accepted sparing this region in the node-negative neck when delineating the lymph node target volumes in conformal radiotherapy and intensity-modulated radiation therapy. It may be time for the head and neck surgeons to validate this boundary.

Acknowledgments. The authors are indebted to C. Beguin, MD, from the department of Medical Informatics and Biostatistics for statistical analysis, and K. Thomas Robbins, MD, Southern Illinois University School of Medicine, Springfield, IL, for his critical reading of this manuscript.

REFERENCES


EDITORIAL COMMENT

The purpose of a neck dissection is to remove those nodes involved by or at risk for involvement by metastatic cancer. This concept has not changed since its inception as a distinct operation; what has changed is our definition of what nodes are at risk, and this change has allowed for the development of the modified and selective operations. The expectation of these surgical modifications is not improved disease control but rather decreased operative morbidity while maintaining oncologic effectiveness.

In keeping with this strategy, Dr. Hamoir and his co-authors provide new and important evidence that would allow for further refinement of the anatomic boundaries of a neck dissection done for treatment of a malignancy of the mucosal surfaces of the upper aerodigestive tract. The evolution of similar data relating to level II lymph nodes has allowed for the subdivision of this level into levels IIA and IIB. Routine elective removal of the level IIB nodes is no longer believed to be necessary in most circumstances. This has allowed us to avoid the increased morbidity in terms of accessory nerve dysfunction that has been documented to accompany the increased dissection of the upper one third of the nerve that goes along with level IIB nodal extirpation. In an analogous fashion, Dr. Hamoir’s group provides data that would allow us in those situations in which the posterior triangle level V lymph nodes require removal to stay inferior to the spinal accessory nerve. They show that there was a relative paucity of nodes in the tissue above the nerve and that the nodes when present were never involved with cancer. Although they do not provide evidence that shoulder dysfunction is diminished by this approach, it seems a reasonable assumption as an extrapolation of the data that exist for dissection of the upper one third of the nerve. It is important to note that their conclusions cannot be extrapolated to nasopharynx or skin malignancies.

Until a better answer than surgery and/or radiation can be found for the treatment of neck metastases from upper aerodigestive tract cancer, refinements such as this that limit our treatment to only those areas at risk will remain as an important part of our efforts to decrease the significant morbidity that goes along with our treatment of this disease.

James I. Cohen, MD, PhD
Oregon Health & Sciences University
Portland, Oregon