Since the first description of the radical neck dissection by George Crile almost a century ago, many variations and modifications of the procedure have been added. These include the functional neck dissection, the modified radical neck dissection, and various selective neck dissections. In response to the need for an organized approach in describing these operations, the Committee for Head and Neck Surgery and Oncology of the American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS) in 1988 initiated an effort to develop a standardized classification system for neck dissection (Table 1). During this process, input was obtained from the Education Committee of the American Society for Head and Neck Surgery (ASHNS) and its Council. The final product, endorsed by the ASHNS and the AAO-HNS, was published in the ARCHIVES and as a monograph by the AAO-HNS in 1991.

In 1998, 10 years following the initiation of the neck dissection classification project, an ad hoc committee of the newly formed American Head and Neck Society (AHNS) was convened to review the original classification scheme. This was prompted by the AAO-HNS's desire to update its monograph on the subject and include the recent revisions to the American Joint Commission on Cancer (AJCC) staging system for head and neck cancer. However, there was also a need to consider revisions to the neck dissection classification in light of new observations regarding the biological function of lymph node metastases, further refinements in selective neck dissection procedures, as well as a need to redefine the anatomical boundaries of certain neck levels and be consistent with the anatomical boundaries used in radiologic studies of the neck.

Chaired by the primary author (K.T.R.), the Committee for Neck Dissection Classification of the AHNS met several times over a 2-year interval to complete its work. Representation on the committee also included a radiologist, (P. S.), who had worked within his own specialty to define parameters by which the orientation of lymph nodes in the neck could be accurately described in relation to the level system. During this interval, the members serving at that time on the Academy’s Committee for Head and Neck Surgery and Oncology provided additional advice.

As the committee members reviewed the 1991 neck dissection classification system (Table 1), there was a general consensus that the basic approach previously followed had clearly achieved its original objective to standardize neck dissection terminology using a system that was logical, straightforward, and easy to remember. In fact, the committee members noted that the worldwide use of the system was a testimony to its practicality and usefulness. Consequently, a strong desire was expressed to maintain this structure because any radical alterations carried a risk of losing the widespread support for a standardized neck dissection classification. However, it was also believed there was an opportunity to introduce cer-
tain modifications that would allow the original classifi-
cation to remain contemporary and in keeping with
the current philosophy for managing lymph node
metastases.

DIVISION OF LYMPH NODES BY LEVELS

The committee supported the continued use of the level
system to delineate the location of lymph node disease
in the neck (Figure 1). The level system is well known
and easy to remember and now serves as the basis for de-
scribing various selective neck dissections. Contrary to
the recommendations by others, it did not recommend
including additional levels such as level VII for the su-
perior mediastinum. It was believed that the 6 levels cur-
cently used encompassed the complete topographic
anatomy of the neck. Lymph nodes involving regions not
located within this region would be referred to by the name
of their specific nodal group. In addition to the superior
mediastinum, other examples include the retropharyn-
geal lymph nodes, the periparotid lymph nodes, the buc-
cinator nodes, and the postauricular and suboccipital
nodes. Figure 1 depicts the topographical boundaries of
the level system.

DIVISION OF NECK LEVELS BY SUBLEVELS

The committee decided to introduce the concept of sub-
levels into the classification, since certain zones have
been identified within the 6 levels, some of which may
have biological significance independent of the larger
zone in which they lie. These are outlined in Figure 2
as sublevels IA (submental nodes), IB (submandibular
nodes), IIA and IIB (together comprising the upper
jugular nodes), and VA (spinal accessory nodes) and VB
(transverse cervical and supraclavicular nodes). The
boundaries for each of these sublevels are specified in
Table 2.

The risk of nodal disease in sublevel IIB is greater
for tumors arising in the oropharynx compared with the
oral cavity and larynx. Thus, in the absence of clinical
nodal disease in sublevel IIA, it is likely not necessary to
include sublevel IIB for tumors arising in these latter
sites. The dissection of the node-bearing tissue of sub-
level IIB (submuscular recess) is not without an in-
creased risk of morbidity. Adequate exposure necessi-
tates significant manipulation of the spinal accessory
nerve (SAN) and may account for trapezius muscle
dysfunction observed in a significant minority of
patients following a selective neck dissection. Sublevel
IA is another example in which many surgeons opt
not to remove this zone unless the primary cancer in-
volves the floor of mouth, lip, or structures of the ante-
rior midface.

Level V is the third region in which the committee
believed there was merit in subdividing it into levels VA
and VB. The superior component, level VA, primarily
contains the spinal accessory lymph nodes, whereas
level VB contains the transverse cervical and supraclavicular
nodes, which carry a far more ominous prognosis when positive for aerodigestive tract malign-
ancies.
Table 2. Lymph Node Groups Found Within the 6 Levels and the 6 Sublevels

<table>
<thead>
<tr>
<th>Lymph Node Group</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submental (sublevel IA)</td>
<td>Lymph nodes within the triangular boundary of the anterior belly of the digastric muscles and the hyoid bone. These nodes are at greatest risk for harboring metastases from cancers arising from the floor of mouth, anterior oral tongue, anterior mandibular alveolar ridge, and lower lip (Figure 2).</td>
</tr>
<tr>
<td>Submandibular (sublevel IB)</td>
<td>Lymph nodes within the boundaries of the anterior belly of the digastric muscle, the stylohyoid muscle, and the body of the mandible. It includes the preglandular and the postglandular nodes and the prevascular and postvascular nodes. The submandibular gland is included in the specimen when the lymph nodes within the triangle are removed. These nodes are at greatest risk for harboring metastases from cancers arising from the oral cavity, anterior nasal cavity, soft tissue structures of the midface, and submandibular gland (Figure 3).</td>
</tr>
<tr>
<td>Upper jugular (includes sublevels IIA and IIB)</td>
<td>Lymph nodes located around the upper third of the internal jugular vein and adjacent spinal accessory nerve extending from the level of the skull base (above) to the level of the inferior border of the hyoid bone (below). The anterior (medial) border is the stylohyoid muscle (the radiologic correlate is the vertical plane defined by the anterior surface of the submandibular gland) and the posterior (lateral) boundary is the posterior border of the sternocleidomastoid muscle. Sublevel IIA nodes are located anterior (medial) to the vertical plane defined by the spinal accessory nerve. Sublevel IIB nodes are located posterior (lateral) to the vertical plane defined by the spinal accessory nerve. The upper jugular nodes are at greatest risk for harboring metastases from cancers arising from the oral cavity, nasal cavity, nasopharynx, oropharynx, hypopharynx, larynx, and parotid gland (Figure 3).</td>
</tr>
<tr>
<td>Middle jugular (level III)</td>
<td>Lymph nodes located around the middle third of the internal jugular vein extending from the inferior border of the hyoid bone (above) to the inferior border of the cricoid cartilage (below). The anterior (medial) boundary is the lateral border of the sternohyoid muscle, and the posterior (lateral) boundary is the posterior border of the sternocleidomastoid muscle. These nodes are at greatest risk for harboring metastases from cancers arising from the oral cavity, nasopharynx, oropharynx, hypopharynx, and larynx (Figure 3).</td>
</tr>
<tr>
<td>Lower jugular (level IV)</td>
<td>Lymph nodes located around the lower third of the internal jugular vein extending from the inferior border of the cricoid cartilage (above) to the clavicle below. The anterior (medial) boundary is the lateral border of the sternohyoid muscle and the posterior (lateral) boundary is the posterior border of the sternocleidomastoid muscle. These nodes are at greatest risk for harboring metastases from cancers arising from the hypopharynx, thyroid, cervical esophagus, and larynx (Figure 3).</td>
</tr>
<tr>
<td>Posterior triangle group (includes sublevels VA and VB)</td>
<td>This group is composed predominantly of the lymph nodes located along the lower half of the spinal accessory nerve and the transverse cervical artery. The suprACLavicular nodes are also included in posterior triangle group. The superior boundary is the apex formed by convergence of the sternocleidomastoid and trapezius muscles, the inferior boundary is the clavicle, the anterior (medial) boundary is the posterior border of the sternocleidomastoid muscle, and the posterior (lateral) boundary is the anterior border of the trapezius muscle. Sublevel VA is separated from sublevel VB by a horizontal plane marking the inferior border of the anterior cricoid arch. Thus, sublevel VA includes the spinal accessory nodes, whereas sublevel VB includes the nodes following the transverse cervical vessels and the suprACLavicular nodes with the exception of the Virchow node, which is located in level IV. The posterior triangle nodes are at greatest risk for harboring metastases from cancers arising from the nasopharynx, oropharynx, and cutaneous structures of the posterior scalp and neck (Figure 3).</td>
</tr>
<tr>
<td>Anterior compartment group (level VI)</td>
<td>Lymph nodes in this compartment include the pretracheal and paratracheal nodes, precricoid (Delphian) node, and the perithyroidal nodes including the lymph nodes along the recurrent laryngeal nerves. The superior boundary is the hyoid bone, the inferior boundary is the suprACLavicular notch, and the lateral boundaries are the common carotid arteries. These nodes are at greatest risk for harboring metastases from cancers arising from the thyroid gland, glottic and subglottic larynx, apex of the piniform sinus, and cervical esophagus (Figure 2).</td>
</tr>
</tbody>
</table>

DEFINITION OF LYMPH NODE GROUPS

It was agreed that the names depicting the lymph node groups within each of the 6 neck levels were well accepted and used in a uniform manner (Table 2). Continued support of this nomenclature would preclude the introduction of other terms that would potentially be ambiguous (eg, deep cervical nodes). Table 2 also outlines the lymph node groups located within each of the 6 neck levels.

ANATOMICAL BOUNDARIES OF THE NECK LEVELS

The anatomical boundaries of the 6 neck levels as identified in the first article on neck dissection classification were well defined with the exception of a few instances in which there were minor inaccuracies or ambiguities (Table 3).1 For example, the stylohyoid muscle rather than the posterior belly of the digastric muscle more accurately defines the posterior border of level IB. Similarly, the plane defined by the sensory branches of the cervical plexus has been added to delineate the boundary between the posterior borders of levels II through IV and the anterior border of level V. This parameter is in addition to the posterior border of the sternocleidomastoid muscle (SCM) and provides a more practical intraoperative landmark for the surgeon (Table 3 and Figure 2).

CORRELATION OF NECK LEVEL BOUNDARIES WITH ANATOMICAL MARKERS DEPICTED RADIOLOGICALLY

In the 1991 neck dissection classification,1 not all of the anatomical structures used to define the boundaries were readily visible on radiologic studies such as computed tomography and magnetic resonance imaging. Consequently, radiologists have now identified landmarks that more accurately identify the location of lymph nodes according to the level system.3 Using radiologic landmarks, level I includes all of the nodes above the level of the lower body of the hyoid bone, below the mylohyoid muscles, and anterior to a transverse line drawn on each axial image through the posterior edge of the submandibular gland. Level 1A represents those nodes that lie between the medial margins of the anterior bellies of the
The definitions of types of neck dissection remain unchanged as previously outlined in the 1991 classification article.1 These are (1) radical neck dissection is considered to be the standard basic procedure for cervical lymphadenectomy, and all other procedures represent 1 or more alterations of this procedure; (2) when the alteration involves preservation of 1 or more nonlymphatic structures routinely removed in the radical neck dissection, the procedure is termed modified radical neck dissection; (3) when the alteration involves preservation of 1 or more lymph node groups/levels routinely removed in the radical neck dissection, the procedure is termed selective neck dissection; (4) when the alteration involves removal of additional lymph node groups or nonlymphatic structures relative to the radical neck dissection, the procedure is termed extended neck dissection.

CLASSIFICATION OF NECK DISSECTION

Classification of neck dissection is outlined in Table 1. It is essentially the same as the 1991 version1 with the exception that specific names for certain types of selective neck dissection have been deleted. As outlined in the section on selective neck dissection, the rationale for this recommendation is based on the increased number of variations, which have been introduced over the past decade.
RADICAL NECK DISSECTION

Radical neck dissection (Figure 3) refers to the removal of all ipsilateral cervical lymph node groups extending from the inferior border of the mandible to the clavicle, from the lateral border of the sternohyoid muscle, hyoid bone, and contralateral anterior belly of the digastric muscle medially, to the anterior border of the trapezius muscle. Included are all lymph nodes from levels I through V. The SAN, internal jugular vein, and SCM are also removed. Radical neck dissection does not include removal of the suboccipital nodes, periparotid nodes (except intraparotid nodes located in the posterior aspect of the submandibular triangle), buccinator nodes, retropharyngeal nodes, and midline visceral (anterior compartment) nodes.

MODIFIED RADICAL NECK DISSECTION

Modified radical neck dissection (Figures 4, 5, and 6) refers to the excision of all lymph nodes routinely removed by the radical neck dissection with preservation of 1 or more nonlymphatic structures (ie, the SAN, internal jugular vein, and SCM). The structure(s) preserved should be specifically named (eg, modified radical neck dissection with preservation of the SAN).
Selective neck dissection refers to a cervical lymphadenectomy in which there is preservation of 1 or more of the lymph node groups that are routinely removed in the radical neck dissection. The lymph node groups removed are based on the patterns of metastases, which are predictable relative to the primary site of disease. For oral cavity cancers, the lymph nodes at greatest risk are located in levels I, II, and III. The lymph nodes at greatest risk for oropharyngeal, hypopharyngeal, and laryngeal cancers are located in levels II, III, and IV, whereas for thyroid cancer, the lymph nodes in VI are at the greatest risk.

Refinements in Selective Neck Dissection Nomenclature

Probably the most significant change in philosophy with regard to managing lymph node disease over the past decade relates to the selectivity with which lymph node groups at risk are being removed. Without the use of the selective neck dissection has become more widespread despite some earlier concerns that it may not be as effective as neck dissections in which all lymph node levels are removed, such as the modified radical neck dissection. However, of equal significance have been the reports indicating that certain neck levels may have less or greater importance than previously thought with regard to risk of occult disease based on the specific site of origin of the primary tumor. An excellent example of this is carcinoma of the oral tongue. Although it is well appreciated that patients with oral tongue cancer have a high risk of nodal involvement even for those with small primary lesions without clinical evidence of positive nodes, the extent by which the risk remains high for each neck level is controversial. Skip metastases to level IV may be a potential problem, and many surgeons prefer to include this region when performing an elective selective neck dissection. However, the terminology to describe the neck dissection procedure for this situation is vague. Some prefer to apply the term supraomohyoid neck dissection because this is the standard elective procedure typically used for oral tongue cancer. But this is inaccurate because supraomohyoid neck dissection was intended to include only levels I through III. Others prefer to use the term extended supraomohyoid neck dissection or anterolateral neck dissection, which more accurately outlines the removal of levels I through IV. Unfortunately, acceptance of these additional terms adds complexity to the nomenclature system and runs the risk of adding confusion.

The 1991 neck dissection classification system did not provide an accurate description of procedures in which the surgeon chooses to preserve certain sublevels. For example, the buccinator nodes may represent the primary echelon nodal basin for oral cavity cancers involving the buccal mucosal, hard palate, and upper alveolar ridge. These nodes are not included in the standard supraomohyoid neck dissection, and a better method is needed to define the inclusion of such structures. To not further confuse this issue, it was determined by the committee that exclusion of these “named” neck dissections would facilitate the standardization and referencing of these procedures. Therefore, further in this text, we will no longer refer to these “named” selective neck dissections except in the description of specific levels.

Selective Neck Dissection (SND) for Oral Cavity Cancer

In the treatment of oral cavity cancer, the procedure of choice is SND (I-III) (Figure 7). This refers to the removal of lymph nodes contained in the submental and submandibular triangles (level I), the upper jugular lymph nodes (level II), and the middle jugular lymph nodes (level III). The cutaneous branches of the cervical plexus and the posterior border of the SCM mark the posterior limit of the dissection. The inferior limit is the junction between the superior belly of the omohyoid muscle and the internal jugular vein. One of the justifications to eliminate naming of dissections for oral cavity cancer comes from the observations regarding invasive oral tongue carcinomas. In the case of oral tongue cancer, there is evidence indicating level IV is also at risk. Thus, some authorities recommend the selective neck dissection procedure for this subsite within the oral cavity to be SND (I-IV). For cancers involving the midline structures including the floor of mouth and ventral tongue, the lymph nodes on both sides of the neck are at risk and the procedure of choice is a bilateral SND (I-III).

Selective Neck Dissection for Oropharyngeal, Hypopharyngeal, and Laryngeal Cancer

The procedure of choice for these anatomic sites is SND (II-IV) (Figure 8). This refers to the removal of the upper jugular lymph nodes (level II), the middle jugular lymph nodes (level III), and the lower jugular lymph nodes (level IV). The superior limit of dissection is the skull base. The inferior limit is the clavicle. The anterior (medial) limit is the lateral border of the sternohyoid muscle and the stylohyoid muscle. The posterior (lat-
eral) limit of the dissection is marked by the cutaneous branches of the cervical plexus and the posterior border of the SCM. In the case of cancers involving the oropharynx, there is evidence indicating that the lateral and retropharyngeal nodes are also at risk. Similarly, cancers of the hypopharynx may involve the retropharyngeal lymphatics. Level IIB is at greater risk for metastases associated with oropharyngeal lesions relative to laryngeal and hypopharyngeal cancers. Thus, if level IIB is excluded as is sometimes done for laryngeal and hypopharyngeal cancers, the procedure would be designated SND (IIA, III, IV). When lymphatic metastases occur bilaterally, the procedure of choice is a bilateral SND (II-IV). If the retropharyngeal lymph nodes are included, as in the case of cancers involving the pharyngeal wall, the procedure is designated SND (II-IV), retropharyngeal nodes. If the nodes in level VI are removed, as in the case of laryngeal and hypopharyngeal cancers extending below the level of the glottis, the procedure is designated SND (II-IV, VI).

Selective Neck Dissection for Cancer of the Midline Structures of the Anterior Lower Neck

For cancer of the midline structures of the anterior lower neck, the procedure of choice is SND (VI) and is most often indicated with or without dissection of other neck levels for thyroid cancer, advanced glottic and subglottic larynx cancer, advanced piriform sinus cancer, and cervical esophageal/tracheal cancer (Figure 9). This SND refers to the removal of the lymph nodes within the central compartment of the neck including the paratracheal, precricoid (Delphian), and perithyroidal lymph nodes as well as the nodes located along the recurrent laryngeal nerves. The superior limit of dissection is the body of the hyoid bone, and the inferior limit is the suprasternal notch. The lateral limits are defined by the medial border of the carotid sheath (common carotid artery). This procedure is also known as the anterior neck dissection or the central compartment neck dissection. This neck dissection does not have a contralateral counterpart, and it assumes that the lymph nodes are removed on both sides of the trachea. In the case of metastases extending below the level of the suprasternal notch, dissection of the superior mediastinal nodes may be indicated, in which case the procedure is designated SND (VI, superior mediastinal nodes). In the case of thyroid cancer in which there is evidence of nodal metastases into level V, the procedure of choice would include the jugular nodes as well as the posterior triangle nodes and would be designated SND (II-IV, VI).

Selective Neck Dissection for Cutaneous Malignancies

For cutaneous malignancies, the operation of choice depends on the location of the lesion and the adjacent lymph node groups, which are most likely to harbor metastatic disease (Figure 10). In the case of cancers involving the posterior scalp and upper neck, the procedure of choice is SND (II-V, postauricular, suboccipital) (Figure 9). It involves the removal of the suboccipital lymph nodes, retroauricular lymph nodes, upper jugular lymph nodes (level II), middle jugular lymph nodes (level III), lower jugular (level IV), and the nodes of the posterior triangle of the neck (level V). The superior limit of dissection is the skull base anteriorly and the nuchal ridge posteriorly. The inferior limit is the clavicle. The medial (anterior) limit is the lateral border of the sternohyoid muscle and the stylohyoid muscle. The lateral (posterior) limit is the anterior border of the trapezius muscle inferiorly and the midline of the neck superiorly. For cutaneous malignancies arising on the preauricular, anterior scalp, and temporal region, the elective neck dissection of choice is SND (parotid and facial nodes, levels IIA, IIB, III, VA, and the external jugular nodes). For cutaneous malignancies arising on the anterior and lateral face, the elective neck dissection of choice is SND (parotid and facial nodes, levels IA, IB, II, and III). The development of techniques in lymphatic mapping may have a future role in specifically defining nonpredictable lymphatic echelons of risk for cutaneous malignancies.
EXTENDED NECK DISSECTION

Extended neck dissection refers to the removal of 1 or more additional lymph node groups or nonlymphatic structures, or both, not encompassed by the radical neck dissection (Figure 11). Examples of such lymph node groups include the parapharyngeal (retropharyngeal), superior mediastinal, perifacial (buccinator), and paratracheal lymph nodes. Examples of nonlymphatic structures include the carotid artery, hypoglossal nerve, vagus nerve, and paraspinal muscles. All additional lymphatic and/or nonlymphatic structure(s) to be removed should be identified in parentheses.

SUMMARY

The material outlined in the present article is not substantially different from the recommendations made by the Academy’s Committee on Neck Dissection a decade ago. The need to make such few changes reflects the success of the initial efforts made by this committee and the acceptance by head and neck surgeons of the Academy’s classification. Nonetheless, the knowledge of lymph node metastases based on biological and clinical perspectives continues to evolve. The changes made in this update are intended to represent further refinements of our understanding of the biological basis of cervical node metastases and how neck dissection is performed under various circumstances. Consensus on which anatomical structures best define the locations of lymph node groups and the boundaries of dissection is also important for communicating among clinicians. The committee also believes that this article represents a work in progress, and there will be a need to provide future updates as new knowledge and techniques evolve. This article represents a consensus among representative head and neck surgeons of the ASHNS and the AAO-HNS to further define the essential definitions and concepts outlined in this updated classification.

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Corresponding author and reprints: K. Thomas Robbins, MD, Department of Otolaryngology, University of Florida, PO Box 100264, Gainesville, FL 32610-0264 (e-mail: ktrgew@aol.com).

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