

Long-term Results of 100 Consecutive Comprehensive Neck Dissections

Implications for Selective Neck Dissections

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Objective: The optimal surgical procedure for the neck in patients with squamous head and neck cancers is controversial. Selective neck dissections have replaced modified radical neck dissections as the procedure of choice for the clinically negative (N0) neck and are now being considered for patients with early-stage neck disease. We report the long-term local recurrence rates in 100 consecutive patients undergoing a radical or modified radical neck dissection for clinically positive (N+) and N0 neck disease and review comprehensively the literature reporting and comparing regional control rates for both neck dissection types.

Patients: The clinical records of 100 consecutive patients who underwent a comprehensive neck dissection (levels I-V) for squamous head and neck cancers with a minimum of a 2-year follow-up were retrospectively reviewed for primary site of disease, clinical and pathologic neck status, histopathologic grade,

neck dissection type, and the site and time of recurrence.

Results: Complete data were available for 97 patients on whom 99 neck dissections were performed. Three patients died from unknown causes. Seventy-six patients with N+ disease underwent a therapeutic neck dissection, while 24 patients with clinically N0 disease underwent an elective dissection. The overall neck recurrence rate in patients with controlled primary disease was 7%. The neck or regional failure rate for patients completing the recommended adjuvant radiotherapy was 4%. Six (25%) of 24 patients with clinically N0 disease had occult metastases. The recurrence rate for this group was 4%.

Conclusion: Further study is needed to determine the optimal surgical management of the N0 and limited N+ neck.

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THE MANAGEMENT OF CERVICAL lymph node metastases in squamous head and neck cancers is of paramount importance because it is the single most important independent prognosticator of outcome. Since the first systematic description of the radical neck dissection (RND) by George Crile in 1906,¹ neck dissections have assumed a central role in the management of patients with both clinical and subclinical neck disease. The morbidity associated with the sacrifice of the sternocleidomastoid (SCM), internal jugular vein (IJV), and in particular cranial nerve XI (CN XI), along with a better understanding of the biological behavior of gross and microscopic neck disease, has led to modifications of this procedure, championed by Bocca and Pignataro² and Cachin³ in the 1970s, that have allowed for better functional preservation without compromising oncologic safety. A natural progression of this philosophy led to the development of selective neck dissec-

tions (SNDs) in the late 1980s and early 1990s,⁴ which essentially removed the lymph nodes at risk based on patterns of spread^{5,6} while preserving all vital structures of the neck. Although originally advocated as a staging procedure for the negative (N0) neck, indications have now expanded to include patients with early neck disease. Recurrence rates after SND range from 5% to 11%.⁷

The acceptance of selective procedures assumes that patterns of nodal spread are predictable. Byers et al,⁸ in their analyses of "skip metastases" in 1997, challenged the conventional thinking. They pointed out that in oral tongue cancer, 15% of patients presented with only level III or level IV disease, the latter residing outside the boundary of the traditionally described supraomohyoid neck dissection (SOHD). Similar findings have been reported by others.^{9,10} However, Khafif et al¹¹ found that only 2% of patients had isolated level IV metastases in a series of patients with oral cavity cancers. Ferlito et al¹² recently reviewed the literature on skip

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Table 1. Tumor Distribution by Primary Site

Primary Site	Number
Tonsil	25
Tongue base	23
Lateral tongue	17
Floor of mouth and/or alveolar ridge	12
Unknown primary	5
Larynx	5
Hypopharynx	4
Miscellaneous	9

Table 2. Tumor Distribution by Nodal Status

Nodal Status	Number
N0	24
N1	17
N2a	13
N2b	27
N2c	9
N3	10

metastases and recommended that the SOHD be extended to include level IV.

Historically, the policy at the Department of Otolaryngology–Head and Neck Surgery at Stanford University Medical Center has been to advocate a comprehensive neck dissection for patients with both positive (N+) and N0 disease. This treatment philosophy allowed us an opportunity to review our treatment results and to compare them with failure rates associated with SNDs. We report the long-term recurrence rates and disease characteristics of 100 consecutive patients who underwent RND or modified RND (MRND) for both N0 and N+ squamous cancer of the neck at our institution.

METHODS

A retrospective review of *International Classification of Diseases, Ninth Revision (ICD-9)* codes at the Stanford University Medical Center, Stanford, Calif, was used to identify patients who underwent neck dissections (ICD-9 codes 40.3-40.42 and first diagnosis 140.0-149.9). The hospital records for 100 consecutive patients who underwent RND or MRND with a minimum of a 2-year follow-up were reviewed. The study was approved by the Stanford institutional review board. To obtain up-to-date information on the clinical status of patients whose records were incomplete, we contacted them either directly, using contact information found in their medical records, or through an agency, if they had moved from their most recent known location. Patients were treated with surgery alone, surgery with adjuvant radiation therapy, or with primary combined chemoradiotherapy followed by surgical salvage. Neck dissections involved the comprehensive removal of all 5 neck levels, I through V. Neck dissections were categorized as RND, in which CN XI, the SCM, and IJV were sacrificed, or MRND, in which 1 or more of these structures were preserved.¹³ Data retrieved and analyzed included the primary site of disease, neck

dissection type, clinical and pathologic neck stage, histopathologic grade, and date and site of recurrence.

RESULTS

Data were collected from 102 neck dissections on 100 patients who were observed for at least 2 years or until their deaths. Complete data were available on 97 patients with 99 dissections; 3 patients had died from unknown causes despite being free of disease at last review. Two patients had undergone a bilateral neck dissection for bilateral neck disease.

There were 74 men and 26 women. The median age was 55.6 years, with an age range of 27 to 91 years. The most common primary regions of disease were the oropharynx and oral cavity, collectively accounting for almost 80% of cases. The most common sites were the tonsil, tongue base, and oral tongue, representing 25%, 23%, and 17% of cases, respectively. Five patients had an unknown primary site. A detailed distribution of cases with respect to the primary site is provided in **Table 1**. The miscellaneous group includes squamous cancers of the nasopharynx, maxilla, buccal mucosa, and major salivary glands. Twenty-seven percent of tumors were poorly differentiated; 59% were moderately differentiated; and 14% were well differentiated. Thirty percent had unfavorable histopathologic features of angioinvasion, perineural invasion, and/or extracapsular spread.

Seventy-six patients had clinically palpable neck disease and underwent a therapeutic neck dissection. Forty-eight were treated initially with surgery for the primary tumor and the neck disease and subsequently underwent postoperative radiation therapy. The remaining 28 with N+ disease, all N2 to N3, were treated with primary chemoradiotherapy followed by a planned neck dissection. Twenty-four patients without clinical neck disease underwent an elective comprehensive neck dissection when the risk of occult neck metastases was thought to be greater than 20%.

Fifty-nine patients presented with N2 to N3 neck disease. **Table 2** provides the distribution according to lymph node stage. Eighty patients underwent an MRND, of which 25 had preservation of all 3 nonlymphatic structures (SCM, IJV, and CN XI).

Twenty-two patients experienced recurrence locally, regionally, or with distant metastasis. Six patients developed isolated primary-site recurrence; 9, neck recurrence (3 with uncontrolled primary disease); and 4, distant metastases (4 bone, 2 lung). One patient developed an extensive locoregional recurrence that was difficult to positively identify as either a primary or neck failure and was scored as a neck recurrence. Thus, the treatment in 7 patients with controlled primary disease failed solely in the neck. Of these, 2 patients did not complete the recommended adjuvant radiation therapy, and 1 refused it. The neck recurrence rate, therefore, for patients who completed the recommended neck treatment was 4%. Of those who experienced failure in the neck, 3 had a lateral tongue site, 3 a tongue base site, and 1 a tonsil primary site. Two patients had N1 disease, 3 had N2, and 1 had N3 disease. One patient had clini-

cally N0 disease and was also confirmed histologically as N0; this patient had a well-differentiated T2 lateral tongue lesion with no evidence of perineural or angioinvasion. This patient did not receive adjuvant radiation therapy. Five of the 7 patients experiencing neck treatment failure had unfavorable histopathologic features of perineural or angioinvasion at the primary site, and 3 had extracapsular spread in the neck. The time to recurrence ranged from 6 to 15 months, with a median of 8.8 months.

Twenty-four patients with N0 disease underwent an elective neck dissection. Of these, 6 (25%) had microscopic disease by routine hematoxylin-eosin stains. None of these cases was noted to have extracapsular spread. One patient, mentioned above with histologically N0 disease, experienced recurrence in the neck.

COMMENT

The appropriate management of the neck in patients with squamous head and neck cancers is critically important because the presence of cervical metastasis is the most powerful independent indicator of regional recurrence and survival. Historically, the surgical management of the neck has been an RND, pioneered by Crile¹ at the turn of the 20th century. His classic description involved removal of lymph nodes of all neck levels, I through V, the SCM, IJV, CN XI, submandibular gland, tail of the parotid gland, and the sensory branches of the cervical plexus. Although RNDs provide the best neck control rates and are still recommended today in the management of patients with locally advanced neck disease, they are associated with significant morbidity, particularly with respect to shoulder function. Sparing CN XI, the first modification to the RND, was described in the 1950s by Ward and Robben.¹⁴ This led to the conceptualization of the MRND and functional neck dissection by Suarez¹⁵ in the 1960s, popularized by Bocca and Pignataro² and Cachin³ a decade later. These latter researchers found that preserving the nonlymphatic structures that did not have gross invasion by metastatic neck disease did not adversely affect control rates and significantly improved shoulder morbidity. In the late 1980s, Ballantyne⁴ and others carried this philosophy further and proposed a more limited neck dissection, the SND, that removed only the lymph node levels at risk of microscopic disease while preserving all nonlymphatic structures. Though originally proposed for the elective treatment of regional nodes at risk, SNDs are now being used for patients with early-stage neck disease and show recurrence rates of between 5% and 11%.⁷

The conceptual foundation of the SND is the predictable patterns of nodal spread.^{5,6} Byers et al⁸ challenged this notion in their publication on skip metastases. They found that as many as 15% of patients with oral tongue cancer presented with only level III or level IV disease and therefore believed that the traditional SOHD was oncologically inadequate. Woolgar⁹ found the incidence of skip metastases in his series of 154 patients to be 10%, while Lydiatt et al¹⁰ observed that the SOHD removed only 60% to 70% of nodes at risk, which can be increased to

80% to 94% if level IV nodes are included. Khafif et al,¹¹ however, in their series of 51 patients with T1-T3 N0 oral cavity tumors, found that only 2% of cases presented solely with metastases to level IV nodes. Ferlito et al¹² recently reviewed the literature on skip metastases and proposed the inclusion of level IV into what they termed the “extended SOHD.”¹²

The move toward the acceptance of SNDs over MRNDs in the elective management of the clinically N0 neck is based largely on retrospective studies comparing local recurrence rates. There has yet to be a well-controlled, multi-institutional, randomized trial systematically addressing the efficacy of SND as an oncologic procedure in achieving locoregional control, yet a recent study on the practices of head and neck surgeons in North America suggests that 75% would recommend an SND for the management of the clinically N0 neck.¹⁶ Having made the philosophical shift in neck management without robust objective evidence, we may have missed the opportunity to truly validate this treatment policy prospectively under well-controlled randomized study. We have instead made our best judgments based on the findings and recommendations of retrospective studies, acknowledging that retrospective reviews are intrinsically flawed in their statistical analysis and conclusions.

There are a number of difficulties in making valid comparisons between MRNDs and SNDs. First, there are no universally accepted guidelines for the anatomic limits for the variety of SND procedures available. The exact anatomic boundaries for an SND vary among institutions and even among surgeons within an institution.¹⁷ Previously defined limits for an SND for a particular primary site may need to be revised in light of more recent data of node basins at risk.¹² In addition, the nodes at risk are yet to be clearly defined for every anatomic site, and inaccurate data of nodal involvement will result if all the appropriate lymph nodes are not sampled.¹⁸

The second difficulty is that most series reporting regional control rates for SNDs and MRNDs include patients with both N0 and N+ disease to varying degrees.¹⁷ To make any kind of useful analysis, we need to make a clear distinction in comparing regional control rates between the two. In addition, if we are to consider surgery as the sole treatment modality for histologically N0 disease (or even selected N1 disease), it may be important to consider prospectively the importance of “micrometastases.” These are usually not detected by positron emission tomography with fluorodeoxyglucose 18 and may be missed with routine hematoxylin-eosin staining. The incidence of histologically microscopic disease in clinically N0 disease ranges from 10% to 27%, and an additional 4% to 8% of cases may harbor micrometastases.¹⁹

Third, the indications for SND are not universally agreed upon. Though initially advocated for the elective treatment of the clinically N0 neck, SND is now considered for the management of early neck disease (often confounded by the routine addition of adjuvant radiation therapy as part of the treatment strategy)^{20,21} and as surgical salvage after organ-preserving chemoradiation.^{22,23}

Finally, representing a fundamental weakness of all retrospective analyses, comparisons made retrospec-

tively between SNDs and MRNDs do not control for primary site, the use of adjuvant radiation therapy to improve locoregional control, or the often more advanced disease present in individuals undergoing MRNDs vs those undergoing SNDs.

Recurrence rates following an SND in the clinically N0 neck range from 5% to 11%.⁷ McGuirt et al²⁴ reported a 3.8% recurrence rate in patients with a floor-of-mouth carcinoma who underwent SOHD. Spiro et al²⁵ described 287 patients who had 320 SOHDs electively for oral and oropharyngeal carcinoma. The recurrence rate was 5% in those with histologically N0 nodes vs 7% in those with pathologically N+ disease. Seventy-five percent of patients with N+ disease received adjuvant radiation therapy. Hosal et al,²⁶ in a series of 300 elective SNDs, reported a regional recurrence of 4%, with 2 recurrences occurring outside the dissected field. Mani and van den Hoogen²⁷ reported a recurrence rate of 7% in 57 patients electively treated for oral cavity carcinoma. For patients with laryngeal and hypopharyngeal primary lesions who underwent an elective lateral neck dissection, Spiro et al²⁸ and Johnson²⁹ found a regional recurrence rate of 7% and 9%, respectively. The histologically N+ nodes obtained from elective SNDs range from 20% to 27%.²⁴⁻²⁹

Recurrence rates following MRND in the clinically N0 neck range from 0% to 5%. Bocca et al³⁰ reported a series of 237 patients with primarily laryngeal carcinoma who underwent an elective MRND with a regional recurrence rate of 2.4%. Byers,³¹ in a series of almost 1000 cases, noted a recurrence of 3% (when patients with multiple N+ nodes or extranodal spread who did not receive adjuvant radiation therapy were excluded), and Calearo and Teatini,³² in their study of 476 dissections, found an overall incidence of 3.5%. In an earlier publication, Lingenman et al³³ reported no recurrences in 98 patients who underwent an elective MRND. In the present series of 24 previously untreated patients with N0 disease observed for 2 years, the regional control rate was 4%. The incidence of histologically N+ nodes from elective MRNDs ranges from 10% to 15%.³⁰⁻³³

Pitman et al³⁴ compared 280 patients who underwent 322 MRNDs against 114 patients who underwent 168 SNDs in the clinically N0 neck. These patients had primary tumors of the oral cavity, oropharynx, hypopharynx, and larynx. The overall recurrence rate for the MRNDs was 5.8%, compared with 3.5% for the SNDs. This was not statistically significant, and so the researchers were led to conclude that SNDs are as effective as MRNDs. Clayman and Frank,¹⁷ in 1998, reviewed the literature comparing SNDs with MRNDs and elegantly presented arguments for and against SNDs. Recognizing the limitations of retrospective analyses, these researchers concluded that an SND is as effective as an MRND in the elective treatment of clinically N0 necks. Leemans and Snow,³⁵ however, disagree, and combining data of more than 1000 patients who underwent both procedures, they calculated a statistically improved control rate for patients undergoing an MRND. Johnson,¹⁸ who believes that MRND may be adequate treatment for selected patients with no more than 2 involved nodes without extracapsular extension, asks, "Is selective neck dissection [alone] adequate therapy for patients with limited occult metastases?" Most of the lit-

erature quoted here suggests a tendency to administer adjuvant radiation therapy even in cases of limited microscopic disease in patients undergoing a selective dissection. The Brazilian Head and Neck Cancer Study Group³⁶ published, in 1998, a multi-institutional study of 148 patients with oral cavity cancer who underwent an elective SOHD or MRND. To date, this is the only prospective study comparing these 2 procedures. There were no significant differences in local control and overall survival. In the patients who underwent MRND, metastases to level IV were seen in 5 cases, 2 of which had positive nodes solely at this level. Although the authors conclude that SNDs are oncologically safe, they mention 2 caveats: first, even experienced surgeons were not able to accurately predict occult disease in the neck; second, SNDs should be performed only by experienced head and neck surgeons and not surgeons in training or community surgeons.

The role of SNDs in the N+ neck is controversial. Byers et al,³⁷ in a review of 517 SNDs with and without adjuvant radiation therapy, found that the neck recurrence rates in patients with N1 disease was 5.6% and 35.76%, respectively. For N2b disease, the regional failure rate was over 30% regardless of whether the patients received adjuvant radiation therapy. Chepeha et al³⁸ reported a series of 58 SNDs, 26 of which treated clinically N+ neck lesions smaller than 3 cm. Adjuvant radiation therapy was given for findings of more than 2 positive nodes, extracapsular spread, or advanced primary stage. Six patients developed recurrent neck disease, 2 of which occurred outside the dissected field. The regional control rate with surgical salvage was 94%. Kolli et al²⁰ retrospectively described 69 patients who underwent 84 SOHDs for oral cavity and oropharyngeal cancers for both N0 and N+ disease. The regional control rates were 88% for pathologic N0 compared with 71% for pathologic N+. They found that an SOHD alone was oncologically inadequate for patients with histologically N+ neck disease, and that adjuvant radiation therapy significantly improved regional control rates.

Pellitteri et al²¹ noted a 3% recurrence rate in 33 patients with N0 disease compared with 12.5% in 34 patients with N+ disease. Andersen et al³⁹ reviewed 106 patients with N+ disease and reported 9 recurrences, 6 within the side of the dissected neck, reflecting a regional control rate of 94.3%. Seventy-one percent of patients received adjuvant radiation therapy. Finally, Muzaffar⁴⁰ recently conducted a 25-year review comparing SND with MRND in patients with neck disease, all receiving adjuvant radiation therapy. Regional recurrence rates were 3.3% and 5.2% in SND and MRND, respectively, which led him to conclude that an SND with adjuvant radiation therapy is as efficacious as an MRND. However, the overall improved 2-year disease-free survival rate of 80% for the SND group vs 64% for the MRND group suggests that the 2 groups may not be comparable.

In addition to oncologic efficacy, an important consideration in the comparison of the 2 neck dissection types is the associated morbidity affecting shoulder function. Good prospective data are lacking in this area, but a well-conducted study by Chepeha et al,⁴¹ using a validated functional shoulder assessment scale, found a significant im-

provement in postoperative shoulder function in patients receiving an SND compared with those undergoing MRND.

In conclusion, we lack adequate objective data to truly resolve the issue of how best to surgically manage the N0 and limited N+ neck. Given the narrow spectrum of comparable rates reported in the literature, and given that the paradigm shift has already taken place in the management of the N0 neck, important considerations should now be (1) indications for postoperative radiation therapy in patients with histologically positive N1 disease or with 2 or fewer nodes without extracapsular spread and (2) whether micrometastases should be actively sought and considered in the decision-making process. These controversial issues need to be studied objectively and prospectively, with caution, as we move into the realm of the ultimate SND, the sentinel node biopsy, bearing in mind that the ultimate goal of oncologic safety must never be compromised.

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