Results of Selective Neck Dissection in Management of the Node-Positive Neck

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Background: Although increasingly accepted in treatment of the N0 neck, use of selective neck dissection in patients with node-positive squamous cell carcinoma of the head and neck remains controversial.

Objective: To determine the oncologic efficacy of selective node dissection in patients with node-positive squamous carcinoma of the head and neck.

Setting: Three tertiary care academic/Veterans Affairs medical centers.

Methods: Ten-year retrospective medical chart review of 106 previously untreated clinically and pathologically node-positive patients undergoing 129 selective neck dissections and followed for a minimum of 2 years or until patient death.

Results: Regional metastasis was clinically staged as N1 in 58 patients (54.7%), N2a in 5 (4.7%), N2b in 28 (26.4%), N2c in 14 (13.2%), and N3 in 1 (0.9%). Extracapsular extension of tumor was present in 36 patients (34.0%), and postoperative radiation therapy was administered to 76 patients (71.7%). Overall, 9 patients experienced disease recurrence in the neck. Six of these recurrences were in the side of the neck that had undergone selective neck dissection, for a regional control rate of 94.3%.

Conclusions: These results support the use of selective neck dissection in carefully selected patients with clinically node-positive squamous cell carcinoma of the head and neck region. Regional control rates comparable to those achieved with comprehensive operations can be achieved in appropriately selected patients.


THE PRIMARY goal in the treatment of patients with head and neck cancer is control of the disease. However, with increasing recognition of the substantial morbidity of radical surgical treatment, more emphasis is being placed on surgical conservatism if it does not negatively impact disease control and if it offers improved posttreatment function and cosmesis. The evolution of neck dissection is representative of this trend. Radical neck dissection, first described by Crile1 in 1906, has served as the standard method of managing cervical metastases in patients with head and neck cancer for most of the century. Radical neck dissection accomplishes en bloc removal of all cervical lymphatic contents believed to be involved with or at risk for metastatic disease from head and neck malignancy and includes removal of the sternocleidomastoid muscle, internal jugular vein, submandibular gland, and spinal accessory nerve. This operation produces substantial postoperative morbidity from cosmetic and functional standpoints, with typical shoulder dysfunction seen after this surgery.2 With time, surgeons have challenged the necessity of such radical neck surgery and have explored the feasibility of modifications to it.

The rationale for such modifications is based on the finding that modified radical neck dissection (especially modifications that preserve the spinal accessory nerve) results in improved postoperative shoulder function3 and on the realization that neck recurrence is still a significant problem despite the extensiveness of radical neck dissection. Improved understanding of lymph node drainage patterns4,5 and fascial compartments of the neck6 and better understanding of the indications for adjuvant postoperative radiation therapy7,8 have given further impetus to the trend away from the routine use of radical neck dissection in all patients.

Selective neck dissection (SND), which involves selective removal of nodal...
groups most at risk for metastasis with preservation of all nonlymphatic structures, has gradually gained acceptance in the clinically N0 neck and has demonstrated regional control and survival rates similar to those of more extensive neck dissections.8-11

Although SND has been accepted by many as appropriate for use in the clinically node-negative neck, its use in patients with clinically obvious (palpable) metastatic disease remains extremely controversial; however, extension of the indications for its use in this setting seems logical. In the absence of factors that would alter normal lymphatic flow in the neck, such as previous neck surgery, radiotherapy, or the presence of massive obstructive adenopathy, the rationale behind the operation, which like its more radical counterpart seeks to remove the lymph nodes involved by or at risk for involvement by head and neck cancer, remains valid. The finding of equivalent disease control rates in clinically N0 but pathologically node-positive patients undergoing surgery helped encourage this approach.12

Traynor et al13 previously published a smaller study describing the use of SND in patients with known cervical metastases, which showed that in selected patients with N1 or N2 neck staging, SND gave results comparable to those of more extensive neck dissections. The present study is an extension of that previous experience involving increased numbers of patients, increased follow-up time, and involvement of other institutions.

**MATERIALS AND METHODS**

The medical records of all patients who underwent neck dissection at Oregon Health Sciences University and the University of Connecticut Health Center between January 1989 and December 1998 and at Memorial Sloan-Kettering Cancer Center between January 1995 and December 1998 were reviewed. Patients undergoing SND who had clinically obvious metastatic disease and pathologically proven regional metastases were included in the analyzed sample. Patients with nonsquamous carcinoma and oropharynx, a lateral neck dissection involving removal of levels II through IV was performed. For primary tumors of the larynx and hypopharynx, a lateral neck dissection involving removal of levels II through IV was performed.

Patients were considered for SND only in the setting of no previous treatment to the head and neck for this malignancy. Only patients with freely mobile metastatic disease in the neck were eligible. These criteria generally restricted the use of SND to patients with nodal disease less than N3 in stage. Patients whose operations were extended owing to intraoperative findings to include resection of nonlymphatic structures usually preserved during SND (ie, the spinal accessory nerve, internal jugular vein, or sternocleidomastoid muscle) were not included in this study.

All neck dissection specimens were reviewed by a staff pathologist. Patients in whom evidence of extracapsular spread (ECS) or multiple levels of nodal involvement were identified received postoperative radiotherapy on this basis. In addition, other patients received postoperative radiotherapy for indications outside of the neck dissection, such as extensive primary disease or positive margins at the primary resection site. Actuarial disease-specific survival rates and rates of local regional and distant recurrence were determined using the Kaplan-Meier method.

**RESULTS**

Using the patient selection criteria outlined previously, 106 patients were identified who had undergone SND in a clinically and pathologically node-positive neck.

Thirty patients (28.3%) were women and 76 (71.7%) were men; mean ± SD age at the time of treatment was 61.0 ± 11.1 years (range, 35-92 years), and mean ± SD follow-up was 3.4 ± 2.6 years (range, 0.2-10.4 years). Primary site and regional metastatic characteristics are given in Table 1. Most patients had advanced disease at the primary site staged T3 or greater. The regional staging of patients is given in Table 2. Patients were relatively equally divided between N1 and N2 staging, with most N2-staged patients being so classified because of multiple nodal metastases either in the ipsilateral (28 patients) or in the bilateral or contralateral (14 patients) sides of the neck. All of these patients’ nodal metastases were located in levels I through IV of the neck. No patient had clinical evidence of nodal disease at level V.

One hundred twenty-nine neck dissections were performed in 106 patients; 31 patients (29.2%) underwent bilateral neck dissection and 75 (70.8%) underwent unilateral dissection. The types of neck dissection performed are given in Table 3. Extracapsular spread of disease was noted in 36 patients (34.0%). Postoperative radiation therapy to the neck was administered to 76 pa-

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**Table 1. Primary Site Location and Stage of Squamous Cell Carcinoma in 106 Patients Who Underwent Selective Neck Dissection**

<table>
<thead>
<tr>
<th>Location</th>
<th>Patients, No. (%)</th>
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<tbody>
<tr>
<td>Oral cavity</td>
<td>42 (39.6)</td>
</tr>
<tr>
<td>Oropharynx</td>
<td>37 (34.9)</td>
</tr>
<tr>
<td>Larynx</td>
<td>20 (18.9)</td>
</tr>
<tr>
<td>Hypopharynx</td>
<td>7 (6.6)</td>
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**Table 2. Nodal Stage Characteristics of 106 Patients Who Underwent Selective Neck Dissection**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Patients, No. (%)</th>
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<tbody>
<tr>
<td>N1</td>
<td>58 (54.7)</td>
</tr>
<tr>
<td>N2a</td>
<td>5 (4.7)</td>
</tr>
<tr>
<td>N2b</td>
<td>28 (26.4)</td>
</tr>
<tr>
<td>N2c</td>
<td>14 (13.2)</td>
</tr>
<tr>
<td>N3</td>
<td>1 (0.9)</td>
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patients (71.7%); the mean dose administered was 6729 rad (6729 cGy).

Actuarial disease-specific survival at 5 years was 68.8%. Disease-specific survival correlated with nodal status. Five-year actuarial disease-specific survival was 88.1% in N1 patients, 40.0% in N2a patients, 50.1% in N2b patients, and 30.0% in N2c patients (Figure 1). Six patients experienced disease recurrence in the surgical neck (5.7%). Five-year actuarial disease control in the surgical neck was 92.2%. Recurrence in the surgical neck correlated with nodal stage at presentation early in follow-up; however, by 5 years, the recurrence rate was similar for patients staged N1, N2b, and N2c. Five-year actuarial failure rates in the neck were 6.7% in N1 patients, 22.0% in N2a patients, 6.7% in N2b patients, and 7.7% in N2c patients (Figure 2). Extracapsular spread of disease correlated with recurrence in the neck. Patients without ECS of disease had a 5-year actuarial failure rate in the neck of 2.4%, whereas those with ECS of disease had a 21.9% failure rate (P = .05) (Figure 3). Patients with and without ECS of disease had disease-specific survival at 4 years of 55.8% and 75.3%, respectively (P = .02) (Figure 4). Of patients with recurrence in the surgical neck, all 6 had recurrence in the field of the previous neck dissection. Four patients had recurrence at level I, 2 at level II, 1 at level III, and 1 at levels I, II, and III (some patients had recurrence at multiple sites in the surgical neck). In no patient was neck recurrence noted outside of the expected area of lymphatic drainage based on its primary site, and no patient had recurrence in the posterior triangle.

In contrast to the low regional recurrence rate (4.3%) reported in this patient group, at 5 years’ follow-up, 12.3% of patients had experienced local recurrence, and 28.9% had developed distant metastasis.

**COMMENT**

Traditionally, the treatment of patients with clinically palpable metastatic disease in the neck has been radical neck dissection. Modifications of the radical neck dissection over time have been made in a logical manner based on firm anatomic and oncologic principles. Radical neck dissection

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**Table 3. Types of Neck Dissection Performed in 106 Patients Who Underwent Selective Neck Dissection (SND)**

<table>
<thead>
<tr>
<th>Type of SND and Level</th>
<th>Patients, No. (%)</th>
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<tr>
<td><strong>Unilateral</strong></td>
<td></td>
</tr>
<tr>
<td>I-III</td>
<td>57 (53.8)</td>
</tr>
<tr>
<td>II-IV</td>
<td>7 (6.6)</td>
</tr>
<tr>
<td>I-IV</td>
<td>11 (10.4)</td>
</tr>
<tr>
<td><strong>Bilateral</strong></td>
<td></td>
</tr>
<tr>
<td>I-III</td>
<td>10 (9.4)</td>
</tr>
<tr>
<td>II-IV</td>
<td>12 (11.3)</td>
</tr>
<tr>
<td>I-III and II-IV</td>
<td>1 (0.9)</td>
</tr>
<tr>
<td>II-IV and I-IV</td>
<td>2 (1.9)</td>
</tr>
<tr>
<td>I-III and I-IV</td>
<td>1 (0.9)</td>
</tr>
<tr>
<td>I-III and CND</td>
<td>3 (2.9)</td>
</tr>
<tr>
<td>II-IV and CND</td>
<td>2 (1.9)</td>
</tr>
</tbody>
</table>

*CND indicates comprehensive neck dissection.*
section, which was first conceived of as an en bloc resection of the lymphatic structures of the neck, is, in fact, not a complete en bloc resection; other structures in the “bloc,” such as the hypoglossal and vagus nerves and the carotid artery, have never been routinely removed with this operation. Furthermore, results of anatomic studies confirm that the lymphatic structures of the neck lie within a system of aponeurotic compartments that envelop the muscles and vessels of the neck but, aside from close anatomic proximity, have no relationship to the lymphatic structures of the neck. It therefore seemed logical that preservation of other structures usually removed during radical neck dissection, and, in fact, enveloped by these same fascial planes enveloping structures usually preserved during radical neck dissections, would be equally feasible. Recognition of the significant morbidity of accessory nerve sacrifice lead early investigators to turn their initial attention to modification of the radical neck dissection with preservation of this nerve alone. Such modifications, even in selected patients with node-positive disease, have been shown to be as effective as radical neck dissection. Bocca et al also described a “functional” neck dissection in which all 5 nodal groups of the neck are removed and all lymphatic structures are preserved. In the series by Bocca et al, regional recurrence rates in patients with N0 necks were 2.4%, and recurrence rates of 30% were noted for N1 and N2 necks. These rates compared favorably with those in similar patients who had undergone radical neck dissection by the same surgeon.

Several studies have demonstrated that lymphatic flow in the neck occurs in a predictable pattern. Flow to the nodes of the posterior cervical triangle does not occur from nodes in the jugular chain. The lack of drainage to the posterior cervical triangle has been postulated to be due to the presence of lymphatic valves in the cervical lymphatics. Further evidence of the lack of flow to the posterior cervical triangle is demonstrated in a study by Davidson et al of more than 1000 comprehensive neck dissections in patients with squamous cancer of the head and neck that identified metastases to the posterior triangle in only 3% of patients. There was a slight increase of metastases to level V when clinically positive nodes were evident in other levels (5%). These results have been confirmed by other investigators.

Other studies have demonstrated that metastases to the neck from cancers of the upper aerodigestive tract occur in a predictable pattern. Studies by Shah show a predominance of metastases to certain regions based on the primary site. Most oral cavity cancers metastasize to the lymph nodes at levels I through III. Oropharyngeal, hypopharyngeal, and laryngeal lesions demonstrated a predilection for metastatic disease to levels II through IV. Metastatic nodal disease outside of the predominant regions of spread has been shown in this study to be unusual in the absence of involvement of the expected regions.

The evidence of compartmentalization of the cervical lymphatics and the findings of predictable lymphatic flow in the neck do not support the routine removal of all cervical lymph node groups or the routine sacrifice of nonlymphatic structures such as the sternocleidomastoid muscle, internal jugular vein, or spinal accessory nerve in neck dissection. This type of neck dissection (SND) represents the next logical step in the modification of radical neck dissection. Selective neck dissection has been extensively used in patients with a clinically node-negative neck, and treatment results have been shown to be comparable to those of more extensive lymphadenectomies in a similar setting. Selective neck dissection, as a result, has become accepted as a treatment modality for patients without clinical evidence of cervical nodal metastasis.

Use of SND in the clinically positive neck has been controversial. Our unusual selection criteria for patients analyzed in this study, that is, those with clinically and pathologically node-positive neck dissection, was intended to emphasize that these operations were purposefully performed on patients with known cervical metastases, not those who were clinically node-negative at presentation and were later found to have pathologic evidence of nodal metastases. The inclusion of only patients who were clinically and pathologically node-positive in the neck was also done to exclude the small, but definite, incidence of patients who have clinically palpable adenopathy that turns out to be pathologically node negative on postoperative examination. Other researchers have reported series of patients undergoing SND in the clinically node-positive setting. Medina and Byers reported a series that included 114 patients who were clinically node positive, with most being staged N1. Of these patients, 91 (79.8%) had pathologic evidence of metastasis to the cervical lymphatics. When only surgical therapy was performed, regional recurrence of 10% for pathologic N1 disease without ECS and 24% when multiple nodes or ECS was present were described. Postoperative radiotherapy decreased recurrence to 15% in patients with multiple positive nodes or ECS. Byers reported similar recurrence rates in patients undergoing planned therapeutic supramohyoid neck dissection with and without postoperative radiotherapy. Seventy percent of these patients had either ECS of disease or multiple levels of involvement. Based on these re-
sults, Byers suggested that SND has a role in selected patients with early-stage metastatic disease in the neck and that the addition of postoperative adjuvant radiotherapy can improve the disease control rates when ECS, multiple levels of disease, or both are identified. The results reported herein are consistent with those of these other researchers and are comparable to the results reported for more comprehensive operations.  

Based on the aforementioned anatomic and clinical data, it is reasonable to extend the indications for SND to patients with a higher stage of disease, that is, N2, but with smaller, nonfixed nodes. The results of our study support this contention. However, important caveats deserve emphasis. We do not advocate the use of SND in all patients with clinically positive adenopathy. Specifically, SND, we believe, should be applied only in patients without massive adenopathy. Evidence of nodal fixation or obvious gross ECS, a history of neck surgery, and radiotherapy are believed to be relative contraindications to this approach until further information is gathered. The small number of patients in this study with N2a and N3 disease reflects this philosophy. In addition, the surgeon must be prepared to modify the treatment plan during surgery for metastatic disease in the neck. If during the operation unexpected findings, such as adhesion to the jugular vein, sternocleidomastoid muscle, or spinal accessory nerve, are encountered, then those structures should be resected to completely remove all gross disease. In addition, when a suspicious lymph node is encountered at the lowest planned level of the dissection, we believe that it is prudent to extend the operation to include the next nodal group. This principle, however, does not apply when suspicious lymph nodes are encountered at level IV. We do not believe that it is necessary to extend the operation to level V because of the strong evidence that lymphatic flow does not occur from the jugular chain to the posterior triangle; however, when nodal metastasis is encountered at level IV, the surgeon may consider elective treatment of the ipsilateral para-tracheal and upper mediastinal nodes. When the surgical procedure planned includes total laryngectomy, this treatment should include surgical removal of the nodes in question. However, when total laryngectomy is not planned, the risk of injury to the recurrent laryngeal nerve inherent to lymphadenectomy in this area should be considered.

In conclusion, SND can be applied safely and effectively to appropriately chosen patients with clinically node-positive metastasis in the neck from squamous cell carcinoma of the upper aerodigestive tract. Regional control rates comparable to those achieved with more comprehensive operations can be achieved in appropriately selected patients.

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REFERENCES