Superselective Neck Dissection After Chemoradiation

Feasibility Based on Clinical and Pathologic Comparisons

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Objective: To determine whether superselective neck dissection (removal of 2 or less contiguous neck levels) is effective salvage surgery for patients with residual single-level adenopathy after concomitant intra-arterial cisplatin and radiotherapy.

Design: Analysis of prospectively collected data.

Subjects: The study group comprised 177 patients (239 heminecks) with N1 disease.

Interventions: Intra-arterial treatment with cisplatin (150 mg/m²) on days 1, 8, 15, and 22 and radiation therapy (2 Gy/d) 5 times per week for 7 weeks. Comparisons were made between neck-level–specific disease at restaging and pathologic disease after neck dissection.

Results: Tumor sites included oropharynx (n=81), hypopharynx (39), larynx (n=27), oral cavity (n=19), and other (n=11). Response of nodal disease based on clinical evaluation was as follows: complete response, 89 patients (50%); partial response, 81 patients (46%); progressive disease, 4 patients (2%); and unevaluable, 3 patients (2%). Of the 89 patients whose necks were restaged as a partial response, 73 had clinical evidence of residual adenopathy involving only 1 neck level. Within this subset, 54 patients (37 heminecks) subsequently underwent a salvage neck dissection, for which comparisons were made between the restaging evidence of residual adenopathy and the pathologic findings that were specific for each neck level. Only 2 of the 54 patients had evidence of pathologic disease extending beyond the single neck level: one had disease in a contiguous neck level, and the other had disease in a noncontiguous level. The use of superselective neck dissection with removal of only 2 contiguous neck levels would have encompassed known disease in all but 1 patient.

Conclusion: Superselective neck dissection is feasible after this specific chemoradiation protocol has been administered to patients with persistent nodal disease that is confined to 1 level.

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CHEMORADIATION HAS BECOME AN IMPORTANT TREATMENT OPTION FOR ADVANCED HEAD AND NECK CANCER. WHEN COMPARED WITH RADIATION THERAPY ALONE, THE RESULTS HAVE ShOWN SIGNIFICANT IMPROVEMENT IN THE RATES OF LOCAL AND REGIONAL DISEASE CONTROL AND SOME MODEST IMPROVEMENT IN OVERALL SURVIVAL.1 Also, the combination of chemotherapy and radiation therapy administered concurrently appears to be more potent than sequential chemoradiation therapy. Despite the success of this approach, there continues to be controversy on how to manage the associated nodal disease. The common approach used by head and neck surgeons is to perform surgical salvage in the manner that has been well accepted and used based on historical experience with patients who were treated with definitive radiation therapy only. Within this framework, it is a commonly held dictum that persistent or recurrent disease should be managed with surgical procedures that are all encompassing or radical as opposed to those that specifically address the levels of the neck that are at greatest risk.

Compared with radiation therapy alone, concomitant chemoradiation therapy for nodal disease in the neck, with its more potent effects, may allow a more limited surgical approach for residual adenopathy than the more traditional philosophy. We hypothesized that the conservative approach known as superselective neck dissection is an effective surgical salvage procedure for patients with residual lymphadenopathy that is confined to a single neck level after chemoradiation. We have previously defined superselective neck dissection as the complete removal of all fibrofatty tissue contents, including...
lymph nodes, along the defined boundaries of 1 or 2 contiguous neck levels. The comparison of the presence of neck-level-specific nodal disease before and after neck dissection in patients with head and neck cancer who have completed a chemoradiation protocol as definitive treatment for nodal disease may provide support for this hypothesis.

**METHODS**

Between 1993 and 1998, a total of 177 patients with node-positive stage III/IV squamous cell carcinoma of the upper aerodigestive tract were treated with the concomitant intrarterial cisplatin and radiotherapy protocol known as RADPLAT at the University of Tennessee, Memphis. RADPLAT consisted of the administration of intrarterial cisplatin (150 mg/m²) on days 1, 8, 15, and 22 and radiation therapy (1.8-2.0 Gy/d) 5 times a week for 7 weeks. Collectively, there were 239 heminecks with clinically positive nodal disease among the 177 patients in the series. Tumor sites included the oropharynx (n=81), hypopharynx (n=39), larynx (n=27), oral cavity (n=19), and other (n=11). Pretreatment nodal classification was as follows: N1 (n=39), N2a (n=15), N2b (n=44), N2c (n=48), and N3 (n=31).

All patients underwent computed tomography (CT) of the head and neck before and 6 weeks after treatment. The head and neck team reviewed all pretreatment CT scans with a radiologist at the weekly treatment planning conference, and the presence or absence of abnormal nodes within each neck level was prospectively recorded. There were 122 neck dissections performed in 95 patients for the purpose of removing suspected residual disease. After 1995, patients who did not have clinical evidence of residual adenopathy were not recommended for neck dissection. Salvage neck dissections were performed 8 weeks after chemoradiation. The extent of the neck dissection was not uniform in that the majority of patients underwent selective neck dissection rather than modified radical neck dissection. All selective neck dissections encompassed at least 3 neck levels. The surgical specimens were routinely separated by the surgeon and submitted to the pathologist in separate containers corresponding to each neck level. The presence or absence of pathologic lymph node disease for each neck level was then prospectively recorded in the database.

The analysis of the data included comparisons between the presence of neck-level-specific disease before and after chemoradiation based on physical examination and CT scan findings and on the subsequent findings of pathologic lymph nodes by neck level after neck dissection. Specific comparisons were made for the subset of patients who had clinical evidence of residual lymphadenopathy confined to a single neck level.

**RESULTS**

Treatment response of disease within the regional lymph nodes based on clinical criteria (findings of physical examination and radiologic studies) was as follows: complete response, 89 patients (50%); partial response, 81 patients (46%); progressive disease, 4 patients (2%); and unevaluable, 3 patients (2%). Of the 81 patients whose nodal disease was restaged as a partial response, 73 had clinical evidence of residual adenopathy confined to 1 neck level. Within this subset, 54 patients (57 heminecks) subsequently underwent salvage neck dissection and 16 did not. The 16 patients did not undergo salvage neck dissection because they (1) died of disease or other causes (n=3); (2) had evidence of persistent unresectable local disease (n=6); (3) had evidence of distant metastases (n=4); or (4) were noncompliant (n=3).

Among the group of 54 patients who subsequently underwent neck surgery, the distribution of neck-level-specific nodal metastases for each hemineck based on clinical findings before treatment is outlined below.

<table>
<thead>
<tr>
<th>Level</th>
<th>No. (%) of Heminecks With Positive Nodal Disease (n = 57)</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>19 (8)</td>
</tr>
<tr>
<td>II</td>
<td>51 (89)</td>
</tr>
<tr>
<td>III</td>
<td>25 (66)</td>
</tr>
<tr>
<td>IV</td>
<td>6 (10)</td>
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<tr>
<td>V</td>
<td>4 (12)</td>
</tr>
<tr>
<td>VI</td>
<td>1 (2)</td>
</tr>
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Level II was involved most commonly (89% of heminecks), whereas level VI was involved the least (2%). The number of neck levels that were determined to be positive for lymphadenopathy before treatment was as follows: 1 level, 29 heminecks; 2 levels, 23 heminecks; 3 levels, 4 heminecks; and 4 levels, 1 hemineck. With regard to the grouping of clinically positive neck levels, the most common presentation was involvement of level II only (27 heminecks), followed by involvement of levels II and III (17 heminecks). There were 3 instances of involvement of levels II through IV and 2 instances of involvement of level III only. Each of the remaining 8 heminecks had different distributions including: levels I through III, I through II, II through V, II and IV, IV and V, and V only.

Among the 54 patients who underwent salvage neck dissection, comparisons of the respective neck-level-specific disease after chemoradiation and neck dissection indicated that only 2 of the patients had evidence of pathologic disease extending beyond the clinically predicted single neck level. The remaining 52 patients had pathologic findings of positive lymph node disease corresponding to the same levels previously determined by the postchemoradiation restaging analysis, which was based on CT scans and physical examination findings. Details of the 2 situations in which the patients had more extensive disease than predicted are as follows:

Patient 1 presented with a squamous cell carcinoma of the right tonsillar fossa clinically staged as T3 N2c (N2b, right side; N1, left side). There was clinical evidence of lymphadenopathy in level III on the left side and in levels II through IV on the right side. After chemoradiation, the patient had residual adenopathy in level II in the right side of the neck and no clinical evidence of residual disease in the left side of the neck. A selective neck dissection of the right side of the neck was performed, with removal of levels II through IV. Pathologic examination showed evidence of metastatic disease in 1 of 5 nodes in level II, 0 of 6 nodes in level III (although there was calcified material surrounded by a foreign body giant cell reaction), and 3 of 6 nodes in level IV. Operative findings indicated grossly abnormal tissue in more than 1 neck level.

Patient 2 presented with a squamous cell carcinoma of the right tonsil staged as T4 N2c (N2b, right side; N1,
left side). There was clinical evidence of lymphadenopathy in levels II through IV on the right side and level II on the left side. After chemoradiation, there was clinical evidence of lymphadenopathy in level II on the right side and in level II on the left side. The patient underwent a bilateral selective neck dissection with removal of levels II through IV on each side. Pathologic examination showed 2 of 2 positive nodes in level IIA (right side), 2 of 6 positive nodes in level IIA (left side), 2 of 6 positive nodes in level IIB (left side), and 1 of 4 positive nodes in level III (left side). It should be noted that this patient refused to undergo the recommended salvage neck dissection until 14 weeks after chemoradiation.

Therefore, both patients had pathologic evidence of residual nodal disease involving more than 1 neck level; one of them had disease in a second neck level that was contiguous (patient 2), and the other had involvement of a second neck level that was noncontiguous (patient 1). However, in patient 1, there was grossly abnormal lymphatic tissue in the intervening neck level. Patient 1 is the only individual in the series of 54 patients who would not have had all known residual nodal disease removed by a superselective neck dissection.

Our data suggest that it is feasible to perform a conservation salvage neck dissection that is limited to 2 contiguous neck levels for selected patients with persistent lymph node disease after chemoradiation for advanced head and neck cancer. Patients who fall into this selected subset can be identified as those who have clinical evidence of residual adenopathy that is confined to a single neck level as determined by CT imaging and physical examination findings. The data indicate that a systematic dissection along the boundaries defined by the respective neck level in which there is residual adenopathy, as well as a similar dissection of the contiguous neck level containing the secondary echelon of lymph nodes, would have encompassed the residual disease in all but 1 patient. In that case, the amount of abnormal tissue in the intervening neck level found in the surgical specimen would likely have provided sufficient intraoperative evidence for the dissection of more than 2 neck levels. Thus, it appears that the use of more extensive neck dissections, particularly those that remove all 5 levels, is likely unnecessary in cases involving limited residual lymphadenopathy following RADPLAT and possibly other regimens of concomitant chemoradiation.

The concept of selective neck dissection evolved through the work of a number of head and neck surgeons at several institutions, most notably The University of Texas M. D. Anderson Cancer Center, Houston. It is based on the fact that the patterns of lymphatic spread by upper aerodigestive tract cancers are predictable. However, it is important to note that these observations were made for patients with previously untreated disease. More recently, some investigators, including ourselves, have applied the principles of selective neck dissection to patients who have received previous treatment such as radiation alone and chemoradiation. Under these circumstances, the selective neck dissection has involved the removal of at least 3 contiguous neck levels. To our knowledge, others have not proposed the superselective neck dissection, in which the extirpation is limited even further to 2 contiguous levels.

It is important to emphasize that the use of selective and superselective neck dissection after chemoradiation should be considered either as part of the treatment regimen (planned neck dissection) or as an early intervention for persistent disease (early salvage neck dissection). Data are lacking to support this concept for late neck recurrence, in which case the salvage neck dissection should remain a more extensive procedure. In our series, there were 89 patients (50%) who had a complete clinical response of the regional lymphadenopathy associated with their cancer after RADPLAT and therefore did not undergo neck dissection. Regarding this subset of complete responders, we previously reported that the yield of positive nodal disease was 0% among patients with bulky nodal disease (N2-N3) who underwent neck surgery. Based on this finding, we do not recommend cervical lymphadenectomy unless there is clinical evidence of residual adenopathy.

The treatment outcomes of the patients who were analyzed in this study have previously been reported. We found that locoregional disease control and survival among patients who underwent selective and superselective neck dissections were not significantly different from those among patients who underwent a more radical approach. However, in our series, there were very few patients who underwent superselective neck dissection. Therefore, the data from the present analysis add further support to the concept of this ultraconservative approach.

Our conclusions are based on a data set of 54 patients who underwent neck surgery for residual lymphadenopathy that was confined to a single neck level. The data are derived from an analysis of patients who were treated with a protocol that included a more extensive neck dissection, thereby precluding any opportunity for an analysis of outcome among patients who were treated with superselective neck dissection. Further studies are needed to determine whether this approach results in better disease control of the neck than more traditional neck surgery. Ideally, such studies should involve a control group in which patients would have at least 3 neck levels removed for the same extent of residual adenopathy. More treatment outcome data are needed, but in the meantime, our analysis indicates that the use of superselective neck dissection is feasible, but the efficacy of this approach still needs to be proved.

The advantage of the surgical conservation approach used in this group of patients with residual nodal disease after chemoradiation primarily relates to the concept of minimizing the extent of the surgical field and thereby limiting the amount of soft tissue fibrosis. Fibrosis remains a significant problem for patients who require surgery in this setting because of its impact on swallowing, mastication, and range of motion of neck movements. When neck dissections that encompass removal of all 5 neck levels and/or nonlymphatic struc-
tures are performed, too often the result is a wound with extensive fibrosis, which in turn can have an adverse effect on various organ functions. Superselective neck dissections, however, can be performed with much smaller incisions, and the dissections are limited to 2 levels. Based on our more recent experience, patients who have undergone a superselective neck dissection typically recover without developing extensive soft tissue fibrosis. The majority of patients undergo the procedure and are discharged from the hospital on the same day.

The prospectively collected database used for this analysis was created during a time interval when positron emission tomographic scans were not widely available. Therefore, it was not possible to include such data as part of the staging and restaging process. Preliminary indications are that positron emission tomography may become an important part of the assessment process.\textsuperscript{11,12} It is possible that positron emission tomographic scans may allow surgeons to apply the principle of superselective neck dissection even more frequently.

The data used in our analysis involved patients who were treated in a relative uniform manner using concomitant intra-arterial cisplatin and radiotherapy (RADPLAT). It remains to be determined whether the results of our treatment and our conclusions about conservation neck surgery can be extrapolated to other situations in which a different regimen for chemoradiation is used. Nonetheless, we believe that there is a potential role for selective neck dissection in patients with evidence of persistent lymphadenopathy that is limited to 1 neck level and that this approach represents an important strategy to minimize dysfunction and to improve quality of life for survivors.

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Author Contributions: Drs Robbins, Shannon, and Vieira had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Robbins and Shannon. Acquisition of data: Shannon and Vieira. Analysis and interpretation of data: Robbins and Shannon. Drafting of the manuscript: Robbins. Critical revision of the manuscript for important intellectual content: Robbins, Shannon, and Vieira. Study supervision: Robbins and Vieira.

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REFERENCES