Prevalence of Nodal Metastases in the Submuscular Recess (Level IIb) During Selective Neck Dissection

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Objectives: To determine the prevalence of nodal metastases in the submuscular recess (SMR) in patients undergoing selective neck dissection (SND) and to identify potential risk factors for the presence of metastatic disease in the SMR.

Design: Prospective cohort study.

Setting: Academic tertiary care referral center.

Patients: Consecutive patients undergoing SND for squamous cell carcinoma of the head and neck between January 5, 1998, and November 23, 2001, were prospectively analyzed. Patients with a history of neck dissection or whose pathology reports did not clearly distinguish the SMR from other nodal levels were excluded from the study.

Interventions: Patients underwent SND based on the primary tumor site and well established regional lymphatic drainage patterns.

Results: Seventy-four patients underwent 90 SNDs, 16 of which were bilateral. The prevalence of metastases in the SMR was 1.6% (1/63) in clinically N0 necks and 11.1% (3/27) in clinically node-positive necks, with an overall incidence of 4.4% (4/90). There was a statistically significant association between SMR metastases and advanced pathologic N stage ($P = .003$), particularly with positive nodal disease in level IIa ($P = .001$). Extracapsular tumor spread was also shown to have a statistically significant association with metastases in the SMR ($P = .01$). No significant associations were observed between SMR metastases and primary tumor site ($P = .06$), clinical N stage ($P = .09$), a history of primary tumor recurrence ($P = .52$), or previous radiation therapy ($P = .68$).

Conclusion: The results of the present study suggest that nodal metastases in the SMR are rare in head and neck cancer patients undergoing SND.

from the skull base, and posterolaterally by the sternocleidomastoid muscle. Recognition of the SMR as a distinct anatomical sub-site is a relatively new concept, and resection of the SMR contents has traditionally been included as part of the dissection of level II. However, the prevalence of nodal metastases in the SMR is not well characterized, and dissection of the node-bearing tissue in this area is not without risk. Traction injury or disruption of blood supply to the SAN is often unavoidable during exposure of the SMR and may result in significant postoperative shoulder dysfunction, even in the presence of an anatomically intact nerve. These factors have led some authors to suggest that the potential morbidity and increased operative time associated with dissection of the SMR may be unnecessary in patients undergoing SND with limited nodal disease.

In the present study, we prospectively analyzed a series of consecutive patients undergoing SND to further characterize the prevalence of nodal metastases in the SMR. Metastatic involvement of these lymph nodes as it relates to primary tumor site, extent of nodal disease, extracapsular tumor spread, a history of primary tumor recurrence, and previous radiation therapy is discussed.

**METHODS**

Consecutive patients undergoing SND by 1 of 2 staff surgeons in the Department of Otolaryngology and Communicative Disorders at The Cleveland Clinic Foundation (R.M.E.) and the Department of Otolaryngology–Head and Neck Surgery at the Mayo Clinic Foundation (S.S.) between January 5, 1998, and November 23, 2001, were prospectively analyzed. All patients had a diagnosis of head and neck squamous cell carcinoma and underwent SND as part of their cancer treatment. Those SNDs that included level II and had the SMR (level IIb) dissected separately from the main neck dissection specimen were eligible for analysis. In cases of bilateral SND, each neck dissection specimen was considered separately. Patients with a history of neck dissection or whose pathology reports did not clearly distinguish the SMR from other nodal levels were excluded from the study. The American Joint Committee on Cancer18 TNM staging system was used for classification of the primary tumor and regional metastases. Patients with primary tumors warranting adjuvant therapy, extracapsular tumor spread, multiple positive lymph nodes within a single level, or involvement of 2 or more nodal levels routinely underwent postoperative radiation therapy.

For the purpose of this study, the contents of the SMR (level IIb) were dissected, labeled, and processed separately from the remainder of level II (designated level IIa) and the main neck dissection specimen. Specimens were then placed on a neck map to orient the appropriate nodal levels for subsequent histopathologic evaluation. The SMR was defined as the node-bearing tissue bordered deeply by the fascia overlying the splenius capitis and levator scapulae muscles, anteriorly and inferiorly by a plane at the level of the SAN, superolaterally by the inferior border of the posterior belly of the digastic muscle, superiorly by the skull base, and posterolaterally by the sternocleidomastoid muscle. All specimens were submitted for permanent histopathologic analysis. In addition to the total number of lymph nodes harvested and their location, the number of lymph nodes with metastatic disease was determined for each nodal level, including the SMR. The presence of extracapsular tumor spread was also documented.

**RESULTS**

Seventy-four patients underwent 90 SNDs, 16 of which were bilateral. There were 55 men and 19 women. The mean age was 63 years (range, 37-88 years). All patients had a histopathologic diagnosis of squamous cell carcinoma. The primary tumor site included 35 oral cavity tumors (47.3%), 15 oropharyngeal tumors (20.3%), 7 hypopharyngeal tumors (9.5%), 8 supraglottic laryngeal tumors (10.8%), 4 glottic laryngeal tumors (5.4%), 1 sinonasal tumor (1.4%), and 4 unknown primary tumors (5.4%) (Table 1). Primary tumor staging included 9 T1 lesions (12.2%), 22 T2 lesions (29.7%), 14 T3 lesions (18.9%), 23 T4 lesions (31.1%), and 6 T4x lesions (8.1%). Twenty-three (31.1%) of the 74 patients analyzed had a history of radiation therapy for their head and neck cancer.

Of the 90 SNDs performed, 63 (70.0%) were elective and 27 (30.0%) were therapeutic. This corresponded to a clinical N stage of N0 in 63 necks (70.0%), N1 in 2 necks (2.2%), N2a in 6 necks (6.7%), N2b in 9 necks (10.0%), N2c in 8 necks (8.9%), and N3 in 2 necks (2.2%). Twelve (19.0%) of 63 clinically N0 necks were found to have occult nodal disease at the time of SND. All neck dissections included level II, with the SMR (level IIb) removed separately from the remainder of level II (level IIa) and the main neck dissection specimen. Level I was included in 60 dissections, while levels III and IV were included in 88 and 72 dissections, respectively. The mean number of nodes harvested was 4.9 (range, 0-16).
for the SMR, 4.1 (range, 0-13) for level I, 9.0 (range, 0-29) for level IIa, 8.5 (range, 1-26) for level III, and 6.7 (range, 0-29) for level IV (Table 2).

The number of neck dissections with histopathologically positive nodal metastases at each level was determined and is presented according to primary tumor site in Table 3. The prevalence of nodal metastases in levels I through IV for each tumor site was consistent with well established cervical lymphatic drainage patterns. However, of 90 SNDs, only 4 (4.4%) were positive for nodal metastases in the SMR. The primary tumor site, clinical and pathologic TNM stage, and number of positive vs total SMR lymph nodes for these neck dissections are presented in Table 4. Two of the positive SMR neck dissections were from a single patient with an oral tongue primary tumor and bilateral neck metastases. The primary tumor sites for the remaining 2 positive SMR specimens were the hypopharynx and nasal cavity.

The prevalence of metastases in the SMR was 1.6% (1/63) in clinically N0 necks and 11.1% (3/27) in clinically node-positive necks, with an overall incidence of 4.4% (4/90). Of the 4 nodes that were positive in the SMR, 1 was clinically N0 and had failed previous radiation therapy for a T4 hypopharyngeal tumor. At the time of salvage surgery and neck dissection, this patient was found to have extensive bilateral nodal disease and was staged pN2c. The 3 remaining neck dissections that were positive in the SMR were associated with palpable bilateral nodal disease before surgery and were clinically staged N2c. This was consistent with subsequent pathologic neck staging, which was also N2c. Further analysis of the 4 SMR-positive necks demonstrated 3 specimens each with a single positive SMR node among 4 or 5 nodes harvested and 1 specimen with 4 positive SMR nodes among 4 nodes harvested.

Included in the analysis of potential risk factors for nodal metastases in the SMR were primary tumor site, clinical and pathologic N stage, extracapsular tumor spread, a history of primary tumor recurrence, and previous radiation therapy. The univariate associations between SMR metastases and these risk factors were assessed using Fisher exact test. Because of the small number of neck dissections with positive nodal disease in the SMR, no multivariate analysis was performed. $P<.05$ was considered statistically significant, suggesting that the associations that were observed between metastases to the SMR and the various risk factors were not solely because of chance.

A statistically significant association between the presence of nodal metastases in the SMR and advanced pathologic N stage was demonstrated with all 4 SMR-positive necks staged pN2c ($P=.003$). In no instance were there positive nodes in the SMR without metastatic disease in at least 1 other nodal level ($P=.001$). Level IIa was most commonly involved, with all 4 SMR-positive necks also positive in level IIa. In contrast, of the 26 necks with level IIa metastases were positive in the SMR, and 0 of the 64 necks without level IIa metastases were positive in the SMR. This translated to a statistically significant association between the presence of nodal metastases in the SMR and positive nodal disease in level IIa ($P=.001$). The presence of extracapsular tumor spread was also shown to have a statistically significant association with metastases in the SMR, with all 4 SMR-positive necks demonstrating extensive extracapsular spread at multiple nodal levels ($P=.01$). No statistically significant associations between metastases in the SMR and primary tumor site ($P=.06$), clinical N stage ($P=.09$), a history of primary tumor recurrence ($P=.52$), or previous radiation therapy ($P=.68$) were observed.

The regional recurrence rate with control of the primary site for patients with and without SMR involvement was also determined. Of 90 treated necks with a mean follow-up of 9.8 months (range, 2-30 months), there were 5 regional recurrences (5.6%) with the primary site controlled. For those necks with a positive SMR, the mean follow-up was 6.3 months and the regional recurrence rate was 25.0% (1/4). For those necks with a negative SMR, the mean follow-up was 9.9 months and the regional recurrence rate was 4.7% (4/86). However, comparison between SMR-positive and SMR-negative necks with appropriately matched pathologic N stage (N2c) demonstrated regional recurrence rates of 25.0% for both groups. The time to regional recurrence was not significantly different, with a mean of 9.0 months for SMR-positive necks and 8.25 months for SMR-negative necks ($P=.52$).

**COMMENT**

The most significant findings of this study are as follows:

- The prevalence of metastases in the SMR was 1.6% in clinically N0 necks (1/63) and 11.1% in clinically node-positive necks (3/27), with an overall incidence of 4.4% (4/90).
- There was a statistically significant association between metastases in the SMR and advanced N stage, particularly with positive nodal disease in level IIa.
- The presence of extracapsular tumor spread was also shown to have a statistically significant association with metastases in the SMR.
- No significant associations were observed between metastases in the SMR and primary tumor site, clinical N stage, a history of primary tumor recurrence, or previous radiation therapy.
- The limited duration of follow-up in the present study prevented meaningful analysis of regional recurrence rates and overall survival for patients with and without SMR involvement.

It is important to recognize that these findings are based on a small number of SMR-positive neck disse-
A similar study by Talmi et al. looked at patterns of ease in the supraspinal accessory lymph nodes and level IIa with findings of positive nodal disease. The study was conducted on 50 consecutive patients with head and neck squamous cell carcinoma undergoing radical neck dissection. Fifty-six neck dissections were performed, with 47 supraomohyoid neck dissections and 9 level IIa dissections. Nine percent of patients were found to have metastatic disease to the SMR. Only 1 (2.1%) of 47 supraomohyoid neck dissections had metastases to the SMR. Of those patients with positive supraspinal accessory lymph nodes, 95.2% had disease along the superior aspect of the nerve, which was defined as any node adjacent to the SAN along its course from the proximal end to the point of entrance into the sternocleidomastoid muscle. However, it was not specified whether the involved nodes were found above or below the SAN, and it is unlikely that the high prevalence of metastases to the superior SANs described by Schuller et al. reflects nodal disease outside the SMR.

More recent studies have suggested that metastasis to the lymph nodes of the SMR is rare. Kraus et al. conducted a prospective analysis of nodal metastases to the supraspinal accessory lymph nodes, an area corresponding to the SMR. Only 1 (2.1%) of 47 suprathyroid neck dissections in their series of clinically N0 necks had nodal metastases in the supraspinal accessory lymph nodes. This patient presented with a clinically T3 N0 tonsillar squamous cell carcinoma that was upstaged to N2b following neck dissection with findings of positive nodal disease in the supraspinal accessory lymph nodes and level IIa. A similar study by Talmi et al. looked at patterns of metastases in the upper jugular lymph nodes of the SMR. In this series of 102 neck dissections, only 4 specimens (3.9%) were found to have metastases in the SMR. Of these 4 necks, all were staged N2 or N3 and were positive for nodal disease in level IIa. Chone et al. evaluated potential risk factors for metastasis to the posterior triangle apex, an area defined by the authors using the same anatomical boundaries as those of the SMR. The overall prevalence of nodal metastases in this area was 6.5% (4/62 total neck dissections). The prevalence was 2.3% in clinically N0 necks and 16.7% in clinically node-positive necks. Histopathologic metastases at level IIa for clinically N0 necks and at level IIa or III for all neck dissections were considered significant risk factors for metastases to the posterior triangle apex. In all 3 of these studies, there were no instances of an isolated SMR metastasis without involvement of other nodal levels.

The results of the present study are consistent with previous reports and suggest that dissection of the SMR may be unnecessary in patients with a clinically N0 neck or limited nodal disease not involving level IIa. The use of frozen section histopathologic analysis at the time of neck dissection facilitates accurate and timely recognition of nodal disease in these patients and could be used to determine whether the SMR is at risk for metastases at the time of surgery. The identification of several risk factors such as advanced N stage, positive level IIa lymph nodes, and extracapsular tumor spread may help to further delineate which subset of patients undergoing SND is likely to benefit from dissection of the SMR. In doing so, we hope to limit the potential morbidity associated with dissection of the SMR without compromising the oncologic integrity of SND as a staging or therapeutic procedure in the management of head and neck cancer.

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REFERENCES