Objective: To evaluate sensory changes in the head and neck region associated with selective neck dissection with or without preservation of cervical root branches.

Design: Retrospective cohort study.

Setting: University tertiary referral hospital and a Veterans Affairs hospital.

Patients: Fifty-seven patients who had undergone 84 neck dissections with or without preservation of the sensory cervical root branches 3 or more months before evaluation.

Interventions: Questionnaire combined with head and neck sensory examination.

Main Outcome Measures: Neck and facial sensory function.

Results: Neck dissections with preservation of the cervical rootlets were most likely to be associated with a small area of anesthesia in the upper neck below the body of the mandible and anterior to the mid-body of the mandible ($P = .03$). Neck dissections without rootlet-preserving technique increased the area of anesthesia to include all other areas of the neck ($P = .02$).

Conclusions: Preservation of the cervical root branches resulted in a small, limited, and uniform area of the neck rendered permanently anesthetic. Conversely, sacrifice of the nerve branches led to a pattern of anesthesia involving the entire neck.


C RILE$^1$ introduced the concept of neck dissection in 1906 to optimize surgical treatment for patients with cervical lymphatic spread of head and neck cancer. In its earliest form, neck dissection routinely included removal of cranial nerve XI, the internal jugular vein, and the sternocleidomastoid muscle (SCM). Various nerve-, vein-, and muscle-preserving techniques have subsequently been developed.$^{2,3}$ The most recent development has been the selective neck dissection.$^{4,5}$ This approach is based on the reliability of site-specific lymph drainage patterns and has been verified as oncologically sound with appropriate application of adjunctive radiation therapy.$^{6,9}$ Different forms of selective neck dissection target specific nodal groups. Various types include anterolateral (taking levels I, II, III, and IV), supraomohyoid (I, II, and III), and lateral (II, III, and IV).

With the advent of selective neck dissection, elective neck dissection is assuming an ever-increasing role in the management and staging of the clinically negative neck.$^{6,13}$ A critical factor that dictates application of elective neck dissection is the morbidity associated with the operation. Major postoperative complications, such as shoulder syndrome,$^{10,17}$ cerebral hypertension,$^{18}$ and cosmetic deformity, have been reduced with the application of selective neck dissection. However, the ideal operation would be one in which the lymphadenectomy sufficiently removes all nodal disease at risk, with minimal major or minor negative sequelae to the patient. For this reason, it is important to fully characterize the impact and side effects of the procedure. The degree to which surgery causes localized numbness is one such factor and has important implications for patient counseling. Most surgical approaches for selective neck dissection anatomically spare the sensory branches of the cervical roots that provide cutaneous innervation to the skin of the neck. However, to date, no study has analyzed the impact of this anatomical preservation on final sensation. The purpose of this study was to determine patterns of anesthesia in the head and neck region associated with these procedures.
PATIENTS AND METHODS

PATIENTS

A retrospective review of patients who had previously undergone selective neck dissection with a minimum of 3 months follow-up after surgery was undertaken. Patients with skin grafts or flaps for skin surface reconstruction in the area of study were excluded. Hospital charts and operative notes were reviewed for information relating to age, sex, tumor stage, nodal status, primary site, radiation therapy, as well as specific nodal groups taken. Patients were selected for the study if they met the above criteria and were available for interview and examination in the head and neck clinic.

ANESTHESIA ANALYSIS

For analysis of areas of anesthesia, the patient’s face was divided into 8 regions (Figure 1). These areas were chosen based on anatomic landmarks that would hold meaning for the patient as well as the clinician. Region A represents the lower half of the external ear, extending from the root of the helix to the tip of the lobule. Region B is the midface and includes the face above a line drawn between the oral commissure and the angle of the mandible. Region C, the lower face, extends from below this line to the inferior border of the mandible. The neck is divided into upper and lower portions based on a horizontal line at the level of the thyroid prominence. Region D is the upper posterior neck behind the anterior border of the SCM. Region E is the upper anterolateral neck, extending from the anterior border of the SCM to a vertical line drawn from the facial notch of the mandible. Region F is the lower posterior neck behind the anterior border of the SCM. Region G represents the upper anterior neck between vertical lines drawn through each facial notch. Region H, the lower anterior neck, is the lower neck between these lines.

Patients were tested for response to simple fine-point sensation. The areas in which there was no sensation were mapped out and each region was given a sensory score as follows: 0, complete anesthesia in less than 25% of the region tested; 1, complete anesthesia in 25% to 75% of the region tested; or 2, complete anesthesia in more than 75% of the region tested.

Data were recorded based on the presence or absence of sensation; hypesthetic areas of skin were considered uninvolved. Each patient’s pattern of anesthesia was recorded on a template. Data were then cumulated and analyzed using the Mann-Whitney rank sum test and Kruskal-Wallis 1-way analysis of variance on ranks.

TECHNIQUE

Two surgical techniques (nerve-preserving and nerve-sacrificing) were used in this patient population that reflected a difference in surgical technique between the individual attending surgeons at the time of operation, not tumor or patient factors. The operations were otherwise identical in scope and execution.

All neck dissections were approached through a horizontal neck crease incision with elevation of the skin flaps up to the body of the mandible and inferiorly to the level of the cricoid. Subplatysmal dissection is performed predominantly anterior to the posterior border of the SCM and ipsilateral to the midline. The greater auricular nerve is specifically preserved. However, as the fascia along the anterior border of the SCM was divided from the level where the external jugular vein crosses it superiorly and it crosses the omohyoid muscle inferiorly, one or more cutaneous sensory branches must be sacrificed for surgical access. The SCM is then reflected off the underlying soft tissues, dissecting back along its medial surface until the cervical rootlets can be identified wrapping around its posterior border. At this point in the nerve-preserving procedure, the dissection is carried forward using the plane of the cervical rootlets as the deep plane of dissection. This continues to the point of the cervical rootlets’ entry or exit from between the deep muscular layer of the neck (Figure 2). This plane serves not only to protect the cervical rootlets but also the posterior portion of the eleventh nerve and phrenic nerve, which run respectively behind and deep to these structures. In the nerve-sacrificing technique the nerves are severed at their point of identification and the dissection continued down to the deep cervical fascia on the floor of the neck. The dissection is then turned forward along the deep layer of the deep cervical fascia until the point of exit or entry of the cervical rootlets between the deep musculature of the neck is encountered. The cervical root nerves are then re-cut to allow further reflection of the tissue anteriorly. Dissection from this point anteriorly up over the internal jugular vein was identical in both techniques.

RESULTS

Fifty-seven patients who underwent 84 neck dissection and met the inclusion criteria were evaluated. Patient demographics are listed in the Table. There were no significant differences in mean time from surgery to examination and the use of adjuvant radiation between the 2 groups.

Figure 3 depicts the mean scores for the different types of selective dissection. Cervical rootlet-preserving dissections resulted in an area of anesthesia in the upper anterior neck (region G) more than in any other region (P = .03). There were no statistically significant differences between different types of rootlet-preserving dissections, nor did the time from operation to examination (beyond 3 months) or the use of radiation influence this outcome.

Neck dissections in which the cervical root branches were not preserved yielded a different pattern of anesthesia (Figure 3). These patients were left with numbness throughout the ipsilateral neck. For all regions of the neck except region G, this numbness was statistically more likely to remain numb than in the nerve-preserving group (P = .02) (Figure 4).

COMMENT

The goal of any surgical procedure is to return patients as much as possible to their premorbid state. As our understanding of lymphatic spread from head and neck cancer...
has increased, there has been an increased emphasis on long-term functional and cosmetic outcomes of neck dissection. The incidence of the severe and long-lasting shoulder syndrome seen after radical neck dissection has been reduced by the selective operation, although some patients may still experience a mild, temporary shoulder syndrome, typically resolving in 3 to 4 months. The negative cosmetic impact of the selective neck dissection is also minimal compared with the more radical operation. With a reduction or elimination of these more significant morbidities, an emphasis on understanding and quantifying issues such as sensory change becomes more important for patient counseling. The effect of the more limited dissection on postoperative sensory function of the face and neck has not been previously described.

We found that when the cervical root branches are preserved, which is neither difficult nor time-consuming, the areas of the face and neck rendered anesthetic by selective neck dissection are much more limited than when they are sacrificed (Figure 3). These patients will likely have some permanent numbness of the anterior neck above the level of the thyroid prominence between the mandibular facial notches. This is most likely related to the obligatory sacrifice of the transverse cervical nerve where it crosses the anterior border of the SCM. Sacrifice of the cervical root branches, however, resulted in a significant sensory deficit involving the entire ipsilateral neck.

Potential problems with the methods of this study exist. Anatomical preservation of the nerve rootlets does not guarantee that irreversible traction injury does not occur. Although reliable anatomical landmarks were chosen to divide the face and neck into standardized re-
gions, there remains possible error in the mapping of these regions onto each patient due to anatomical variations. In addition, as the examiner was not routinely blinded to the procedure the patient had undergone, there may have been introduction of bias into the data. However, the reproducibility of the areas of anesthesia, independent of radiation use and time from operation would suggest that such sources of error were minimized.

In conclusion, selective neck dissection performed in a manner preserving the cervical root branches has a small, predictable impact on sensation of the face and neck. The upper anterior neck between each facial notch of the mandible is the region typically rendered anesthetic. Sacrifice of the cervical root branches results in a significant extensive sensory deficit involving the entire ipsilateral neck.

Accepted for publication November 12, 1999.

Presented as a poster at the annual meeting of the American Head and Neck Society, Palm Desert, Calif, April 24, 1999.

Corresponding author: James I. Cohen, MD, PhD, Department of Otolaryngology, Head and Neck Surgery, Oregon Health Sciences University, PV-01, 3181 SW Sam Jackson Park Rd, Portland, OR 97201.

REFERENCES