

Epitomes

Important Advances in Clinical Medicine

Otolaryngology—Head and Neck Surgery

The Council on Scientific Affairs of the California Medical Association presents the following inventory of items of progress in otolaryngology—head and neck surgery. Each item, in the judgment of a panel of knowledgeable physicians, has recently become reasonably firmly established, both as to scientific fact and important clinical significance. The items are presented in simple epitome, and an authoritative reference, both to the item itself and to the subject as a whole, is generally given for those who may be unfamiliar with a particular item. The purpose is to assist busy practitioners, students, researchers, and scholars to stay abreast of these items of progress in otolaryngology—head and neck surgery that have recently achieved a substantial degree of authoritative acceptance, whether in their own field of special interest or another.

The items of progress listed below were selected by the Advisory Panel to the Section on Otolaryngology—Head and Neck Surgery of the California Medical Association, and the summaries were prepared under its direction.

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Magnetic Resonance Imaging—Guided Needle Biopsy of Head and Neck Lesions

FINE-NEEDLE ASPIRATION of inaccessible and deep-seated lesions of the head and neck may be difficult to do. If a definite diagnosis can be obtained by aspiration, however, an open surgical biopsy of the lesion and its associated risks can be avoided. Although superficial lesions may be aspirated under the guidance of direct palpation, fine-needle aspiration of inaccessible lesions requires imaging guidance.

Computed tomography (CT) has previously been most useful in guiding the aspiration of nonpalpable lesions. But because magnetic resonance imaging (MRI) is replacing CT as the imaging study of choice to evaluate many areas of the head and neck, the ability to do MRI-directed aspiration for cytologic examination is becoming increasingly important. Magnetic resonance imaging-guided needle placement offers advantages over CT guidance of better soft tissue contrast resolution and the ability to locate lesions inapparent on CT images. In addition, the oblique imaging planes of MRI provide better visualization of the needle tract. Computed tomographic images are limited to the axial plane, making needle tip localization difficult in some patients. Magnetic resonance imaging also eliminates the risk of ionizing irradiation to radiologists and patients.

Conventional stainless steel biopsy needles, when used with MRI, produce imaging artifacts caused by an alteration in the homogeneity of the magnetic field. This magnetic force may also produce undesired movement of the needle. Magnetic resonance imaging-compatible needles incorporating alloys with increased nickel content that reduces imaging artifacts and almost completely eliminates the deflecting force of the magnets on the needle are now commercially available. Thus, MRI-guided fine-needle aspiration is a valuable diagnostic procedure because it

permits the aspiration of head and neck lesions previously inaccessible by other means. Some investigators are now using the MRI-guided needle technique to attempt to deliver laser or radiofrequency energy as a possible treatment technique.

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Treatment of Laryngeal Dysphonias

IMPROVED UNDERSTANDING of the elements controlling the voice is leading to new surgical methods directed at different forms of dysphonia that have been difficult to manage. This heightened understanding has emerged through the efforts of researchers interested in laryngeal biomechanics, microscopic tissue elements, and neuromuscular control.

We now realize that the sound emanating from the vocal folds is produced by modulating airflow through a tissue wave. This traveling, or harmonic, wave is produced primarily by the loose connective tissue covering the fold, otherwise known as the lamina propria (cover). Physiologic alteration of the tissue wave, and ultimately the voice, occurs by contraction of the intrinsic and extrinsic laryngeal muscles (body). Thus, mass lesions that interfere with tissue wave propagation must be removed with as little disturbance of the loose connective tissue as possible. The use of lasers is seldom required; rather, microsurgery leaves the vocal fold edge as straight and intact as

possible. Defects in the lamina propria, such as sulci, atrophy, or scarring, must be corrected to ameliorate abnormal wave motion. In this regard, collagen or fat injections and mucosal grafts are being used with increasing frequency and success.

Almost as important as the cover-body theory has been the knowledge that the left and right vocal folds vibrate in unison, with both normally opening and closing simultaneously and in harmony. To accomplish this, both vocal folds must be brought together during phonation and must show similar viscoelastic properties. Phonosurgeons have begun to correct biomechanical inequalities between the vocal folds by surgically simulating the muscular contraction of the various intrinsic muscles. This is often accomplished by surgically modifying the laryngeal cartilaginous framework. Moving a window in the thyroid cartilage medially approximates the folds and simulates thyroarytenoid muscular contraction. The arytenoid cartilage can be adducted to simulate lateral cricoarytenoid and interarytenoid muscular contraction. Expansion or retrodisplacement of the anterior thyroid cartilage can be used to lengthen or shorten the vocal folds, leading to an alteration in the most comfortable pitch production. These operations on the laryngeal skeletal framework can be used to correct a weak voice or one with unusually high or low frequency.

Along with advances in understanding the biomechanics underlying vibration, the literature concerning the innervation of the larynx has grown. These neurophysiologic studies have encouraged surgeons to devise therapies to modify lost or diminished control of neuromuscular laryngeal function. Selective reinnervation of nerve and nerve muscle pedicles of the laryngeal muscle groups is gaining recognition as an effective means of improving neuromuscular function.

The convergence of scientific knowledge concerning tissue rheology, biomechanics, and neuromuscular control will soon lead to better reconstructive techniques after trauma or tumor ablation. The ultimate goal will be the ability to construct a new larynx from autologous tissues, and laryngeal transplantation is an intermediate but reachable goal within the next four to six years.

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Management of the Internal Carotid Artery in Skull Base Operations

ONE OF THE MOST IMPORTANT ADVANCES in the current management of head and neck cancer is skull base surgery. Patients previously doomed by the extension of upper aerodigestive tract malignant tumors to or through the skull base now have a reasonable chance of cure.

With the close cooperation of head and neck, neurologic, and reconstructive surgeons, tumors that extend beyond the traditional boundaries of each discipline can now be successfully ablated by a team approach. The most successful efforts take place in institutions with designated, well-coordinated skull base surgery teams.

Tumor ablation is impeded when tumors encroach on or invade the middle cranial fossa and involve the internal carotid artery. The preoperative assessment of carotid artery involvement is difficult, but attempts to establish invasion of the vessel have been made using computed tomography and magnetic resonance imaging. The absence of a flow void or 360 degrees of arterial encirclement by tumor definitively establishes arterial invasion and mandates resection if cure is to be achieved. The lack of interface between tumor and vessel, as seen by these two methods or by ultrasonography, suggests no invasion. Displacement of the carotid artery, erosion of the petrous bone adjacent to it, or involvement of the cavernous sinus does not necessarily indicate vessel invasion.

Before surgical intervention, it is essential to study the relative safety of sacrificing the carotid artery. Is the collateral arterial supply sufficient to oxygenate the brain and prevent stroke if the carotid artery is taken? The most commonly used test to make this judgment is the internal carotid balloon occlusion test. With this test, the Seldinger technique is used to pass an intra-arterial balloon through the groin, placing it high in the cervical segment of the internal carotid artery. If the patient can withstand a 15- to 20-minute period of occlusion without having neurologic symptoms, then in 85% of cases, no ischemic stroke will develop if the carotid artery is taken. A number of techniques have been used to refine this test, such as radioactive and stable xenon testing before and after balloon test occlusion and the concomitant use of single-photon emission computed tomographic scanning and positron emission tomography. Transcranial Doppler testing and induced hypotension improve the predictive quality of the test. Unfortunately, no test is 100% reliable, and none can anticipate an embolic complication.

Although the preoperative assessment may indicate the possibility of internal carotid artery invasion by tumor, this scenario can only be established during the operation. If the tumor simply involves the periosteal lining of the carotid canal in the petrous bone, then this layer can be removed and the artery saved. Even if the adventitia of the vessel is involved, the artery can still be spared in benign tumors and most low-grade malignant tumors. Occasionally even a high-grade tumor can be successfully removed by peeling the adventitia off the artery. In most high-grade tumors, however, the artery must be taken.

In those cases where the balloon occlusion test is positive, a number of options exist. A patient could be informed that the procedure is too risky and that some palliative regimen such as irradiation or chemotherapy should be chosen. A staged procedure in which the superficial temporal artery is anastomosed to the middle cerebral artery can be done to reroute the circulation at a time before the definitive resection. The most common proce-