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GERIATRIC OTOLARYNGOLOGY

*Michael M. Johns, MD; Sarah Wise, MD; Steven M. Parnes, MD**

Otolaryngology—head and neck surgery—is an important and diverse specialty. Otolaryngologists care for people with a wide variety of problems, ranging from quality-of-life–impairing communication disorders to life-threatening diseases of the head and neck. Commensurate with changing demographics of Western society, it is not surprising that up to one third of patients seen by the average otolaryngologist are aged 65 or over. Advances in public health and medicine have led to increased life expectancy and, with this increase, a growing emphasis on quality of life for older persons.

Pediatric otolaryngology has become a distinct subspecialty within the field, but geriatric otolaryngology has not; despite its importance, research, education, and clinical focus in geriatric otolaryngology has been lacking. The principles of geriatric medicine and issues of concern specific to elderly otolaryngologic patients have not been widely applied in otolaryngology. Furthermore, a significant portion of the literature dealing with geriatric issues in otolaryngology consists of case reports and uncontrolled case series. This review updates the chapter by Hinrich Staecker in *New Frontiers in Geriatrics Research*, which was the first comprehensive review outlining a research agenda in geriatric otolaryngology. [1] The purpose of this follow-up is to update the review of current knowledge in geriatric otolaryngology, to identify the extent to which the Key Questions defined in *New Frontiers* have been answered, and to further define the basic and clinical information needed for the future advancement of geriatric otolaryngology.

The original three Key Questions in otolaryngology from *New Frontiers* are listed below. This update identifies research that has addressed these questions in the interval since the initial publication and then expands upon these questions in light of the new research.

> ***Otolaryn KQ1***: **How can research be used to improve hearing-related quality of life for elderly persons?**
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> ***Otolaryn KQ2***: **Can disorders of the peripheral vestibular system be accurately recognized and their causes determined, and does targeted treatment benefit elderly patients with balance disorders or dizziness?**
>
> ***Otolaryn KQ3***: **Does standard management of head and neck cancer compromise quality of life in the elderly patient to a greater degree than in the younger patient?**

See also the subsection on new Key Questions in the section New Horizons in Geriatric Otolaryngology, at the end of the chapter.

* Johns: Assistant Professor of Otolaryngology, Director of Emory Voice Center, Emory University School of Medicine, Atlanta, GA; Wise: Assistant Professor of Otolaryngology, Emory University School of Medicine, Atlanta, GA; Parnes: Professor and Head, Department of Otolaryngology, Albany Medical College, Albany, NY.

METHODS

A comprehensive literature search was conducted on the National Library of Medicine's PubMed database. The initial review by Staecker covered the time period from 1980 to April 2001. [1] This follow-up review adds publications from April 2001 through October 2005. The search strategy combined various terms for otolaryngology: *hearing*, *balance*, *head and neck cancer*, *swallowing*, *allergy*, *sinusitis*, *voice*, *larynx*, *smell*, and *olfaction*. Individual hits were refined by the use of the "related articles" button. Otolaryngology textbooks with chapters on geriatrics were reviewed, and their bibliographies were added to the database. Additional requirements were either that the publication be a review, clinical trial, randomized controlled trial, or meta-analysis, and that terms for risk or age factors be present as title words or MeSH headings. Terms denoting age were *age factors*, *age*, *aging*, *elderly*, *geriatric*, *gerontologic*, *older*, or *octogenarian*, *nonagenarian*, or *centenarian*. Relevant reports were organized by subspecialty and reviewed, focusing on the extent to which Key Questions in *New Frontiers* were answered and new Key Questions were raised.

PROGRESS IN DISORDERS OF THE AUDITORY SYSTEM

For a new agenda item, see the subsection on disorders of the auditory system in New Horizons in Geriatric Otolaryngology, at the end of the chapter.

EPIDEMIOLOGY

See *New Frontiers,* pp. 203–204.

DISEASES OF THE PINNA AND EXTERNAL AUDITORY CANAL

See *New Frontiers,* p. 204.

DISEASES OF THE TYMPANIC MEMBRANE AND MIDDLE EAR

See *New Frontiers,* pp. 204–205.

***Otolaryn 1 (Levels A, B)*: Randomized controlled trials or prospective cohort studies of otosclerosis patients are needed to compare the effects of surgery or amplification on function and quality of life.**

New Research Addressing This Question: In the interval since publication of *New Frontiers,* no randomized or prospective studies have been performed to answer this question. A retrospective study of older adults helps shed light on this topic. [2] The authors note "that stapedioplasty offers greater improvement in quality of life for selected adults aged 60 and older than for younger adults. The operation also appears to be as safe for adults aged 60 and older as for younger adults. Stapedioplasty provides subjects with satisfactory social hearing level (hearing capacity sufficient for normal social relations) and slows the progression of otosclerosis. Providing older patients with good auditory functionality improves their state of health, quality of life, and cognitive processes." Furthermore, a retrospective study on patients of all ages (including older adults) suggests that amplifica-

tion using a bone-anchored hearing aid improves function and quality of life in these patients. [3] Evidence has been published indicating that stapes surgery for otosclerosis in elderly adults is as safe and at least as effective as that in younger adults. [2,4–7] Additionally, geriatric patients may derive more quality-of-life benefit from otosclerosis surgery than younger patients. [2]

Modification of This Question in Light of New Research: This question should remain on the research agenda unmodified.

> ***Otolaryn 2 (Level B)*: Patients with unilateral hearing loss of any cause should be compared with those who have bilateral hearing loss in an observational study, either at a single time or longitudinally to assess functional and quality-of-life outcomes.**

New Research Addressing This Question: These studies have yet to be performed. The marginal quality-of-life and functional decrements that may occur in unilateral versus bilateral hearing loss remain unclear.

Modification of This Question in Light of New Research: This question should remain on the research agenda unmodified.

> ***Otolaryn 3 (Level A)*: The effects of bilateral surgery should be compared with those of unilateral surgery in randomized controlled trials or prospective cohort studies of elderly patients with otosclerosis.**

New Research Addressing This Question: The additional value of operating on the second ear in geriatric otosclerosis patients is not clear. However, evidence suggests an adequate degree of safety associated with bilateral surgery in both the young and elderly population. [8]

Modification of This Question in Light of New Research: This question should remain on the research agenda unmodified.

> ***Otolaryn 4 (Level B)*: In order to better define the contribution in older people of eustachian tube dysfunction to hearing loss, an observational study, at a single time or longitudinally, should be carried out in which audiogram and tympanogram findings are correlated with symptoms and signs of eustachian tube dysfunction.**

New Research Addressing This Question: Eustachian tube dysfunction has been described in older as well as younger patients, but new information has been published that demonstrates no greater incidence of eustachian tube dysfunction, related hearing loss, or middle ear pathology in older adults than in younger adults. [9] Additionally, over a 5-year span in aged adults, little change occurs in middle ear mechanics. [10] These clinical studies are in contrast to previously published work, which found functional compliance to change with aging, which affects the overall function of the eustachian tube. [11]

Modification of This Question in Light of New Research: This question has been addressed and can be dropped from the research agenda. Eustachian tube function does not appear to lead to change dramatically or lead to increased pathology in the elderly population.

***Otolaryn 5 (Levels, B, A)*: If a strong correlation between eustachian tube dysfunction and hearing loss is found (see Otolaryn 4), interventions to improve eustachian tube dysfunction should be tested in preliminary studies and ultimately in a randomized controlled trial to determine if improving eustachian tube function improves hearing in older people with and without presbycusis.**

New Research Addressing This Question: See previous section, where new research is described that refutes this strong correlation.

Modification of This Question in Light of New Research: This question becomes unnecessary as a result of new research, and the item can be dropped from the research agenda.

PRESBYCUSIS OR SENSORINEURAL HEARING LOSS

See *New Frontiers,* pp. 205–206.

Impact of Presbycusis on Quality of Life

See *New Frontiers,* pp. 206–207.

Inheritance of Presbycusis

See *New Frontiers,* p. 207.

The Impact of Hearing Loss on Dementia

See *New Frontiers,* pp. 207–208.

Treatment of Presbycusis

See *New Frontiers,* p. 208.

Neurotology

See *New Frontiers,* pp. 208–209.

***Otolaryn 6 (Level B)*: An instrument that would test hearing in small groups set in a noisy environment needs to be developed and validated. Such an instrument would be helpful in all the following recommended studies.**

New Research Addressing This Question: This instrument remains to be developed.

Modification of This Question in Light of New Research: This question should remain on the research agenda unmodified.

***Otolaryn 7 (Levels B, A)*: There is a need for a definitive test of the widely accepted belief that bilateral hearing aids are better than unilateral aids. This could be done by prospective cohort study or by randomized controlled trial. Such studies are needed both for implantable and external-ear hearing aids. Outcome measures**

should include hearing, speech discrimination, quality of life, and cost-benefit analysis. In the case of unilateral implantation, the unoperated ear can serve as an additional control regarding hearing.

New Research Addressing This Question: The value of hearing restoration for both ears versus only one remains unclear. No studies have been performed that shed light on this important question.

Modification of This Question in Light of New Research: This question should remain on the research agenda unmodified.

Otolaryn 8 (Level B): **The value of unilateral and bilateral implantable hearing aids needs to be assessed. A preliminary evaluation would require only measures of hearing and quality of life in the preoperative period with removable hearing aids in use, comparing these with similar measures taken after unilateral or bilateral implantation.**

New Research Addressing This Question: This research has yet to be performed.

Modification of This Question in Light of New Research: This question should remain on the research agenda unmodified.

Otolaryn 9 (Level B): **Studies of elderly patients with profound sensorineural hearing loss are needed that resemble trials for moderate to severe hearing loss in the same age group. The economic benefits of cochlear implantation in the geriatric population is beginning to be defined. Prospective observational studies are now needed that will take into account issues such as loss of independence and cost-benefit ratios.**

New Research Addressing This Question: Prospective observational studies to address this question have not been published. However, carefully designed retrospective outcomes studies demonstrate favorable cost-benefit ratios and functional results for cochlear implantation in the older adult. [12]

Modification of Question in Light of New Research: The magnitude of the problem of presbyacusis warrants the prospective studies that were originally suggested in *New Frontiers*. This question should remain on the research agenda unmodified.

Otolaryn 10 (Level B): **An observational study comparing temporal bone pathology, pertinent molecular markers, and audiometric data would significantly aid our understanding of age-related hearing loss.**

New Research Addressing This Question: Recent studies are beginning to define deficits in addition to the previously described degeneration of the auditory hair cells, auditory neurons, and stria vascularis. Schuknecht and Gacek classified presbycusis on the basis of histologic criteria. In their review of the subject, they reported that the four diagnostic criteria of age-related hearing loss (sensory cell degeneration, neural degeneration, strial

atrophy, and cochlear conductive loss) held up in a review of 21 cases that met the clinical diagnosis of presbycusis. Of note was the observation that most cases seemed to have a mixed pathologic pattern. [13] More recent analysis of temporal bone specimens has shown a high incidence of mutations of mitochondrial DNA within the peripheral auditory system. [14]

Although hearing loss is a known and nearly ubiquitous phenomenon of aging, the factors associated with the age of onset, progression, and severity of hearing loss remain unknown. Increasing evidence suggests, however, that genetic makeup is an important factor. [15,16]

Modification of This Question in Light of New Research: Although much work continues in this important area, understanding of age-related hearing loss is far from complete. Ongoing studies to answer this question are needed, and the question should remain on the research agenda unmodified.

> ***Otolaryn 11 (Level B)***: **Research has linked hearing loss with reduced quality of life, loss of independence, and depression. Observational studies are needed that would correlate patient-based outcomes measures and degree of hearing loss. These data should be used to develop guidelines for otolaryngologists to consider in obtaining geriatric consultation for at-risk patients.**

New Research Addressing This Question: New research, interestingly, demonstrates that elderly persons significantly underestimate the degree of their hearing loss and that, despite having significant deterioration in hearing thresholds over a 10-year period, they fail to notice worsening hearing. This research highlights the importance of education regarding hearing screening and rehabilitation. This is particularly important in light of evidence that suggests that hearing rehabilitation may be associated with improved cognitive function over time, although this is controversial. [17,18]

Modification of This Question in Light of New Research: Although new research highlights the need for increased education of both older persons and their physicians regarding the prevalence and impact of presbycusis, it is still not clear what effect hearing loss has on the older person's independence, depression, and other general outcomes. Therefore, this question should remain on the research agenda unmodified.

> ***Otolaryn 12 (Level B)***: **Studies have defined impaired central auditory processing and identified its importance in aging. Central auditory testing is currently performed only in tertiary care centers and takes up to half a day for a single patient. Briefer test panels need to be developed and validated to aid the screening of older patients. This can be carried out as an observational trial for hypothesis generation.**

New Research Addressing This Question: No significant progress has been made to address this question.

Modification of This Question in Light of New Research: This question should remain on the research agenda unmodified.

PROGRESS IN DISORDERS OF THE VESTIBULAR SYSTEM

See *New Frontiers,* p. 210. For a new agenda item, see the subsection on disorders of the vestibular system in New Horizons in Geriatric Otolaryngology, at the end of the chapter.

HISTOLOGIC STUDIES

See *New Frontiers,* p. 210.

ETIOLOGY OF DIZZINESS

See *New Frontiers,* pp. 210–211.

DEVELOPMENTS IN VESTIBULAR TESTING

See *New Frontiers,* p. 211.

TREATMENT OF AGE-RELATED BALANCE PROBLEMS

See *New Frontiers,* pp. 211–212.

Otolaryn 13 (Level B): **The available literature supports the idea that vestibular disease is commonly misdiagnosed. An observational study is needed to determine how different practitioners evaluate and treat the chief complaint of dizziness that is assumed to be of vestibular or undefined origin. This study should also determine the prevalence of the use of medications such as meclizine and the prevalence of physical therapy referral. Findings should then be used to develop best practice guidelines.**

New Research Addressing This Question: New research into this important area is lacking, and the questions posed remain unaddressed.

Modification of This Question in Light of New Research: This question should remain on the research agenda unmodified.

Otolaryn 14 (Level A): **Currently, several patient-based outcomes questionnaires for vestibular disorders are available. Vestibular testing can consist of a combination of very different test modalities, including electronystagmography, rotary chair testing, testing of positional nystagmus, and posturography. A prospective randomized controlled study is needed to define which modality or combination of modalities is optimal for evaluating the elderly patient and determining level of vestibular system impairment and impact on quality of life.**

New Research Addressing This Question: No new research has been published to help sort out this complicated problem.

Modification of This Question in Light of New Research: This question should remain on the research agenda unmodified.

***Otolaryn 15 (Level B)*: Currently, no data exist correlating aging, vestibular function, and vestibular system histopathology. A collection of temporal bones of different aged patients with vestibular test results is needed to achieve a level of understanding similar to that we have for the auditory system.**

New Research Addressing This Question: This database remains to be generated, although its importance cannot be underestimated.

Modification of This Question in Light of New Research: This question should remain on the research agenda unmodified.

PROGRESS IN DISORDERS OF THE NOSE AND SINUSES

For a new agenda item, see the subsection on the aesthetics of the aging nose in New Horizons in Geriatric Otolaryngology, at the end of the chapter.

SMELL

See *New Frontiers,* pp. 212–213. For new agenda items, see also the subsection on smell in New Horizons in Geriatric Otolaryngology, at the end of the chapter.

SINUSITIS AND NASAL DISCHARGE

See *New Frontiers*, p. 213. For a new agenda item, see the subsection on sinusitis and nasal discharge in New Horizons in Geriatric Otolaryngology, at the end of the chapter.

***Otolaryn 16 (Level B)*: An observational study is needed to define the incidence of sinusitis in older people and to learn whether diagnostic and treatment approaches to the elderly patient are different. Most studies of sinusitis give an average age but have not assessed their data in terms of age cohorts. If age-related differences are identified, risk-factor assessment (elderly versus nonelderly) will have to be carried out by means of prospective cohort studies.**

New Research Addressing This Question: The fundamental question raised remains. The incidence of sinusitis in the population of elderly community-dwelling persons remains unclear. Whether older people are more or less prone to sinusitis and whether diagnostic and treatment approaches are the same as for younger patients remain unknown.

Rhinosinusitis is extremely common in the United States. Rhinosinusitis affects 16% of the adult population annually and has vast economic consequences. [19] The true prevalence of rhinosinusitis in the elderly population has not been studied and remains to be determined. However, given the increased incidence of comorbidities in older adults, medical and surgical therapies for rhinosinusitis may have significant implications in the elderly patient. Patients with rhinosinusitis are often treated with extended courses of antibiotics and steroids, and surgical therapy is recommended in selected patients. Colclasure et al compared 56 patients over the age of 60 who underwent endoscopic sinus surgery with a general adult population undergoing the same surgical procedure. These authors identified no major complications in the elderly cohort. Additionally, postoperative subjective and

objective improvement was found to be consistent with reports of the same measures in the general adult population. The authors concluded that endoscopic sinus surgery is safe and effective in the elderly population. [20]

Some new information regarding the etiology and potential risk factors of sinonasal inflammatory disease in general has been published (see next section).

Modification of This Question in light of New Research: The core question seeking the differences in the incidence and prevalence of sinonasal disease in the geriatric patient remains. This question should remain on the research agenda unmodified.

> ***Otolaryn 17 (Level B)***: **Depending on the outcome of the research recommended in Otolaryn 16, a prospective study on the risk factors for sinusitis in the elderly person is needed. This would examine the incidence of allergic and nonallergic rhinitis, as well as the environmental factors that predispose the older person to sinusitis.**

New Research Addressing This Question: Many elderly patients report symptoms of rhinitis (ie, an inflamed, irritated, or runny nose). Although there are many potential causes of rhinitis, seasonal and environmental allergies are present in older persons and should be considered in differential diagnoses. Some recent publications have addressed the diagnosis and treatment of allergy in the elderly patient. Crawford et al assessed allergic disease in the older person by studying 132 adult men. These authors found that the prevalence of rhinitis remained stable in the elderly age group. However, skin test reactivity and mean total serum IgE did decline among elderly subjects with rhinitis in comparison with younger subjects. This implies that although rhinitis is prevalent in older patients, nonallergic causes of rhinitis should also be considered in these patients. [21] King and Lockey also noted that because of atrophic or sun-damaged skin in elderly patients, skin-prick allergy testing in this population must be performed and interpreted with caution. [22]

Antihistamines are often used to treat allergy symptoms. However, first-generation H_1-antihistamine therapy must be used with caution in the elderly patient. These antihistamines may produce significant side effects in older persons because of the physiologic changes of normal aging, as well as drug-drug or drug-disease interactions. [23] The newer, nonsedating antihistamines appear to be safe and effective alternatives to earlier-generation antihistamines for treating older patients.

The use of injection immunotherapy in elderly patients has been debated. Asero evaluated specific injection immunotherapy to birch and ragweed in 39 elderly allergic patients, who were compared with 37 elderly control patients who refused to undergo immunotherapy. The patients who underwent immunotherapy had significantly reduced symptoms and significantly reduced use of oral antihistamines after 1 to 5 years of immunotherapy than the control patients. The author concluded that injection immunotherapy is an effective option in healthy elderly persons whose symptoms are not controlled symptomatically by medication therapy. [24]

Modification of This Question in Light of New Research: The agenda item should remain on the research agenda unchanged because the risk factors for the development of rhinosinusitis in the elderly population remain.

PROGRESS IN DISORDERS OF SWALLOWING

See *New Frontiers,* pp. 213–215.

***Otolaryn 18 (Level B)*: Currently, there is no consensus on the optimal evaluation of the dysphagia patient. A comparison of functional endoscopic evaluation of swallowing with modified barium swallow is needed to evaluate swallowing function and outcome of therapy in patients with dysphagia. Specificity and sensitivity should be determined, and cost-benefit analysis should be carried out.**

New Research Addressing This Question: Dysphagia is likely the most significant medical condition affecting the geriatric otolaryngic patient. The incidence of aspiration pneumonia is on the rise in comparison with other types of pneumonia, and pneumonia is the fifth leading cause of death in persons aged 65 and over. [25,26] Dysphagia is common in the elderly age group, with prevalence estimates ranging from 15% to 50%, depending on the population studied. [25] Although significant advances in geriatric dysphagia research have occurred since publication of *New Frontiers*, important questions remain in our understanding of this condition.

Swallowing is a complex function that depends on precise neurosensory and neuromuscular function of the upper aerodigestive tract. Age-related changes, such as sarcopenia, reduced laryngopharyngeal sensation, and diminished oral and pharyngeal coordination, make elderly persons at least prone to dysphagia, if not themselves causing the dysphagia. In a study of normal volunteers (N = 80) divided into four age cohorts, liquid and semisolid swallows were studied with manometry and videofluoroscopy. Total swallowing time and time to initiation of oropharyngeal swallowing were found to be prolonged in advanced age in this and surface electromyographic studies. [27] Upper esophageal sphincter pressure, peak pressure, and rate of bolus propagation do not appear to be affected by age above 65. [28] Other studies at least partially contradict these data, showing an overall slowing of pharyngeal swallowing time but also confirming an impairment in the opening of the upper esophageal sphincter. [29]

The high rate of dysphagia in the geriatric age group is likely related to these changes compounded by common geriatric conditions, such as Parkinson's disease, stroke, xerostomia, and frailty. Xerostomia is a common geriatric otolaryngic complaint that may significantly contribute to dysphagia. The incidence of this problem is estimated to be as high as 1 in 5 elderly noninstitutionalized adults. Whether xerostomia is a natural change with aging is controversial, with evidence for both sides of the argument. [30–35] However, xerostomia is a common side effect of many prescription and nonprescription medications. Astor et al observed that medication (particularly anticholinergics and antipsychotics) and systemic illness are probably the most common causes of xerostomia. [36] Furthermore, Sjögren's syndrome may be underdiagnosed in patients complaining of xerostomia. In an analysis of 100 consecutive patients aged 60 years and over presenting at a xerostomia clinic, 60% were found to have salivary gland hypofunction. Of these, two thirds were found to suffer from Sjögren's syndrome. [37]

Modification of This Question in Light of New Research: Important questions remain with respect to geriatric dysphagia. The true prevalence of this problem in the community-dwelling older population still needs to be determined, and level A studies are

needed. Its impact on quality of life and overall nutritional status also need to be studied. New agenda items are therefore proposed; see the subsection on disorders of swallowing in New Horizons in Geriatric Otolaryngology, at the end of the chapter.

PROGRESS IN DISORDERS OF THE LARYNX

For
new agenda items, see the subsection on disorders of the larynx in New Horizons in Geriatric Otolaryngology, at the end of the chapter.

VOICE

See *New Frontiers,* pp. 215–216.

> ***Otolaryn 19 (Levels B, A)***: **An epidemiologic study of the true incidence and etiology of age-related voice disorders is needed. For this purpose, a normal population (ie, not referred or otherwise selected patients) needs to be identified and screened for voice disorders. New surgical methods of treatment should be explored. Prospective randomized studies comparing conservative with surgical treatment for presbylarynges would follow.**

New Research Addressing This Question: One commonly underdiagnosed area of health concern among the geriatric population is dysphonia. Despite the crucial role that phonation plays in communication, the prevalence of geriatric dysphonia has been ill characterized. The most widely reported figure of 12% vocal dysfunction in the elderly age group has, in fact, been erroneously disseminated for two decades. [38–42] A new study by Golub et al has set out to answer the first part of question Otolaryn 19, namely, the prevalence of dysphonia in the geriatric population. The authors screened over 100 persons in a community independent-living facility and demonstrated that the prevalence of perceived dysphonia in this population was 20%. Furthermore, moderate to severe quality-of-life impairment resulting from their dysphonia was found in 13%. [43] This study highlights the significant problem of dysphonia in the aging population and reinforces the need for further research in this area.

The major differential diagnosis of vocal symptoms in the geriatric population includes unilateral vocal fold paralysis, benign and malignant vocal fold lesions, inflammatory conditions (laryngopharyngeal reflux), neurologic disease (vocal tremor, Parkinson's disease, stroke, spasmodic dysphonia), and age-related dysphonia. [44] Age-related dysphonia, or presbylarynges, is generally regarded as a diagnosis of exclusion to be made only after thorough medical and speech evaluation. One study found it to be the cause of dysphonia in only 4% of such dysphonic patients. [45] Another found it to be much more common, however, and cited it as the cause of symptoms in 30%. [38]

Although its incidence may be uncertain, the impact of age-related dysphonia is well known. Patients may complain of vocal fatigue, an inability to project their voice, and an inability to be heard over noise. Such limitations on oral communication may lead to social withdrawal and depression. Surgical treatments for age-related dysphonia, such as injection laryngoplasty and laryngeal framework surgery, are limited by their invasive nature and uncertain efficacy. Behavioral intervention (voice therapy) is a safer alternative but is limited by the requirement for multiple visits. A new study by Berg et al demon-

strates the efficacy of voice therapy in presbyphonia in a case-control study. Individuals with presbyphonia undergoing voice therapy were found to have significant voice-related quality-of-life improvement over that seen in control participants. [46]

Modification of This Question in Light of New Research: Even though work defining the prevalence of geriatric dysphonia has been performed, the incidence and causes remain unclear. Voice therapy appears to be effective for presbyphonia. The efficacy of surgical therapy (injection augmentation, laryngeal framework surgery) for this problem remains unclear. Studies comparing voice therapy and surgical treatments are warranted. The agenda item should remain on the research agenda unchanged.

MALIGNANCIES

See *New Frontiers,* p. 216.

PROGRESS IN HEAD AND NECK CANCER

See *New Frontiers,* pp. 216–218.

> ***Otolaryn 20 (Level B)***: **We need to understand better the present practice regarding head and neck cancer care. For this purpose, we recommend a prospective, multi-institutional study of a cohort of older patients with head and neck cancer. Observations would include comorbidity, functional status, advance directives, and physician recommendations, followed by description of the perioperative and postoperative course, complications, recovery, and rehabilitation. The outcome would be a regression-based model of preoperative, perioperative, and postoperative risk factors predicting outcomes, as well as a description of present practice.**

New Research Addressing This Question: Much new research has been performed to shed light on the many elements of this question. A number of retrospective studies have examined the effect of age on surgical and survival outcomes in head and neck cancer patients, with varied results. To date, there have been no prospective randomized trials that evaluate surgical, survival, or quality-of-life issues resulting from head and neck malignancies in elderly patients. Some authors have reviewed treatment considerations relevant to older patients with head and neck cancer and offered general guidelines for treating this age group. Genden et al encourage strong consideration of comorbid conditions in the elderly patient with head and neck cancer when selecting a treatment strategy. [47] Similarly, Bernardi et al advise that treatment of head and neck malignancies in the elderly patient should take into account the physiologic age of the patient in addition to tumor characteristics. [48] Finally, Gillani and Grunberg specifically note that conditions such as cardiovascular disease and chronic obstructive pulmonary disease increase in incidence and severity with cumulative tobacco exposure, as do head and neck malignancies. Cardiovascular disease and chronic obstructive pulmonary disease may complicate both surgical and chemoradiotherapeutic cancer treatment regimens. However, with careful planning, head and neck cancer treatment strategies can be formulated for elderly patients that retain the same efficacy as therapies for younger patients. [49]

Differentiated thyroid carcinoma affects adults of all age ranges. However, in older persons with thyroid carcinoma, poorer prognostic features are often present, such as follicular or Hürthle cell subtypes, extrathyroidal extension, and metastases. [50] van Tol et al encourage therapy to include total thyroidectomy with node dissection and radioiodine ablation. These authors note that treatment of persistent, recurrent, or metastatic disease must be based on disease stage and not denied on the basis of age. [50]

Administration of chemotherapy in older patients must be considered carefully, given its potential systemic toxicities in a patient population with an increased prevalence of comorbidities. Argiris et al compared response and toxicity in elderly and younger patients undergoing palliative chemotherapy for head and neck cancer. Although they found objective response rates and median survival time of the two groups to be similar, they found the elderly patients to have significantly increased incidence of nephrotoxicity, thrombocytopenia, and diarrhea with palliative chemotherapy regimens. [51] Because of the increased toxicity of chemotherapy in older persons, trials of head and neck chemotherapy regimens specifically designed for elderly patients or patients with medical complications have recently been performed. [52] In addition, Gebbia et al have reported a prospective study of the use of recombinant human erythropoietin in elderly patients undergoing chemotherapy with carboplatin and 5-fluorouracil for the treatment of head and neck cancer. Patients treated with recombinant human erythropoietin were found to have a statistically significant decrease in transfusion requirements for chemotherapy-related anemia in comparison with patients who did not receive erythropoietin. Patients who received erythropoietin also had improved quality of life. [53]

Although there has been some clinical research progress in the treatment of head and neck cancer in elderly patients, no large-scale prospective randomized trials of outcomes and toxicities of head and neck cancer treatment in this age group have been performed. It is important to recognize that, on the basis largely of retrospective studies, it is thought that fit elderly individuals can usually tolerate surgical and radiation therapies typically performed for head and neck tumor resection. With regard to chemotherapeutic protocols, outcomes in younger and older patients are also equivalent. However, the toxicities of chemotherapy appear to be increased in the elderly patient. Prospective randomized trials are still needed to determine definitively the effect of surgery, radiation, and chemotherapy for the treatment of head and neck cancer in the elderly age group.

Modification of This Question in Light of New Research: The agenda item should remain on the research agenda unchanged.

> ***Otolaryn 21 (Level B)***: **We need to know the outcomes to be expected in older patients with head and neck cancer who are surgical candidates. A prospective multi-institutional study is needed that measures functional status, quality of life, social functioning, and depression as outcomes. Preoperative data should be compared with follow-up data for 1 to 3 years. Observations should be stratified by the scope of the surgery performed.**

New Research Addressing This Question: Although the specific question above remains unanswered, new research does address elements of it. Authors have reviewed treatment considerations relevant to older patients with head and neck cancer and offered general

guidelines for treating this age group. See the discussion of Otolaryn 20 for descriptions of the relevant research. [47–49]

Modification of This Question in Light of New Research: The agenda item should remain on the research agenda unchanged.

Otolaryn 22 (Level A): **Depending on the outcome of the study recommended in Otolaryn 21, a prospective, possibly randomized controlled study comparing different surgical approaches for individual cancers (eg, tongue, pharynx) should be designed and performed.**

New Research Addressing This Question: More and more patients with head and neck cancer are being treated primarily with organ preservation–based protocols (chemotherapy plus radiation therapy). See the discussion of Otolaryn 20 for descriptions of the relevant research [51–53] and comments that follow about the need for further research.

Modification of This Question in Light of New Research: Despite changing trends in head and neck cancer treatment away from primary surgical therapy, surgery will always play a role in certain situations. Keeping in mind the significant consequences of both medical and surgical therapy for head and neck cancer, the question stands, but may be modified. Outcomes studies (levels A, B) are needed comparing minimally invasive surgical techniques with lower morbidity and standard surgical extirpations in the geriatric population.

Otolaryn 23 (Level B): **The wealth of data emerging from molecular biology studies of head and neck cancer need to be explored in terms of age. Prospective observational studies are needed to determine if the markers and molecular genetics of head and neck cancer are different in the elderly persons and if this impacts treatment decisions.**

New Research Addressing This Question: Much research is ongoing in this new frontier of head and neck cancer research. No studies to date have been published identifying molecular markers, and genetics differ in the geriatric and the younger patient. Regardless, molecular predictors of response to therapy will be forthcoming and will change the care of all patients with head and neck cancer.

Modification of This Question in Light of New Research: The agenda item should remain on the research agenda unchanged.

NEW HORIZONS IN GERIATRIC OTOLARYNGOLOGY

NEW KEY QUESTIONS IN GERIATRIC OTOLARYNGOLOGY

Otolaryn KQ4: **Diseases in the otolaryngic arena commonly present diagnostic challenges for primary care physicians. These challenges are often magnified by the hearing and communicative difficulties**

of older persons. Research is needed to develop simple high-yield diagnostic tools that the primary care practitioner can use to detect otolaryngic diseases.

Hypothesis-generating studies: Studies of the diagnostic accuracy of otolaryngic history and physical examination in the primary care setting are necessary to determine areas of deficiency in otolaryngic diagnosis by primary care physicians. These could be preliminarily performed with large-scale retrospective reviews of reasons for primary care referral of elderly patients to otolaryngologists, comparing rationale for referral with the ultimate diagnosis following otolaryngologic evaluation.

Hypothesis-testing studies: Once the most common reasons for otolaryngologic referral and missed diagnosis of the elderly patient are identified, outcomes research studies of simple diagnostic tests for use by the primary care physician may be developed.

Otolaryn KQ5: **Multiple medical comorbidities among older persons often increase the medical and surgical risk for older otolaryngology patients. Research is needed to determine whether the use of minimally invasive diagnostic and therapeutic techniques in the geriatric patient decreases the medical and surgical morbidity in this age group.**

Hypothesis-testing studies: Many minimally invasive diagnostic and therapeutic strategies have been developed and implemented in recent years. Investigation into the use of minimally invasive techniques for diagnosis and therapy in the elderly age group is necessary. The indications, complications, and postprocedure morbidity of minimally invasive techniques should be compared with traditional diagnostic and therapeutic strategies to determine the potential benefit of using minimally invasive techniques in treating otolaryngologic disorders in the elderly patient.

Otolaryn KQ6: **Laboratory investigation and application of stem cell and other biological therapy for restoration of special sense and communication organs may provide elderly persons with olfactory, gustatory, and hearing rehabilitation without the use of external devices. Research is needed to determine whether stem cell therapy is a viable alternative for rehabilitation of the special senses in the elderly patient.**

Hypothesis-generating and -testing studies: Laboratory research into the possibility of stem cell engineering for special sense rehabilitation is necessary as a first step and would likely be performed initially by tissue-culture methodology. Animal models incorporating engineered special sense organs from stem cell propagation, with subsequent tests of organ function, would follow this. Ultimately, the feasibility of human implantation of special sense organs engineered from stem cells would be considered.

Otolaryn KQ7: **Hearing aids have been used for many years for rehabilitation of failing auditory nerves or presbycusis. As patients age, nerves of swallowing and communicative organs also begin to have decreased function. Research is needed to determine whether advances in engineering solutions can assist in rehabilitation of failing swallowing or communicative organ function in the elderly person.**

Hypothesis-testing studies: The safety and feasibility of implantable devices for assistance in speaking and swallowing should be assessed in small-scale trials. Provided that implantable devices to assist the elderly person in speaking and swallowing function are proven feasible and safe, larger cohort studies are necessary to assess quality-of-life issues and long-term complications that appear to be associated with these devices. Newer devices should be compared with standard therapies, such as vocal cord injection or implants for speaking therapy and dietary changes or gastrostomy tube placement for swallowing difficulties.

DISORDERS OF THE AUDITORY SYSTEM

Cerumen impaction can have a significant effect on the hearing of elderly patients. In a random sampling of hospitalized elderly patients over a 1-year period, 30% were found to have cerumen impaction. Improved hearing was obtained in 75% of ears that underwent removal of cerumen. [54] Furthermore, a recent randomized controlled study suggests that cerumen impactions can be prevented by weekly administration by the patient of topical lipolotion. [55] Further hypothesis-testing research is needed on simple patient-based methods to prevent and treat cerumen impactions.

Otolaryn 24 (Level A): **Large-scale hypothesis-testing studies on the effectiveness of patient-based remedies to prevent and treat cerumen impaction are needed.**

DISORDERS OF THE VESTIBULAR SYSTEM

With increasing national emphasis on falls in the elderly age group, the role of vestibular rehabilitation in fall-prone patients is gaining importance. Vestibular rehabilitation is rehabilitation therapy for dizziness and balance and can be more generally referred to as *balance therapy.* Many health insurance companies do not pay for vestibular rehabilitation, citing this therapy as unproven. Further investigations into the efficacy of therapy are needed to support its role in treating the geriatric dizzy patient.

Otolaryn 25 (Level A): **Outcomes studies of vestibular therapy using controlled designs are needed to demonstrate the effectiveness of this therapeutic modality.**

DISORDERS OF THE NOSE AND SINUSES

Smell

Previous research has shown that olfactory sensitivity in older persons is diminished. [56,57] However, the true prevalence of olfactory disturbance in the elderly age group has been documented only recently. In 2002, Murphy et al reported results of olfactory testing as measured by the San Diego Odor Identification Test in 2491 persons aged 53 to 97 years. The mean prevalence of olfactory impairment found in this study was 24.5%. Olfactory impairment was noted to increase with age, with 62.5% of participants aged 80 to 97 exhibiting disturbance of olfaction. Additionally, self-report of olfactory disturbance in this study sample was low (9.5%), and olfactory disturbance self-report decreased in accuracy with increasing age. [58] The high prevalence of olfactory disturbance among older

persons may have considerable impact on appetite, nutritional choices, and energy consumption, leading to adverse effects on protein and micronutrient intake and potential nutritional deficiencies. [59]

Since publication of *New Frontiers*, a substantial amount of research in the realm of olfactory changes with aging has been published. This recent literature encompasses olfactory loss in both normal aging and in various disease states. Wang et al used functional magnetic resonance imaging (fMRI) technology to assess age-related changes in the central olfactory system, comparing 11 young and 8 elderly participants; these authors found significantly reduced University of Pennsylvania Smell Identification Test (UPSIT) scores in the elderly group, as well as reduced volume and intensity of olfactory brain structure fMRI signal. [60] Another study, performed by Suzuki et al, comparing 6 young with 6 elderly participants using fMRI olfactory brain imaging also found decreased activation of olfactory areas in the elderly participants. [61] Finally, an investigation of cerebellar odor processing revealed significantly decreased fMRI activation of two out of three cerebellar odor processing areas in 10 aged participants in comparison with 10 young controls. [62]

Decreased olfactory sensitivity has been previously reported in individuals with Alzheimer's disease (AD). [63] Armed with this knowledge, researchers and clinicians have recently begun to explore the utility of olfactory testing in the diagnosis of elderly patients with cognitive impairments. Early diagnosis of AD allows early treatment of this devastating disease from both a medical and psychosocial standpoint. Devanand et al studied the predictive ability for eventual diagnosis of AD of deficiencies in olfactory identification in patients with mild cognitive impairment. In this study, 90 patients with mild cognitive impairment and 45 healthy control persons were given the UPSIT at baseline and followed for eventual development of AD. Patients with low olfaction scores exhibited greater likelihood for development of AD than the other patients. Furthermore, time to AD development was predicted by the combination of low olfaction scores and the lack of awareness of olfactory deficit. [64] Peters et al evaluated olfaction in 14 AD patients, 8 mild cognitive impairment patients, and 8 healthy control participants via olfactory event-related potential measurement. Seven patients with AD and 4 mild cognitive impairment patients demonstrated no olfactory event-related potentials, whereas all control participants showed discernible responses. [65] Finally, Schiffman et al studied olfaction in 33 patients at risk for development of AD because of multigenerational evidence of disease, comparing them with 32 control participants. The results supported the above findings that individuals at risk for AD development exhibit worse performance on olfactory measures than those not at risk. [66]

Olfactory testing has also been evaluated as a possible tool for early detection of cognitive decline in persons at genetic risk for AD. Wang et al studied olfactory identification in 28 persons with and mild cognitive impairment who exhibited the apolipoprotein E epsilon-4 (apoE4) allele, a predictor of early cognitive decline in AD, comparing their performance with that of 30 control persons. ApoE4-positive patients identified significantly fewer odors on the Cross-Cultural Smell Identification Test than did control persons. This suggests that the decreased olfactory identification in mild cognitive impairment may predict AD development. [67] Suzuki et al also found that among AD patients, those positive for apoE4 alleles had a stronger correlation between the Mini-Mental State Examination scores and Picture-Smell Identification Test scores than those without the apoE4 allele. [68]

In addition to early diagnosis of AD, differentiation between AD and other causes of dementia is important from a treatment perspective. Duff et al used the Pocket Smell Test to evaluate patients in three groups of 20, one group with AD, one with vascular dementia, and one with major depression. Significantly lower Pocket Smell Test scores were found in patients with AD than in patients with either vascular dementia or major depression. [69] This differentiation between AD and vascular dementia via olfactory testing was not supported by Gray et al in a 2001 study reporting that patients with vascular dementia and AD were found to have similar olfactory impairment. [70]

Gilbert et al assessed odor recognition memory in patients with AD and Lewy body variant (LBV) of AD confirmed by pathologic diagnosis, comparing them with healthy control persons. Olfactory recognition memory was found to be impaired in LBV and AD, with LBV patients exhibiting more impairment than AD patients on olfactory remote memory tasks. Odor memory tasks may be helpful in differentiating LBV and AD. [71] In addition to the utilization of odor recognition memory tasks for differentiation of LBV and AD, Westervelt et al have shown that odor identification testing can also be used to differentiate between these two entities, with LBV patients showing significantly lower odor identification ability than AD patients. [72]

Olfactory testing research has also been applied to the identification of Parkinson's disease (PD) and the differentiation among variants of PD. Among patients with PD, 70% to 90% exhibit olfactory impairment independently of disease severity and duration. [73] Double et al used the University of Pennsylvania 12-item Brief Smell Identification Test to test 49 nondemented PD patients and 52 control participants. Abnormal olfaction was exhibited by 82% of the PD patients but only 23% of the control participants. Five of the 12 Brief Smell Identification Test odors discriminated PD patients from controls. [73] Olfactory testing research has sought to evaluate the utility of olfactory impairment testing in diagnosing presymptomatic PD, as in AD. Sommer et al combined olfactory tests with substantia nigra transcranial sonography and single photon emission computed tomography (SPECT) imaging in patients with olfactory disturbance but without evidence of PD. These tests revealed abnormal substantia nigra findings in some patients, although the eventual development of PD will require longitudinal follow-up. [74] Research in olfactory testing has also revealed its utility in the differentiation between idiopathic and nonidiopathic PD, as well as between PD and vascular Parkinsonism. [75,76]

Otolaryn 26 (Level B): **New evidence has revealed the high prevalence of olfactory disturbance in elderly persons. However, self-recognition of olfactory impairment among older persons is low. Observational studies assessing the impact of olfactory impairment on the quality of life, safety, and health care of the elderly person are needed.**

Otolaryn 27 (Level A): **Basic science investigation of the biological mechanism of olfactory loss in the elderly person and potential mechanisms for preventing olfactory loss should be undertaken.**

Otolaryn 28 (Level A): **Large randomized controlled clinical trials of the utility of olfaction testing in the early detection and subtype differentiation of diseases affecting the geriatric patient (ie, Alzheimer's disease and Parkinson's disease) are necessary. Such trials will allow the establishment of parameters for further referral of elderly patients to specialists who diagnose and treat these entities. Addi-**

tionally, establishment of simple olfactory testing and parameters to evaluate early abnormal cognitive function will allow implementation of such tests in the primary care arena.

Aesthetics of the Aging Nose

Aesthetic surgical procedures are performed commonly and have gained popular acceptance in recent years. Functional and cosmetic rhinoplasties are increasingly being performed in older persons. The physical changes of the aging nose must be recognized if appropriate surgical procedures for elderly patients are to be performed. Vacher et al performed a fresh cadaver study on 40 subjects older than 70 years to examine external nasal characteristics. These investigators identified thin skin, muscular infiltration by subcutaneous fat, and involution of nasal tip muscles in the elderly noses. [77] In a 2004 review, Rohrich et al addressed a multitude of factors that should be considered when planning and executing rhinoplasty in the aging patient. Some of the factors include diminished skin elasticity and dermal thinning, as well as an increase in the density of sebaceous glands of the nasal tip, which may ultimately give way to the development of rhinophyma. As the external nose ages, the cartilaginous framework may become attenuated and fragmented, leading to drooping of the tip and relative elongation and convexity of the nasal dorsum. In addition, with loss of dentition, the maxillary alveolar bone becomes hypoplastic, which adds to the appearance of a relatively longer nose. Along with aesthetic concerns, loss of cartilaginous support in the nasal tip may produce symptomatic nasal airway obstruction by redistributing nasal airflow. Rohrich et al suggested that alteration of the external bony nasal framework in older individuals should be undertaken with caution because of the fragile nature of aged bones. [78] Thus, although rhinoplasty may be safely performed in the elderly patient, the anatomic and physiologic changes that commonly occur in the aging nose should be known and observed by the surgeon.

Otolaryn 29 (Level B): **Observational studies are warranted assessing the effect of loss of nasal function on quality of life for older adults. Outcomes studies investigating the results of rejuvenation therapy for the aging nose would follow.**

Sinusitis and Nasal Discharge

The basic physiology of nasal and sinus function in the elderly person still remains to be elucidated.

Otolaryn 30 (Level B): **The presence of an age-related alteration in mucociliary function or in the sinonasal inflammatory cascade should be investigated to assess the potential for an increased incidence of sinonasal disease in elderly patients.**

DISORDERS OF SWALLOWING

Novel treatment strategies, such as surface electrical stimulation therapy, are being promoted. However, little high-grade evidence exists as to the value of these therapies over traditional swallowing therapy. Hypothesis-generating and hypothesis-testing studies are needed to identify and develop the future treatment strategies for this difficult and important problem.

***Otolaryn 31 (Level B)*: Observational studies are needed to determine the prevalence of dysphagia among community-dwelling older persons, along with the quality-of-life and nutritional impairments that may result from this condition.**

***Otolaryn 32 (Level A)*: Hypothesis-testing studies (case-control and randomized controlled studies) are needed to determine the outcomes of traditional swallowing therapy and augmented swallowing therapy (ie, surface electrical stimulation).**

***Otolaryn 33 (Level D)*: Hypothesis-generating studies (basic bench and translational research studies) are needed to identify bioengineering-based and tissue-engineering–based treatment strategies for restoring neurosensory and neuromotor functional impairments in the older person with dysphagia.**

DISORDERS OF THE LARYNX

Although the clinical information and strategies outlined in the section Progress in Disorders of the Larynx are important areas for new research, future novel diagnostic and therapeutic strategies will ultimately rest upon foundations in basic science. The basic physiologic changes in the aging larynx are not completely understood.

***Otolaryn 34 (Level B)*: Further basic science investigation (bench research in animal models or controlled functional imaging studies) into the pathophysiology of presbyphonia is needed, with particular emphasis on changes in the central neuromuscular control of the aged larynx.**

***Otolaryn 35 (Level B)*: To serve the related agenda item Otolaryn 34, further development of an animal model (bench research) to study age-related voice change and regenerative strategies is needed.**

***Otolaryn 36 (Levels D, B)*: Hypothesis-generating and -testing studies are needed to identify and test novel strategies to treat the aging larynx (such as stem cell and bioengineered solutions). These would initially be performed in an animal model and then followed with controlled studies in human subjects.**

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