EDITORIAL

Expectations—1999

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Expectations are high for continuation of significant advances in the discipline of tinnitology for the benefit of the tinnitus patient in 1999. The significant advances in tinnitology reported in 1997 and 1998 are expected to continue in 1999. We foresee attempts to improve the accuracy of tinnitus diagnosis and anticipate the introduction of treatment modalities that offer to tinnitus patients increased efficacy for achieving tinnitus relief (i.e., tinnitus control).

BASIC SCIENCE

Investigations now are in progress for understanding basic mechanisms of ototoxicity and apoptosis and the role of calcium, potassium, the calcium-activated proteases (or calpains), and the caspases, particularly in underlying pathologies of ischemia, trauma, hemorrhage, and neurodegeneration. These investigations are considered to provide a growing base of information that will be applicable to the development of a neuropharmacology for a particular type of tinnitus. Animal experimentation in the cochlear effects of noise exposure has been reported to have identified electrophysiological alterations in the auditory neuron; such experimentation demonstrates alterations and characteristics in the recordings consistent with epileptiform responses. Continuation of such efforts in vivo animal experimentation may establish guidelines for implementing human clinical treatment methods in an attempt to maintain hearing and to prevent or treat early tinnitus. Such efforts very well may influence the clinical course of tinnitus and could interrupt the development of severely disabling tinnitus.

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Ongoing electrophysiological investigations are seeking to identify an electrophysiological correlate for both the affect and sensory components of tinnitus. The results of such investigations may, for the first time, lead professionals involved with tinnitus diagnosis to accept a test that can objectify the symptom of tinnitus. Such correlates are expected for clinical application using both auditory and vestibular stimulation.

Plastic changes identified in the brain after auditory and visual stimulation are considered to be distinctly applicable to understanding basic mechanisms of different clinical types of tinnitus; such changes also may be clinically applicable for both diagnosis and treatment. Recent reports have identified plastic changes in the primary auditory cortex in tinnitus patients. Current experiments attempting to identify the effect of the calpain antagonist leupeptine on cochlear blood flow are expected to provide basic scientific support for the clinical investigation of leupeptine in humans. The results could be applied to noise protection and might have an associated positive influence on symptoms of hearing loss and tinnitus. Investigations of the efferent system are expected to contribute to our basic understanding of auditory function and of specific actions and interactions of neurotransmitter systems.

TINNITUS DIAGNOSIS

Increasingly, tinnitus diagnostic protocols are focusing on the identification of different clinical types of tinnitus and on identification of factors known to influence the clinical course of tinnitus, particularly the severely disabling type. Past reports of vestibular testing are expected to be clinically applicable not only for identification and treatment of abnormalities in the vestibular labyrinth but for abnormalities reported with position testing. In this regard, recent reports of a technique called *craniocorpography* or brain mapping are particularly interesting.

Such brain-imaging techniques as functional magnetic resonance imaging, positron emission tomography, single-photon computed tomography, and magnetoencephalography are expected to confirm the significance of brain involvement (reported since 1989) in tinnitus patients. Such techniques would reveal the roles of the primary auditory cortex and associated cortices and the cerebellum and their clinical application, particularly in identifying the medical significance of tinnitus.

Investigations of specific receptors in the brain or the ear (or in both) may establish varying degrees of activity, one of which may be the existence of deficiency states associated with or causing tinnitus. Such identification is expected to be clinically applicable to treatment.

TINNITUS TREATMENT

In general, an increasing number of reports of tinnitus control involve both instrumentation and medication. In addition, alternative medical approaches are being introduced, reflecting the absence of a cure for tinnitus. In 1999, clinical reports of multiple modalities of tinnitus therapy are expected to increase.

Instrumentation

Reports of tinnitus retraining therapy with the technique of habituation have cited a significant incidence of long-term tinnitus relief. An update of this ongoing experience is expected to reflect the current clinical state. Specifically, what are the criteria for patient selection that have been identified and what patient factors interfere with or increase the incidence of positive results or complications (if any)?

The reports of attempted tinnitus control using externally and internally placed electrically stimulating devices are expected to increase the application of such devices for tinnitus relief. Criteria for patient selection, short- and long-term results, complications, and attempts to understand the underlying mechanisms involved are expected in 1999, as is a comparison of results for tinnitus relief, over both short and long term. Most important is determining the incidence of achieving tinnitus relief with the habituator alone as compared with the need for combining it with other therapeutic modalities (i.e., medication).

The application of external laser for its photodynamic effect on gingko delivered intravenously for tinnitus control is expected to increase. Reports as to patient selection, complications, and clinical course of patients both before and after treatment also are expected.

The device called *Aurex* has drawn the attention and interest of both affected patients and professionals involved in the diagnosis and treatment of tinnitus. Reports of criteria for patient selection, technique, and results of efficacy (in both the short and long term) are researched with interest. Also expected in 1999 is a report of a feasibility study with an implantable electrical stimulator.

Medication

Reports of control of a particular clinical type of tinnitus with neuroprotective drug protocols directed to pathologies considered to underlie the symptom of tinnitus (i.e., ischemia, hemorrhage, trauma, and neurodegeneration) are expected to increase in 1999. The use of antiseizure medication, either alone or in combination with benzodiazepines, and the use of anions, particularly magnesium, have been reported in the past for maintenance of hearing as well as ear protection from noise exposure.

Clinical trials of the drug caraverine, a calcium channel–blocking agent for a "synaptic cochlear-type tinnitus," have continued to exhibit positive results and are expected to be updated to clarify issues of criteria for patient selection, route-of-delivery complications, and short- and long-term results.

The use of steroids by both mouth and instillation into the middle ear for perfusion of the inner ear has raised the issue of attempts to identify the underlying mechanisms of auditory and vestibular function and dysfunction, which may positively influence the symptom of tinnitus. It is expected that basic science investigation will increasingly attempt to identify the location and incidence of occurrence of receptor density for various steroids.

Surgery

Intratympanic drug therapy, reintroduced in the 1970s by Sakata and, since 1997, modified by application of a new delivery system of microcatheters that provide for delivery of microdosages of medications applied to the round window, is expected to be increasingly reported with a focus on the symptom of tinnitus. Preliminary positive results for tinnitus relief of the past are expected to be increased with such techniques. Reports are expected for the recommendations and establishment of criteria for patient selection, technique, complications, and short and long term results of steroid therapy.

EDUCATION

Tinnitus meetings in 1999 are highlighted by the Sixth International Tinnitus Seminar, Cambridge UK, September 5–9, 1999. Significantly, an increasing number of meetings have been scheduled on an international level to focus specifically on the symptom of tinnitus (see meetings announcements in this issue).

It is expected that the increased incidence of meetings focusing on tinnitus both by patient support groups and professionals involved in basic science and clinical medicine will hasten the achievement of the goal that we all share in common—namely, a cure for all clinical types of tinnitus.

CONCLUSION

In conclusion, along with our tinnitus patients and our colleagues, we entertain a substantial number of expectations for significant improvements in basic science, diagnosis, and treatment of all clinical types of tinnitus.