Acoustic Neuroma & Hearing Preservation Program at UCSF
Hearing Loss

The Acoustic Neuroma and Hearing Preservation Program at UCSF comprises a multidisciplinary team of doctors, nurses, and scientists devoted to the care of patients with complex hearing problems. We offer a wide range of treatment options that are customized to meet the needs of each patient, including several modes of frameless and frame-based radiosurgery. Our neurosurgeons have expertise in all surgical approaches to acoustic neuroma and use cutting-edge technology to restore and preserve hearing before or after surgery. We also provide comprehensive evaluations to determine the cause and extent of hearing loss. Recent collaborations between scientists and clinicians at UCSF have yielded new insights into the genetic signals that contribute to acoustic neuroma recurrence and progression. These findings will likely pave the way for novel treatments that target specific molecular features of an individual patient’s tumor. At UCSF our mission is to provide the most comprehensive and advanced care for patients with acoustic neuromas and hearing loss, and we are continually striving to translate our scientific advances into more-effective therapies.

THE TEAM

Neurological Surgery:
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Otolaryngology — Head and Neck Surgery:
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(Photos above, left to right)
An acoustic neuroma (also called a neurinoma or vestibular schwannoma) is a benign growth that arises from the vestibulocochlear nerve. Despite the biological indolence of these tumors, the clinical sequelae can be devastating. Understanding the molecular features that predict growth of sporadic vestibular schwannoma has been an important goal of the Acoustic Neuroma and Hearing Preservation Program at UCSF. Recently our scientific team has established a novel method to study the genetics of each patient’s tumor in order to evaluate the tumor’s sensitivity to various drugs. This model relies upon establishing cell cultures from our surgical specimen (A, B), followed by transfection with viral vectors that allow the cells to grow indefinitely, and uses luminescence for noninvasive xenograft in vivo studies (C). Histology of xenografts ex vivo recapitulates the original surgical histology (D, E).
Multidisciplinary Approach of UCSF

At UCSF we offer a wide range of treatment options that can be tailored to the individual patient. These include surgical approaches using intraoperative navigation and neurophysiological monitoring, as well as the most up-to-date stereotactic radiation technology. Every patient evaluated at UCSF is discussed among a team of dedicated physicians to determine the best treatment approach, and a skull base tumor board comprised of otolaryngologists, radiation oncologists, neurosurgeons, and neuroradiologists meets monthly to review complex skull base tumor cases.

Observation

Not every patient needs to be treated right away. Small tumors detected incidentally or associated with very minor symptoms can be observed with interval MRI scans and follow-up audiograms. However, growing tumors that are observed but not treated may cause more problems and may be harder to treat as symptoms progress. Early detection and treatment of growing tumors offers the best chance of long-term cure and functional recovery.

Microsurgery

The goal of microsurgery is to resect as much tumor as possible without injuring the brain and nerves that control facial function, hearing, and balance.

The Retrosigmoid Approach

This approach is used when the tumor is located mostly outside the internal auditory canal and adjacent to the brain stem. It can be effective for hearing preservation and decompressing the brain when a large tumor has grown.

The Translabyrinthine Approach

This is an approach through the mastoid and semicircular canals to the internal auditory canal, where the tumor is found. The translabyrinthine approach provides direct exposure of the tumor without the need to retract normal brain. It is only indicated for patients who have profound hearing loss or very large tumors with a significant intracanalicular component.

The Middle Fossa Approach

This approach has the best record for preserving hearing when resecting tumors less than 2 cm in diameter. This approach is limited to relatively small acoustic neuromas that are mostly in the inner auditory canal and involves the retraction of the temporal lobe to access the tumor from above.
Radiation Treatment

The goal of radiation treatment is to stop tumor growth without injuring the important structures surrounding the tumor. Radiation will not remove a tumor, but may shrink it after time. In general, there is no clear advantage of one modality over the other, but tumors with a specific size and shape may be more effectively treated with one type of radiosurgery or radiotherapy. Accordingly, centers such as UCSF, which have all modalities of radiation treatment available, offer the most comprehensive approach.

**Gamma Knife® Radiosurgery**
Radiation is delivered in a single session to the tumor from 200 sources that converge precisely on the tumor. By having a lower dose of radiation from multiple sources converge on a single location, normal tissue in the path receives a minimal dose, reducing the chance of radiation injury.

**Fractionated Stereotactic Radiotherapy**
Radiation is delivered over multiple sessions at a lower dose to decrease the side effects to surrounding nerves.

This type of treatment may be useful for patients with large tumors for whom microsurgery or radiosurgery is not possible.

**LINAC Radiosurgery**
Radiation is delivered in a single session to the tumor. Images of the patient and tumor help localize the specific path of radiation to target the tumor. Because the radiation passes through normal tissue, there is a slight risk of injury to surrounding nerves. At UCSF we use the CyberKnife® to deliver this type of radiosurgery.

Gamma Knife® treatment plan.
Facts on Hearing Loss in Adults

• One in every ten (28 million) Americans has hearing loss, making it the most common sensory disorder.

• The prevalence of hearing loss increases with age, and it can affect up to one in three individuals over age 65. Most individuals develop hearing loss over a period of 25 to 30 years.

• Among seniors, hearing loss is the third most prevalent medical condition, following arthritis and hypertension.

• While the vast majority of Americans (95%) with hearing loss could be successfully treated with hearing aids, only one in five currently use them. Only one in 20 adults with hearing loss can be managed with medical or surgical treatment.

Types of Hearing Loss

• Sensorineural hearing loss (or nerve-related deafness) involves damage to the inner ear caused by:
  - aging
  - prenatal and birth-related problems
  - viral and bacterial infections
  - heredity
  - trauma
  - exposure to loud noise
  - fluid backup
  - certain medications
  - a tumor involving the inner ear

Almost all sensorineural hearing loss can be effectively treated with hearing aids. When hearing aids no longer benefit due to the severity of the loss, cochlear implants are often an option. A rare cause of sensorineural hearing loss is a ‘central’ problem, which affects the auditory nerve or brain itself.

• Conductive hearing loss is due to a problem involving the outer or middle ear and may be caused by:
  - blockage of wax
  - a ruptured eardrum
  - birth defects
  - ear infections
  - stiffening of the middle ear bones or other heritable conditions

It can often be effectively treated medically or surgically.

• Mixed hearing loss refers to a combination of conductive and sensorineural loss and means that a problem occurs in both the outer or middle and the inner ear.

An audiogram demonstrating down-sloping, severe sensorineural hearing loss.
The best treatment depends upon the type and cause of hearing loss. There are several types of hearing aids that can be prescribed, and surgical treatments such as a cochlear implant may be indicated. Each patient is unique and a comprehensive work-up by an experienced team of neurootologists is the first step to determining the best treatment.

**Facts About Hearing Aids**
- The hearing-aid fitting process typically consists of six stages: assessment, treatment planning, selection, verification, orientation, and validation.
- A majority of eligible individuals with hearing loss are fitted with two hearing aids (binaural).
- Approximately one-third of hearing aids in use today are equipped with a telecoil. This is an optional feature that couples directly with hearing-aid-compatible telephones and assistive listening devices, improving intelligibility in noisy situations, in poor acoustical environments, and at long distances from the speaker.
- There are over 1,000 models of hearing aids that can be chosen from based on the type and level of a patient’s hearing loss.

**Facts About Cochlear Implants**
- Currently, over 80,000 people worldwide have cochlear implants.
- Approximately 25,000 people in the United States have cochlear implants.
- Nearly half of all cochlear implant recipients are children.
- Cochlear implants can help an estimated 200,000 children in the United States who do not benefit from hearing aids.
- The demand for cochlear implants is increasing annually by 20%.
- Cochlear implants function by bypassing the injured inner ear to directly stimulate the auditory nerve. Because most patients with severe sensorineural hearing loss still have an intact and functional auditory nerve, the implant is able to re-create the sensation of sound.
- Cochlear implants provide a wide range of sound information and performance. With time and appropriate rehabilitation, most users understand more speech than they did with their hearing aids and many are able to communicate by regular telephone or enjoy music.
- In select patients with partial deafness, newer technologies, such as combined electric and acoustic stimulation, can allow preservation of existing levels of hearing while using the implant to electrically stimulate those frequencies that are absent.
How to refer a patient to the Acoustic Neuroma and Hearing Preservation Program at UCSF

Contact Andrew T. Parsa MD, PhD
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http://neurosurgery.medschool.ucsf.edu
http://ohns.ucsf.edu
http://www.ucsf.edu/radonc

Recent Presentations


Sanai N, Aranda D, Cheung SW, Parsa AT. Microsurgical resection of vestibular schwannomas as the primary treatment for young adults. Presented on April 26-May 1, 2008 at the 76th Annual Meeting of the American Association of Neurological Surgeons, Chicago, IL.