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Brain Tumour Foundation of Canada is generously supported by individuals, corporations and employee groups. It is through the tireless dedication of donors that help is available for anyone affected by a brain tumour, including patients, survivors and their loved ones.

# Ask the Expert Information Sheet

## Brain Tumours and Hearing Challenges

*By: Angela Ryan, Audiologist, and Greg Noel, VP/Director of Audiology (Nova Scotia Hearing and Speech Centres)*

### What is audiology?

Audiology is the study of hearing and balance and its related disorders. An audiologist is a professional trained to screen, diagnose and rehabilitate hearing and balance disorders for people of all ages.

### How you hear

The auditory system is very complex; while the ear is critical for hearing, it is not the entire story as we ultimately hear with our brains. The pathway that sound takes after leaving the inner ear while rapidly traveling towards the brain is intricate. The following structures are involved in the central auditory pathway: the cochlear nucleus, superior olivary complex, the lateral lemniscus, the inferior colliculus, thalamus, subcortical areas, temporal lobe and the corpus callosum.

### Brain tumours and hearing challenges

The hearing symptoms related to brain tumours vary depending on the size, location, type and what the tumour is made of. Difficulties may include hearing in crowds or background noises, difficulty figuring out where a sound is coming from, discriminating similar sounding words, trouble listening to music, or getting mixed up in the intent of what a speaker is saying.

When a brain tumour affects the lower portion of the hearing system (the ear and lower brainstem), the audiologist may detect a problem on the audiogram (a graph of hearing). When a tumour affects the central hearing of the central auditory nervous system, its impact must be measured by other means at the audiologist's disposal. This can be completed with behavioural testing (e.g., listening to a series of numbers presented simultaneously to both ears and having to repeat all the numbers heard) or by attaching small electrodes to the person's head and measuring responses to certain sounds. The latter is called Auditory Evoked Potential Testing because sounds are used to stimulate the auditory centres of the brain and these can be mapped on a computer. There are a number of behavioural tests that are available to assess auditory processing, but typically a clinician will choose four or five measures they know to be sensitive to certain regions of the central auditory pathway and specific types of auditory processing deficits.

### What kinds of brain tumour can affect hearing?

An acoustic neuroma is one type of tumour that can cause a hearing loss. This tumour generally arises from the balance portion of the hearing nerve and the hearing portion of the nerve can be affected. Typical findings include a high frequency hearing loss and

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Adult, Pediatric and Non-Malignant Brain Tumour Handbook available in English and French.

“A Friend in Hope” children’s storybook available in English and French.

20+ Adult Support Groups across Canada (in-person and virtual)

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BrainWAVE Pediatric Support Program

Print BrainStorm Newsletter  
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- E-BrainStorm
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All patient resources are available free-of-charge in Canada. Call 1-800-265-5106 or visit [www.BrainTumour.ca](http://www.BrainTumour.ca) for additional details and information.

poor word recognition scores on the audiogram. These may only affect one ear. Brain tumours can impact hearing by either directly impacting the auditory relay centres or by mass effects, meaning a tumour may create pressure or cause certain parts of the brain to move or displace depending on the size of the tumour. If that region happens to be involved in the hearing network, the person may have trouble hearing.

### What is an FM system?

An FM system is an electronic device that transmits sound directly to the listener’s ear. The speaker wears a compact transmitter and microphone while the listener wears a portable headset. This system is commonly used to help people with hearing loss hear better in group meetings, church settings and classes.

### Brain Tumour Patient Case Study

A referral was received for hearing evaluation of a 49 year old female, Sally\*, who experienced difficulty hearing in background noise. According to her report, Sally’s hearing issues were first noted after having a low-grade tumour removed from the right temporal-parietal region of her brain. Unfortunately, a pre-operative hearing evaluation had not been carried out which makes pre/post comparisons impossible in this case. Sally’s audiogram revealed normal hearing thresholds for the low to mid frequencies with a moderate hearing loss in the high frequencies in both ears. This is consistent with a loss of hearing sensitivity for high pitch sounds, but did not fully explain her reported hearing difficulties at home and work. A follow-up appointment was arranged, during which behavioural tests of auditory processing and auditory evoked potentials were given in order to gain a better understanding and quantitative measures of the Sally’s hearing challenges.

Behavioural testing revealed Sally had difficulty with tests requiring listening in background noise and also temporal processing, which would likely lead to trouble detecting the subtle transitions of speech, especially in noise. In addition, she had more difficulty with temporal processing in her left ear than right ear, which mirrors published research that has shown the ear opposite to the previous brain surgery will show more weakness than the ear on the same side. This is consistent with Sally’s reported difficulty hearing in noise. The evoked potentials testing revealed abnormal left ear results with normal right ear findings. This, along with the behavioural results, suggests there is an auditory processing and central component to Sally’s hearing difficulties in addition to her documented high frequency hearing loss.

Sally was advised to pursue a trial with amplification, given her high frequency hearing loss, and an FM system if she needed additional assistance in background noise. Additionally, it was recommended that Sally begin auditory training (e.g., music therapy and hearing in noise training software) in an effort to hopefully improve her auditory processing abilities. Sally will be seen again in two years to monitor her progress.

\* Names have been changed for confidentiality



**braintumour**  
foundation  
OF CANADA

205 Horton St E  
Suite 203  
London, Ontario  
N6B 1K7

📞 519.642.7755  
1 [800] 265.5106  
📞 519.642.7192  
[www.braintumour.ca](http://www.braintumour.ca)

