Q & A

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WHAT DO I NEED TO KNOW ABOUT CENTRAL AUDITORY PROCESSING DISORDER?

Audrey Vernick, Director of Patient and Family Advocacy for the Pediatric Epilepsy Surgery Alliance, interviews Dr. Tammy Riegner, an audiologist with Nemours/Alfred I. DuPont Hospital for Children, Wilmington, DE

Q: In layman's terms, what is a central auditory impairment/disorder?

A: In the most basic terms, central auditory impairment is any breakdown in the parts of the brain that send, interpret, and organize sounds (just sounds, not language). This is also referred to as Cortical Auditory Impairment or central hearing loss. Included in this broad category is the more specific diagnosis of Central Auditory Processing Disorder (CAPD), which is a group of auditory behaviors where active **listening** skills do not work efficiently in sounds (speech and non-speech) and make sense of them.

Q: What types of surgeries would lead to CAPD? Or, how does surgery cause a CAPD?

A: Any surgical procedure that interrupts the normal function of the auditory parts of the brain can lead to a central auditory impairment. For example, **resection of the corpus callosum or disconnection of the temporal lobe can cause this impairment** (such as in hemispherectomy, Temporal-Parietal-Occipital Disconnection (TPO), temporal lobectomy, or corpus callosotomy). By interrupting the blood flow to or the neural pathways of the higher auditory pathway in the brain, we interrupt the ability of that part of the brain to take in and/or send out information efficiently.

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Q: How is this different from a neurotypical child with CAPD?

A: Some central auditory impairment results from direct medical intervention (for example, brain surgery) for severe neurological problems such as epilepsy, brain tumor, or aneurysm. Sometimes there can be physical changes/disease processes in the body that can result in a breakdown. And sometimes, an impairment occurs because the neural pathways in the brain, for whatever reason, do not develop at the same rate or in the same way as other people in an age group. The difference between these cases is that some children are born with a disorder, some develop a disorder because they mature a little slower compared to their peers, and some acquire a disorder because **something has physically interrupted those pathways in the brain from detecting sounds efficiently**. In the case of children with surgically-acquired impairment, there will likely be some **permanent** amount of auditory impairment, although the severity changes with the child's participation in therapies and growth over time.

Q: How does this impact kids? What behaviors would we see?

A: Another tough question that is not so simple to answer. Every child is different in how they show a specific deficit or deficits (rarely is it just one). This is because we, as human beings, do not exist as one diagnosis. We must look at each child and his or her situation as a whole. But to oversimplify this just a bit to answer your question: some of the main areas of struggle from a purely auditory standpoint would be: significant difficulty understanding speech in the presence of ambient noise (nonsense background sounds) or competing speech (meaningful speech coming from more than one person), difficulty making sound-symbol associations such as in phonics, difficulty following timing and speech cues that give our speech meaning (e.g. asking a question versus making a statement, understanding humor or sarcasm) – just to name a few. Although the following are not direct central auditory impairments, you may also see problems in areas that use auditory information like auditory memory and auditory attention. Sometimes you may see some significant auditory sensitivity, but parents have to be careful as this can be more of an overall sensory processing concern and may not come from the auditory pathway at all.

Q: Who should we see? Does any audiologist do these types of tests?

A: If you are concerned about central auditory impairment, first, you need to see an **audiologist who specializes in the area of Central Auditory Processing**. As with all

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things, not every audiologist is the same – you want one who is experienced in this area and **understands the impact of specific disorders and surgical interventions**. Additionally, your audiologist may need to be a resource for amplification or assistive listening devices, therapies, and other professionals who may need additional resources. Your audiologist will be one member of your child's **multidisciplinary team**, a group of professionals from a wide background of skills working together to understand how your child best functions in everyday life.

Q: What tests should we ask for?

There is a battery of **behavioral tests** that can be performed to assess specific CAPD areas of deficit. Behavioral testing means that the child has to participate in listening and answering actively and is done for children who are seven years of age and older – although some tests are available for as young as five years of age (see below). A good battery should be thorough and try to assess the child's major auditory processing skill areas better to understand his or her specific areas of weakness. In other words, in what listening situations does your child do well, and in what situations or with what types of sounds does your child struggle?

Sometimes, due to the complexity of a child's other diagnoses or the child's young age, formal behavioral CAP evaluations cannot be performed. In these cases, some audiologists perform **electrodiagnostic testing** to evaluate the part of the brain that detects and interprets speech sounds, called the auditory cortex. These tests are not as common clinically due to the expense, even though there is much research supporting their use in assessing central auditory function. Some of these tests include the Cortical Auditory Evoked Potential (also called the Late Evoked Auditory Potential), the cABR or Frequency Following Response (FFR), or the P300.

There are some behavioral tests available for children 5 and older. Please note that many of these are screening tests only and cannot give a formal diagnosis of CAPD. They do, however, give us some valuable information about your child's areas of weakness in addition to the information gathered by the electrodiagnostic tests. Some examples of these screening tests are the SCAN-3C and the Differential Screening Test for Processing (DSTP).

As a result of the specialties within a specialty, you may have more than one audiologist working with your child. As long as you feel comfortable with your audiology team, there is nothing wrong with this.

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Q: So, how do we accommodate for this? What do teachers need to know?

A: The guide "*Cortical Auditory Impairment After Hemispherectomy*" has a list of accommodations that address many considerations for accommodations and management for both parents and teachers.

But to summarize some of the *key* auditory accommodations, **improving the listening environment is the MOST important auditory strategy**. This can be done through assistive listening devices such as personal FM systems and remote microphone technology, which reduce the interference of background noise while improving speech, strategic seating, smaller instructional settings, written and visual aids to supplement verbal instructions, teaching recognition of auditory clues when speech is not clear, reducing ambient reverberation and poor room acoustics, improving light to maximize visual cues, and pre-teaching information that will be presented verbally.

Other non-auditory recommendations help other cognitive areas that may use auditory information inefficiently, such as attention and memory. These may include reading supports, audiobooks to assist with auditory memory and active listening skills, referral to a speech-language pathologist, referral to an occupational therapist, and classroom supports to reduce distractors.

My take-home message to both parents and teachers is this: Cortical Auditory Impairment exists but shows up differently in every child because there is often more than one thing happening. There is no "one size fits all." My greatest piece of advice is to be open-minded and look at each child as an individual. Not every need will be the same, but as long as all of the adults in these children's lives are open to considering the individual child's needs and abilities and are adaptive to different situations, we all have the ability to help these children perform at their best. That really is the goal: learning about your child so that we can figure out ways to help him or her be the most successful self that he or she can be.

I know this does not answer all of your questions, which is why I encourage every parent or teacher who has a child with Cortical Auditory Impairment to learn more about overall Cortical Auditory Impairment but, more importantly, to understand the specifics about the individual child in your life who has this complex diagnosis.

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Dr. Tammy Riegner has worked as an audiologist for 20 years for both the adult and pediatric populations. Before receiving her Master of Science in Audiology from West Virginia University in 1997, she helped establish the WVU Hearing Conservation Program. She has worked in both hospital and private practice ENT settings, providing audiological and vestibular evaluations as well as amplification services to patients. In 2015, she pursued her Doctorate in Audiology from A.T. Stills University while working for Nemours/A.I. DuPont Hospital for Children, where she has worked serving the pediatric population since 2008. Her main areas of specialty are pediatric diagnostics, electrophysiological assessment of the peripheral and central auditory pathways, and Central Auditory Processing evaluation. She has collaborated with Nemours Research Department at the Center for Pediatric Auditory and Speech Sciences (CPASS) to translate research into clinical protocols for assessment.

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