Central Auditory Processing Disorder

• “The inability to understand spoken language in a meaningful way in the absence of what is commonly considered a hearing loss.” (Sineps and Hunter, 1997)

• “…auditory processing disorders can coexist with hearing loss…” (Bellis, 2002)


Auditory Processing

“Auditory processing is the ability to attend, discriminate and understand the spoken message, particularly in the presence of competing stimuli and adverse listening conditions.” (p. 2)

Central Auditory Processing

“Central auditory processing is the perceptual processing of auditory information in the central nervous system. It involves several mechanisms that underlie abilities such as discrimination, recognition, temporal integration, localization of the signal in the presence of competing conditions and under degraded acoustic signals.” (p. 2)

NIDCD Definition of (C)APD

“Auditory processing is a term used to describe what happens when your brain recognizes and interprets the sounds around you. Humans hear when energy that we recognize as sound travels through the ear and is changed into electrical information that can be interpreted by the brain. The ‘disorder’ part of auditory processing disorder means that something is adversely affecting the processing or interpretation of the information.” (p. 1 of 3)

Definition of (Central) Auditory Processing Disorder:
“(C)APD is a deficit in neural processing of auditory stimuli that is not due to higher order language, cognitive, or related factors. However, (C)APD may lead to or be associated with difficulties in higher order language, learning and communications functions. Although (C)APD may coexist with other disorders (e.g., attention deficit hyperactivity disorder [ADHD], language impairment, and learning disability) it is not the result of these disorders.” (p. 1 of 26)
Symptoms of (C)APD

“Children with auditory processing disorders appear to be uncertain about what they hear, and may have difficulties listening when there is background noise, following oral instructions and understanding rapid or degraded speech in the presence of normal peripheral hearing.” (p. 361)

Symptoms of (C)APD

- Difficulty performing multi-step directions
- Poor listening skills
- Slow auditory processing speed
- Language problems – developing vocabulary and understanding the spoken word, etc.
- Problems with reading, verbal and reading comprehension, spelling and vocabulary
- Poor academic performance
Symptoms of (C)APD

- Behavior problems
- Problems remembering and recalling information presented orally
- Problems attending to auditory information

Behavioral Symptoms of CAPD

• “difficulty understanding speech in the presence of competing background noise or reverberant acoustic environments
• problems with the ability to recognize the source of a signal
• difficulty hearing on the phone
• difficulty following rapid speech
• difficulty or inability to detect the subtle changes in the prosody that underlie humor and sarcasm
Behavioral Symptoms of CAPD

- difficulty learning a foreign language or novel speech materials, especially technical language
- difficulty maintaining attention
- a tendency to be easily distracted
- poor singing, musical ability, and/or appreciation of music
- academic difficulties, including reading, spelling and/or learning problems.” (p. 5)

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Central Auditory Processing Disorder

- CAPD is not well defined
- May be due to under myelinated neurons in the corpus callosum.
- Those with CAPD process sounds at a slower rate.
- High rate of Otitis Media (ear infections)


Causes of CAPD

“Perhaps the most obvious examples are cases of complete central deafness, in which individuals show pronounced auditory deficits due to lesions existing primarily in the brain, despite presence of normal peripheral systems.” (p. 5)

American Academy of Audiology (August 24, 2010). *Diagnosis, Treatment, and Management of Children and Adults with Central Auditory Processing Disorder*. From website:  
www.audiology.org/resources/documentlibrary/documents/CAPD%20guidelines%208-2010.pdf
Causes of (C)APD

“In terms of pathophysiological mechanisms, APD may be classified as occurring in the presence of: neurological conditions; delayed central nervous system maturation; or other developmental disorders.” (p. 362)

Causes of (C)APD

“Although most individuals with (C)APD do not exhibit frank lesions of the CANS (Central Auditory Nervous System), there is substantial evidence that many individuals with (C)APD do, upon autopsy, exhibit neuromorphological abnormalities in auditory areas of the CNS (Central Nervous System). Moreover, the same or similar patterns of test findings that are seen in anatomically confirmed central auditory dysfunction also appear in children and adults suspected of having (C)APD who exhibit no frank lesion or pathology.” (p. 10 of 26)

Causes of (C)APD

• Tumors of the Central Auditory Nervous System (CANS)
• Prematurity/Low Birth Weight
• Brain Damage
  – Meningitis
  – Head Trauma
  – Heavy Metal Poisoning
  – Lyme Disease
• Cerebrovascular Disorders
• Metabolic Disorders
• Epilepsy
• Delayed Maturation of the Auditory System

Diagnosis of CAPD

“The diagnosis of (C)APD should be made on the basis of a carefully selected battery of sensitive and specific behavioral tests and electrophysiologic procedures, supplemented by observation and detailed case history.” (p. 5)

Diagnosis of CAPD

“The diagnosis should be made by audiologists who have been properly trained in the area of (C)APD, including the administration and interpretation of these tests and procedures.” (p. 5)

Diagnosis of CAPD

- Evaluations for (C)APD should be done in a soundproof room with acoustic control of environment and test stimuli.

(C)APD and Peripheral Hearing Loss

• The ASHA working group on (C)APD stated that (C)APD can be diagnosed in individual’s with peripheral hearing loss.

• “The experienced audiologist can apply several strategies in administering and interpreting central auditory tests to minimize the degree to which peripheral hearing loss influences central auditory test interpretation.” (p 9 of 26)

(C)APD and Peripheral Hearing Loss

- (C)APD evaluations can be done on children, adolescents and adults.
- Such evaluations can even be done with those with peripheral hearing loss if special care and procedures are followed.

ADHD Vs CAPD

• “It is often too difficult to differentially diagnose the two, particularly since the rate of co-occurrence is so high.” (p. 2)
• 41 to 83% of children with CAPD have comorbid ADHD.
• It is not yet known what percentage of ADHD children have CAPD.

CAPD and AD/HD

• Comorbidity rates between 45 and 75%
• CAPD will often respond to stimulant medication. (Tannock and Brown, 2000)
• Audiologist Vs Psychologist/Psychiatrist:
  – CAPD or AD/HD?
• CAPD may be Inattentive AD/HD (Barkley, 2002)


Barkley on AD/HD Vs CAPD

“The relationship of ADHD to the language processing problem known as central auditory processing disorder (CAPD) is uncertain. Some researchers imply that they may not be separate disorders at all, given that teacher ratings of inattention in children with ADHD were significantly related to several tests of auditory processing. The problem here is largely though not entirely due to problems in definition.” (p. 131)

“Children with ADHD often have difficulty with auditory vigilance or attention..., and so they may automatically qualify for a diagnosis of CAPD on that basis alone.” (p. 131)

Barkley on AD/HD Vs CAPD

“What is clear...is that CAPD and ADHD are not identical disorders if more rigorous definitions and criteria are used to determine the presence of CAPD, apart from merely clinical complaints of auditory inattentiveness. It remains uncertain whether CAPD should be considered a valid disorder apart from other already well-documented language disorders of children or whether it merely represents a more recent relabeling of those previously identified language disorders” (p. 131)

Barkley indicated the following:

- Some studies have found that those with CADP have an improvement in relief from their inattentive symptoms when they are administered stimulant medication. He believes such individuals have co-morbid ADHD and the stimulant medication is reducing their inattentiveness.

- He believes 33% of those with ADHD also have CAPD. The general population’s rate is 3 to 5%.

AD/HD and Central Auditory Processing Disorder

• Tannock and Brown reported 45% to 75% comorbidity between AD/HD and CAPD.

• Hynd reported 50% of those with CAPD have AD/HD and 87% of those have comorbid Learning Disorders.


AD/HD and Central Auditory Processing Disorder

• What appears to be comorbid CAPD in those with AD/HD may be a problem with inhibition and subsequent distraction leading to uncertainty of what was heard.

• There may only be symptom overlap with CAPD.

Symptom Differences

AD/HD, CT

1. Inattentive*
2. Distracted*
3. Hyperactive
4. Restless or Fidgety
5. Impulsive
6. Butts in/Interrupts

* Distracted Inattentive symptoms much more prevalent in ADHD, CT

(C)APD

1. Problems hearing noise
2. Problems following oral instructions
3. Poor listening skills
4. Academic problems
5. Poor Auditory Association Skills
6. Distracted/Inattentive*

Comorbidity of (C)APD and AD/HD, CT

“Item analysis revealed that only two of the most frequently cited behaviors were judged as characteristic of both disorders (i.e., inattention and distractibility). The majority of frequently cited behaviors were not seen as common to ADHD and CAPD.” (p. 78)

Comorbidity of (C)APD and AD/HD, CT

“These data are consistent with the hypothesis that APD and ADHD overlap partly while still being distinct entities. In addition to dimensional aspects, the parent’s rating may provide a guideline for establishing a diagnosis based on categorical dimensions.”

Comorbidity of (C)APD and Dyslexia

“Approximately half of the participants with developmental dyslexia showed clinically significant diminished performance on the FPT (Frequency-Pattern Test) and DPT (Duration-Pattern Test) indicative of APD. These results indicate that the percentage of persons with developmental dyslexia and comorbid APD may be substantial enough to warrant serious clinical considerations.” (p. 448)

Comorbidity of (C)APD and AD/HD, IT

Research has shown when pediatricians rated symptoms related to AD/HD, Inattentive Type (SCT) and audiologists rated symptoms rated symptoms related to (C)APD from the same list of 58 symptoms there was no overlap of symptoms.

Comorbidity of (C)APD and Asperger’s Disorder

“We now have research evidence to confirm significant problems for children and adults with Asperger’s syndrome in their ability to understand what someone says when there is background speech or noise...and perceive, discriminate and process auditory information.” (p. 221)

People with Asperger’s Disorder are not good at filling in gaps in hearing.

Special Treatment Considerations with Asperger’s Disorder

- After you give a child with Asperger’s disorder a task ask, “Tell me what you have been asked to do?”
- Write down directions. The more multi-sensory they are the better.
- Directions must be based on the child’s language comprehension, not their ability to read and speak complex words.
- When giving oral instructions pause a few seconds between sentences to allow the child to process the information.

Diagnosing CAPD

- Team approach:
  - Audiologist (Case Manager)
  - Speech-Language Pathologist
  - Educator
  - Psychologist
  - Parents


**National Coalition for Auditory Processing Disorders**: [www.ncapd.org](http://www.ncapd.org)
Diagnosing CAPD

• Physicians – “If there is a disease or disorder related to hearing, you may be referred to an otolaryngologist, a physician who specializes in diseases and disorders of the head and neck.” (National Institute on Deafness and Other Communication Disorders, May 8, 2002, p. 3)

• American Medical Association: www.ama-assn.org
Treating CAPD

• Help with Grieving Process
• Environmental Modifications
  – FM Loop Systems, Amplification, Seating, Etc.
• Remediation (Direct Therapy)
  – Phonological Awareness, Temporal Patterning, Prosody Training, Interhemispheric Training
• Compensatory Strategies

“The accumulated auditory and cognitive science literature supports comprehensive programming incorporating both bottom-up (e.g., acoustic signal enhancement, auditory training) and top-down (i.e., cognitive, metacognitive, and language strategies) approaches delivered consistent with neuroscience principles.” (p. 13 of 26)

Treating (C)APD

- Audiologists may use formal auditory training to take advantage of the brain’s plasticity using computer programs like:

Treating (C)APD

• Such training should take place in the workplace, home and school.

• The following training should be done simultaneously: environmental modifications, direct instruction, remediation and compensation strategies.

Treatment of (C)APD

“Environmental accommodations to enhance the listening environment may include but are not limited to preferential seating for the individual with (C)APD to improve access to the acoustic (and the visual) signal; use of visual aids; reduction of competing signals and reverberation time; use of assistive listening systems; and advising speakers to speak more slowly, pause more often and emphasize key words.” (p. 14 of 26)

Classroom Environmental Modifications

“These modifications may include decreasing reverberation by covering reflective surfaces (e.g., black/white boards not in use, linoleum or wood floors, untreated ceilings), using properly spaced acoustic dividers, using other absorption materials throughout open or empty spaces (e.g., unused coat areas), and/or changing the location of “study” sights. External noise sources can be eliminated or moved away from learning space e.g., aquariums, fluorescent lights that hum, and open door or wall.” (p. 14 of 26)

Classroom Accommodations

“Accommodations that utilize technology to improve audibility and clarity of the acoustic signal itself (assistive listening devices such as FM or infrared technology) may be indicated for some individuals with (C)APD...The strongest indicators for the use of personal FM as a management strategy are deficits on monaural low redundancy speech and dichotic speech tests...” (p. 14 of 26)

Such people have great difficulty in the acoustic environments encountered in schools, home and work.

Curriculum Adaptation

“Specific suggestions may include support for focused listening (e.g., use of note-takers, preview questions, organizers), redundancy (e.g., multisensory instruction, computer mediation), and the use of written output e.g., e-mail, mind-maps.” (p. 15 of 26)

How to Make your Classroom Acoustically Available

• CAPD students sit in first row.
• Provide good lighting in the room.
• Avoid assigning a teacher to student who DOES NOT speak with a common or local accent.
• Acoustical tile in the ceiling
• Carpeting with thick carpeting pad on the floor
• Beards and moustaches need to be well trimmed away from lips. This allows for better speech reading.
• No mini-blinds! Use draperies! Draperies absorb ambient sound better.
Classroom Acoustics

• The American Speech-Language Hearing Association (www.asha.org) has a position paper on this that includes a comprehensive bibliography: Paper number 37, supplement 14.

• The Counsel of Educational Facility Planners International (CEFPI) has the following article on their website about how to build in good classroom acoustics:

Sound Suppression Technology

Bose QuietComfort Sound suppression headphones:
www.bose.com
FM Loop System

Website: www.harriscomm.com

Helpful Websites for CAPD

• National Institute on Deafness and Other Communication Disorders: www.nidcdinfo@nidcd.nih.gov

• American Academy of Audiology: www.audiology.org

• American Speech-Language Hearing Association: www.asha.org

• National Coalition for Auditory Processing Disorders: www.ncapd.org

Helpful Books on (C)APD


Helpful Book on (C)APD