

Special Edition
"Central Auditory Processing
Disorder in Children"

Mini Review

*Corresponding author

Neha Taneja, MASLP

Assistant Professor
Department of Audiology and Speech
Language Pathology
Amity Medical School
Amity Univeristy, Haryana, India
Tel. +91 8860592030
E-mail: neha.aslp04@gmail.com

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A Mini Review on Differential Overview of Central Auditory Processing Disorder (CAPD) and Attention Deficit Hyperactivity Disorder (ADHD)

Neha Taneja, MASLP*

Department of Audiology and Speech, Language Pathology, Amity University, Haryana 122413, India

ABSTRACT

Introduction: Central auditory processing disorder (CAPD) and attention deficit hyperactivity disorder (ADHD) show similar clinical symptoms. Among the many similar characteristics poor attention and reduced scores of central auditory processes are among the most common. Yet there exists a remarkable difference between the two conditions.

Objective: The aim of this paper is to provide a quick overview of the areas of similarities and dissimilarities between CAPD and ADHD to provide a better understanding of the diagnosis and intervention between the two.

Review: The cause of CAPD is attributed to the improper functioning of auditory processes. However, it may also occur in conjunction with some other global dysfunctions affecting other modalities like neural timing deficits, language representation deficits and attention deficits. CAPD has been reported in both children and adults. ADHD has been reported to be the most commonly reported neurobehavioral disorder among children. The children diagnosed with ADHD generally show a poor social, academic and occupational function. The association of ADHD with CAPD has been established on the basis of the common features concerning poor attention and reduced scores for the central auditory processes. At the same time the evidences from various related disciplines like neuropsychology, cognition neuroscience and audiology present a line of difference between ADHD and CAPD.

Conclusion: The overlapping medical characteristics of CAPD and ADHD pose a challenge towards performing the differential diagnosis of ADHD and CAPD. The problems associated with the regulation of behaviour are the most common complaints concerning ADHD over inattention problems. In contrary, in CAPD, deficits of the auditory perceptual problems are a major concern. The approaches towards the management of CAPD and ADHD differ on the basis of the primary disorder. The implementation of selective clinical diagnosis may help plan a better management of these disorders. As per the neuromorphological evidences, the dysfunction in auditory processing is common to both CAPD and ADHD. This forms a basis for specifically assessing the complete functioning of the auditory system. Since the problems of perception, linguistic and cognition coexist in these two disorders, hence there is a need to implement a multidisciplinary approach involving a team of audiologists, teachers, psychologists and physicians for the assessment and defining the therapeutic intervention.

KEY WORDS: Central auditory processing disorder (CAPD); Attention deficit hyperactivity disorder (ADHD); Executive functions; Behaviour; Inattention; Children; Auditory processing.

INTRODUCTION

The cause of central auditory processing disorder (CAPD) is attributed to the improper functioning of auditory processes. However, it may also occur in conjunction with some other global dysfunctions affecting other modalities like neural timing deficits, language representa-

tion deficits and attention deficits.¹ CAPD has been reported in both children and adults. Many disorders affecting the central nervous system such as traumatic brain injury, multiple sclerosis, epilepsy, Alzheimer's disease have reported the occurrence of CAPD.¹ Among the older adults CAPD occurs mostly due to nonpathologic neurologic changes which are age related.² According to a study undertaken by Chermak & Musiek, it was observed that one or more deficits in the central auditory processes may occur in CAPD patients which may further result in deficits associated with the production of auditory evoked potentials and poor behaviour concerning auditory pattern recognition, auditory discrimination and temporal processing (e.g. temporal masking, temporal resolution, and temporal ordering).³ Also in the same study the auditory performance with competing signal and degraded auditory signal was reported to be poor in children affected with CAPD.³ The ability to comprehend has been found to be poor in children with CAPD in noisy situations.⁴ On the other hand, attention deficit hyperactivity disorder (ADHD) has been reported to be the most commonly reported neurobehavioral disorder among children.⁵ The children diagnosed with ADHD generally show a poor social, academic and occupational function and these symptoms are reported commonly before the child is 7-years-old.⁶ Hyperactivity and poor attention are the most common characteristics observed in children diagnosed with ADHD as compared to other peer aged groups.

The association of ADHD with CAPD has been established on the basis of the common features concerning poor attention and reduced scores for the central auditory processes. Poor performance in central auditory tests and attention problems further strengthens our hypothesis establishing the linkage between CAPD and ADHD.⁷ Although, ADHD diagnosed children may be symptomatic of the characteristics associated with CAPD which is supported by the observation that in ADHD patients, there are frequent complaints about the otitis media however, CAPD continues to exist following the restoration of normal hearing after resolving the otitis media.⁸ Many other disorders like CAPD, ADHD and other learning disabilities have also been linked to each other on account of the overlapping clinical symptoms associated with these disorders.⁹ The complexity of the nature of their overlap is not yet clearly understood.³ There exist some evidences from behavioural and neuroanatomical research which has paved the path to investigate the association and distinction between the previously discussed conditions.

LITERATURE REVIEW ON SIMILARITIES AND DISSIMILARITIES AMONG CAPD AND ADHD

CAPD and ADHD have been correlated with each other on the basis of the similarities between their clinical characteristics. However, there exists a clear demarcation between both the disorders, which can facilitate a better differential diagnosis and subsequent management of each of the conditions separately. The link between CAPD and ADHD which has been reported previously are completely based on evidences with respect to

neuromorphological correlates, executive functions and information processing models.¹⁰ The morphological differences and irregularities in the functioning of the brain areas responsible for motor regulation and self-control, highlights the neurobiological basis for defining the relation between central auditory deficits and behavioural problems in ADHD. There also exist some reports of experimental evidences which highlight the slow activity of temporal regions in ADHD.¹¹ The other parameter which has been extensively used to study the nature of overlap between CAPD and ADHD is executive function. Executive functions refer to a set of cognitive processes that are essential for determining the cognitive control over behaviour, the monitoring of such responses and thereby helping to attain a desired goal or reaction. The basic cognitive processes included under executive functions are attention control, cognitive inhibition, cognitive flexibility, working memory etc. Executive functioning helps provide an understanding of the specific use of attention (selective and sustained). It elucidates the significance of attention and memory to register, store and make use of knowledge and experience.¹² Executive function relates to metacognition, the processes which ensure that an individual's behaviour is adaptive and targeted as per the expected behaviour.¹³ Executive skills are crucial for learning, problem solving, regulation of emotion, motivation, listening etc.¹⁴ The prevalence of executive deficits has been reported to be high in children with learning disabilities, ADHD and other childhood neurologic disorders.¹⁵ The occurrence of executive deficits in CAPD children has been reported to be comparatively less.³ Thus, dysfunction due to executive functioning may be due to deficits characterizing ADHD and CAPD. Poor executive functioning has been considered significant towards understanding the cause of language deficits, poor problem solving and pragmatics in ADHD.¹⁰ In CAPD, the auditory perceptual deficits impede the operation of executive functions hence such executive dysfunction is difficult to be assessed thoroughly. The major concern in CAPD is the difficulty in listening or understanding acoustic signals which further makes it difficult for the children to perform higher demanding functions of execution. Executive functions which occupy a higher hierarchy in the tasks gets affected due to improper organisation, monitoring and understanding of acoustic signals thereby reflecting on the limited use of executive tasks. Hence, executive function difficulties are secondary to listening deficits.³ Thus, executive dysfunction has been reported as a secondary parameter in CAPD unlike ADHD where it is considered as a primary clinical concern.³ The primary link of executive function deficits in ADHD has been highlighted based on the common grounds of rule governed behaviour, executive function, and self control. ADHD is characterised by language deficits. The pragmatic and metacognitive behaviour associated with communication are also rule governed and language based.³ Poor executive functioning has been documented in ADHD characterised by symptoms such as deficits in language, poor eye contact, poor problem solving, inappropriate run talking and maintaining discourse since poor metacognition, pragmatic deficits follow a common ground based as language – both of which are rule based. Some authors have reported that ADHD is characterised by execu-

tive dysfunctions, sustained attention deficits, reduced rate of information processing while CAPD executive dysfunction is secondary to the development of listening deficits and specific auditory perceptual deficits.¹⁶ CAPD has been referred to as an input disorder (impeding selective and dividing auditory attention) while ADHD has been reported to be an output disorder in response to programming and execution that leads to sustained attention deficits through different modalities. There also exist evidences supporting the dual diagnosis of CAPD and ADHD with respect to the comorbid attention deficits.

Dissimilarities between CAPD and ADHD have been reported on the basis of nature of attention deficits, reconceptualising ADHD and behavioural differences.¹⁰ Attention deficits have been reported to be the most commonly observed characteristics in children diagnosed with CAPD and ADHD. Attention deficits in ADHD have been reported to be pervasive and supramodal which has affected more than one sensory modality whereas in CAPD it has affected auditory modality only. Also, the inattentiveness noted in children with CAPD results from deficit in information processing, while in children with ADHD, due to poor execution or response programming.¹⁰ Owing to poor attention which characterizes both the disorders, the differential diagnosis of the clinical condition becomes cumbersome. Further, ongoing research towards redefining ADHD as a behavioural disorder rather than an attention deficit disorder, has helped identify a way to differentiate between ADHD and CAPD. Deficits in rule governed behaviour lead to problems in executive functioning and self-regulation.¹⁷ ADHD thus encompassed characteristic features such as poor social skills, language difficulties and poor self-control. Thus, ADHD can be more effectively addressed as a motivational deficit rather than a condition of attention deficit.¹⁸ With respect to behaviour, ADHD is primarily characterised by poor attention and distractibility in children whereas CAPD is primarily associated with selective attention deficits, associated language difficulties and processing deficits. Mainly behavioural deficits such as inappropriate interaction, excessive talking has been reported more frequently in ADHD than CAPD patients.¹⁹ Based on the above findings which emphasises on the differences and similarities between CAPD and ADHD, it can be understood that the proper diagnosis of the two clinical conditions can lead to an efficient management of both, separately. The management criteria for both the clinical disorders must rely on the primary disorder first in each case. The primary disorder in CAPD is marked by listening difficulties or poor acoustic understanding of information whereas in ADHD it is mainly associated with poor attention and language skills. So forth, the primary objectives for managing CAPD would focus on acoustic modifications, auditory training followed by metalinguistic and metacognitive skills. The clinical management of ADHD will incorporate medication and metacognitive or executive control strategies.³ On the above lines of differential management for CAPD and ADHD, the approaches will vary. The primary approaches for CAPD include signal enhancement, auditory training, environmental modifications, metacognitive (executive) strategies, linguistic strategies,

metalinguistic strategies, collaboration and learning strategies. While in ADHD, the main approaches would focus on effective medication, metacognitive or executive strategies including cognitive behaviour modification, social pragmatic skills (role playing, building attention, building vocabulary, pragmatics, problem solving) and building collaboration with families and teachers with regards to effective medication and environmental modification programs (structuring environment, reinforcement and token).³

CONCLUSION

The overlapping medical characteristics of CAPD and ADHD pose a challenge towards performing the differential diagnosis of ADHD and CAPD. The problems associated with the regulation of behaviour are the most common complaints concerning ADHD over inattention problems. In contrary, in CAPD, deficits of the auditory perceptual problems are a major concern. This may lead to inadequate assessment and diagnosis. The implementation of selective clinical diagnosis may help plan a better management of these disorders. Based on the primary characteristics associated with CAPD and ADHD, it becomes possible to selectively choose the therapeutic approach for addressing each of the related symptoms separately. Individuals diagnosed with ADHD, learning disability and CAPD experience speech language processing deficits. As per the neuromorphological evidences, the dysfunction in auditory processing is common to both CAPD and ADHD. This forms a basis for specifically assessing the complete functioning of the auditory system. Since the problems of perception, linguistic and cognition coexist in these two disorders, hence there is a need to implement a multi-disciplinary approach involving a team of audiologists, teachers, psychologists and physicians for the assessment and defining the therapeutic intervention for the management of the discussed conditions. A detailed specific diagnosis will support a medically effective intervention for therapy.

CONFLICTS OF INTEREST

The author declares that she has no conflicts of interest.

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