

## Editorial

### Auditory Processing Disorder

When a child is having difficulty listening in noisy situations e.g. classroom, a hearing test should be considered as a first diagnostic step. If however, the hearing test is normal and the symptom persists, the pediatrician should consider requesting an auditory processing assessment. Hearing loss in childhood is known to interfere with communication, learning, language acquisition, social life and academic achievements. Similarly Auditory Processing Disorder (APD) may affect a child's ability to communicate, normally acquire reading skills and it may interfere with social life and academic achievements. An estimated 5% of school aged children may be affected by the disorder, which in many cases remains undiagnosed.

This is a monothematic issue on pediatric (Central) Auditory Processing Disorder (APD or CAPD). The word monothematic is compound and of Greek origin, "mono" meaning only one and "thematic" meaning topic. It focuses on raising awareness of this disorder and providing evidence and data on speech perception in noise, comorbidity of APD and reading disabilities (Dyslexia), the neural substrate of the disorder and objective biological measures as a supplement for assessment and monitoring of management outcome. The aim is to provide a well-structured overview of presenting symptomatology, comorbidity and neurobiological origin. It should be noted that APD is too complex for all its features and controversies to be presented in a single issue. Nevertheless, authors in this issue are presenting this disorder mainly from the clinician's point of view largely incorporating current research.

The core deficit in APD is difficulty perceiving speech in noise in the presence of a normal hearing test (audiogram). A key point to be remembered by the general practice pediatrician is as Bantwal & Hall state "A normal audiogram does not rule out a hearing deficit. Indeed, we really hear with our brains, not our ears". Both parental and child's concern about hearing should be adequately addressed. Diagnosis of normal hearing sensitivity does not exclude the possibility of APD being present. As a result of this core deficit a child's ability to communicate and learn may be impaired and comorbidity with reading disabilities may present. These impairments have been shown to be associated with anxiety, low self-esteem and difficulty in acquiring friends as possible presenting psychosocial problems and may ultimately lead to academic failure.

30-50% of children with reading disabilities and/or learning disorders present with APD. Causality of this comorbidity is not conclusively defined at the present time. In this issue, preliminary results by Veuillet, Bouilhol & Thai-Van, are presented showing on one end differences in developmental trajectories of auditory descending pathway function between normal reading and dyslexic children and on the other end deficient high level process. Hearing is a sensation requiring bottom-up functionality, which is information conveyed and decoded from the peripheral auditory organ to the central auditory nervous system and the brain cortex. However, cognitive elements play a significant role accelerating information processing and this is denoted as top-down functionality. Top-down and bottom-up functioning in the auditory system are synergistically processing information accomplishing auditory perception. Even though this mentioned relation exists, yet "Too rarely to this day, health professionals faced with children with learning difficulties ask whether an APD is present" as noted in the conclusion paragraph of Veuillet *et al.*

Psychoacoustic APD test battery may reflect elements related to motivation, attention, language and cognition. Tests used in APD battery have been largely developed to probe central auditory nervous system dysfunction as a result of confirmed pathology. Attempting to provide insight on the neurological origin of APD Chermak & Musiek note that there is "a small percentage of children with CAPD and related learning difficulties whose auditory problems arise from neurological disorders. Etiologies may include seizure disorder (e.g., Landau Kleffner Syndrome), traumatic brain injury, neoplasms, neurodegenerative disorders, neurotoxicity, cerebrovascular accidents, metabolic disorders, and genetic disorders". Patterns of psychoacoustic test battery results could contribute to the formulation of a gold standard for APD. This possibility is driven by the observation that children with auditory processing disorder symptoms and no identifiable lesion frequently have deficits

performance patterns that mirror those with documented lesions of the central auditory nervous system. Chermak & Musiek discuss key neuroanatomical factors influencing both central auditory processing tests and electrophysiological procedures.

Auditory processing assessment is based on a test battery of psychoacoustic (behavioral) tests, which should include both verbal and non-verbal stimuli. A recent development in electrophysiology is the speech-evoked auditory brainstem response that “has been linked to communication skills such as speech-in-noise perception and reading ability and provides additional insight for the diagnosis and management of auditory processing disorders”, as presented by Hornickel & Kraus. The inclusion of electrophysiological measurements permits for the cross check principle to be applied. Taking into account that most medical tests are not 100% sensitive and specific and that hearing is a complicated process with a variety of higher order functions involved in it, it is essential to be able to rely on comparing results across different tests before arriving to a diagnosis of APD. This is even more important as comorbidities may be present with Dyslexia, Specific Language Impairment, Learning disabilities, ADHD (Attention Deficit Hyperactivity Disorder), etc. Multidisciplinary approach is fundamental in order to optimize management of APD children.

Hearing in real life situations is much more demanding than that actually tested by a classical hearing test; the main difference being the very simple stimuli used during audiological testing as opposed to the vastly more complex speech stimuli. The aim of this hot topic issue is for the pediatrician to realize this discrepancy and consolidate knowledge regarding hearing testing. When evaluating hearing (especially in a child with speech in noise difficulties and/or learning disabilities) physicians are actually interested in hearing of speech as this is fundamental for both communication and learning. Thus, everyday hearing requires normal auditory processing abilities. In a case of a complaint about hearing, when the audiogram is normal, the pediatrician should consider requesting an auditory processing evaluation.

**Vasiliki Maria Iliadou**

*(Guest Editor)*

Medical School

Aristotle University of Thessaloniki

Greece

Tel: +302310994739

Fax: +302310345893

E-mails: [viliad@auth.gr](mailto:viliad@auth.gr); [viliadou@med.auth.gr](mailto:viliadou@med.auth.gr)