



Mini Review

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Nonverbal Learning Disabilities (Nld) – Clinical Description about Neurodevelopmental Disabilities

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Abstract

Nonverbal Learning Disabilities (NLD) are neurodevelopmental disabilities that present disorders in the cognitive functions linked to the right hemisphere, particularly in the white matter. Their characteristics are the coexistence of social skills difficulties, low academic performance, poor visual-spatial skills and difficulties with motor skills. The information of the medical literature revised by this article along with the personal experience are the basis to describe the most relevant clinical signs that children with NLD show. Since NLD, the Asperger Syndrome and the Attention Deficit Hyperactivity Disorder (ADHD) are similar, the article will also highlight the differences between these development disorders.

Keywords: Right hemisphere; Neuropsychology; Nonverbal learning disabilities; Asperger syndrome; ADHD

Introduction

Nonverbal Learning Disabilities (NLD) have been defined as neurodevelopmental disabilities. The compromised functions are the functions normally assigned to the right hemisphere, which plays a fundamental role to maintain attention, to process visual-spatial information and to express and interpret emotional information [1]. The three main learning areas are: reading, writing and mathematics. Nonetheless, the daily clinical evaluation allows identifying other skills that are no less relevant to the individual and social development: motor coordination; social and interpersonal communication competences; intuitive, spontaneous and emotional stable behavior; and the ability to understand visual information to play or to develop a creative profile. All of them are part of the nonverbal learning, whose neurobiological essence resides in the right brain hemisphere [2]. Nonverbal Learning Disabilities (NLD) are a subtype of learning disorder that is not included in the Diagnostic and Statistical Manual of Mental Disorders, 4th. ed. (DSM-IV-TR) nor the DSM 5. The global prevalence of learning disorders is about 10-15%; however, there are no specific figures about NLD. Additionally, the limits between NLD and other disorders or syndromes such as the Asperger Syndrome or the Attention Deficit Hyperactivity Disorder (ADHD) are sometimes vague [3].

The term NLD is relatively new and its limits and diagnosis criteria are not well established or agreed. Even its existence as a specific entity has been questioned. There are other disorders in the literature that present some of NLD's characteristics: "developmental coordination disorder", "developmental dyspraxia" [4,5], "right hemisphere syndrome" [1,6,7], "DAMP" (Deficit in Attention, Motor control and Perception) [8,9]. A term proposed by Crespo-Eguílaz and Narbona is Procedural Learning Disorder (PLD) [10], which includes an alteration of motor behavior and of verbal and nonverbal cognitive strategies. Unlike dyslexia and dyscalculia, there are no prevalence studies due to the lack of consensus in terminology and diagnosis criteria. Since there are no epidemiological studies, it is not possible to know the percentage of children who might be affected because of the absence of early identification and treatment.

Background

The first descriptions of NLD go back to the 70s, when authors Myklebust and Johnson [11] described a group of children who had difficulties to understand the social context and had limited skills for academic learning. Intelligence tests of these children showed

good results in verbal intelligence quotients and poor results in executive quotients (related to perceptive and handling skills) [12-14]. In 1982, B.P. Rourke provided a more complete view of NLD [15], as well as the possible causes and dysfunctional brain structures. The author linked NLD with a possible alteration of the brain white matter, especially the white matter in the right hemisphere.

Clinical Description

According to Rourke, the children with NLD tend to be sedentary and explore the world through verbal information; therefore, they show difficulties in attention processes of tactile or visual stimuli. Their difficulties in concept formation and abstract reasoning are partially a consequence of receiving information primarily through auditory channel (verbal) without other sensitive motor data. As a result of the above description, there are consequences in the academic area and difficulties at a psychosocial level [16,15]. Perception, analysis capacity and social interaction deficiencies are the causes of problems in reasoning and concept formation. Poor interpretations of nonverbal aspects of communication and of new information processing contribute to inappropriate models of social interaction. At long term, children with NLD will be more likely to display affective symptomatology (depression, anxiety, isolation) [17]. It is frequent the occurrence of visual-spatial problems with difficulties in differentiating right from left and time management, of disorders in interpersonal relationships with difficulties in the interpretation of the meaning of other people's actions, of interpretation of emotions, as well as recurrent difficulties in arithmetic. The children show a strong tendency to solve problems in a routine, mechanical way by using conjectures or previously memorized answers (but inappropriate for the situation), with difficulties in adapting their behavior or answers as the situation changes. The visual-spatial and arithmetic difficulties are reflected in a verbal IQ score of 10 or more points superior to the executive IQ in the Wechsler test for children (WISC-R) [18].

Rourke [15,19] defined the 'non-verbal learning disabilities' (NLD) as a subtype of learning disorder and exposed that among its neuropsychological characteristics are:

- Primary deficit: in the tactile and visual perception, psychomotor activity (gross), adaptation to material or new tasks.
- Secondary deficit: in the tactile and visual attention and exploratory behaviors.
- Tertiary deficit: in the tactile and visual memory, in concept formation and in the problem-solving skills.
- Deficit in some language dimensions: oral praxis, prosody, contents, pragmatics.

The present difficulties can be summarized in three big groups [18]:

- 1) Visual-spatial-organizational: Poor visual recognition, failure in perception and space organization, and difficulties in

building forms stand out. These will affect all learning areas, especially mathematics (due to the compromise of spatial work memory), manual and artistic activities.

- 2) Motoric: Lack of coordination, balance problems and poor development of graphomotor skills. The motoric planning is altered, which makes comprehension, organization and finalization of tasks difficult.

- 3) Social: Lack of ability to comprehend nonverbal communication, difficulties adjusting to transitions and novel situations, and deficits of social judgment and social interaction.

The strengths of children with NLD are linked to language management, declarative memory (for formal information) with good skills in word recognition when reading and when repeating verbal material, and, usually, good spelling and written language, even when it can be difficult for them to write a text. The children can have good attention and auditory memory, which helps to compensate for the visual disattention; they achieve learning mainly through verbal mediation.

Table 1: Deficits of Nonverbal Learning Disabilities. Andrés García Gómez, et al. from the Educational and Psychopedagogical Orientation Team of Cáceres in Spain [20].

Neuropsychological Deficits	Academic Deficits	Social-Emotional and Adaptation Deficits
Difficulties in perception and in visual and tactile discrimination	Deficits in math reasoning and mechanical arithmetic, which are more evident with time when child is 10-12 years old.	Difficulties in perception and in social cognition
Difficulties in psychomotor coordination	Deficit in reading comprehension	Difficulties to understand cues of body language
Difficulties in visual attention	Slow, hard and dysgraphic writing	Difficulties in social interaction
Difficulties in nonverbal memory	School difficulties in activities that require fine motor skills: cutting out, drawing, modelling, graphic making, etc.	Low self-esteem.
Difficulties in reasoning, especially when formulating hypothesis or finding new options to solve a problem.		Higher tendency towards anxiety, depression and suicide compared to general population.
Difficulties in making decisions		
Deficit in executive functions		
Sometimes deficits in linguistic aspects: literal comprehension of language and difficulties in pragmatics.		

In contrast with previously described deficits, in NLD the following linguistic skills are well retained: primary (auditory perception), secondary (verbal and auditory attention) and tertiary (auditory and verbal memory) linguistic skills. The Educational and

Psychopedagogical Orientation Team of Cáceres in Spain (Andrés García Gómez et al.) has organized the NLD's deficits in three main areas, 2-3[20]: (Table 1).

Thompson [20] describes that many of the first NLD symptoms cause pride instead of alarm among parents and educators, who are delighted by the language achievements. The children with NLD tend to talk a lot and can speak as an adult at two or three years old. During their first childhood, their parents and educators consider them as 'gifted'. Sometimes, children with NLD learn early to read. In general, these children are enthusiastic students and are eager to learn; they memorize a great quantity of material in a mechanical way and they can even do mechanical arithmetic easily, which reinforces the idea of their precociousness.

However, the precocious skills in these children need to be understood as a compensation strategy for having difficulties in understanding visual and tactile cues, both in the physical organization of the world and in the elements of nonverbal communication with other people. At school, the nonverbal deficits of these children are expressed in a variety of forms: difficulties to interact with other children; difficulties to acquire autonomy habits; poor physical skills; refusal of doing homework with paper and pencil and other fine motor skill tasks; not adapting easily to environment changes; among others. These forms are interpreted by teachers as indicators of intelligent children, with a precocious development in certain areas but with lazy and whimsical attitudes.

Normally, the difficulties of these children remain unnoticed excepting their poor psychomotor skills during their pre-school education and in great part during their elementary education. They are students who understand well, read well, are able to memorize theoretical contents of different subjects and can perform mechanical arithmetic activities automatically. However, when academic requirements increase, the problems start to become more evident. Rourke [21] has described that these children rarely achieve a 5th or 6th curricular level of elementary education in mathematics. From this point on, the difficulties in reading comprehension, thinking and reasoning, new problems resolution and written expression become more evident.

Besides the abovementioned difficulties, during and after adolescence these kids show difficulties in using different units of measure, are not able to do estimations with the units and also show difficulties when orienting themselves in time and space. Likewise, they show difficulties when using money and planning their expenses. Additionally, due to the conservation of some of their verbal skills, it is not strange that some individuals with NLD complete superior or technical studies. Nonetheless, their difficulties in social skills and higher order cognitive skills can lead to frustration at work or can make it difficult to find one.

Planning and organizational capacity problems can limit success at home, with a partner and with the family. These limitations can be very frustrating; therefore, these individuals can show anxiety and depression symptoms [20].

Nld and the Asperger Syndrome

NLD is a learning disorder and its main symptoms are centered in alterations that are generally attributed to the right hemisphere: spatial orientation, visual-perception, spatial structuring, fine psychomotor activity and pragmatic aspects of language [22]. The Asperger Syndrome (AS), which is classified as an Autism Spectrum Disorder (ASD), has the characteristics of significant alteration in communication and in social interaction, as well as inflexible behavior. "To differentiate the Asperger Syndrome from the High-Functioning Autism (HFA) is complicated. The Asperger Syndrome and the HFA are syndromes defined by diagnosis criteria based on behaviors, while NLD was defined as a learning disorder of the right hemisphere based on the neuropsychological profile [18]".

"Unlike AS, in PLD-NLD the following are absent:

- Restrictive interests and repetitive behaviors, common in Asperger and in the non-specified Pervasive Developmental Disorder (PDD).
- Nuclear disability to establish intersubjective relations, common in individuals with PDD.
- Rigidity and poor imagination, common in individuals with PDD" [23].

A table with the main differences between the two disorders is provided [24] (Table 2).

Table 2: Differences between Nonverbal Learning Disabilities and Asperger Syndrome [24].

	NLD	AS
Difficulties in executive functions	Frequent	Sometimes
Nonverbal reasoning less developed than verbal reasoning	Frequent	Rarely
Better learning with verbal cues than with visual cues	Frequent	Sometimes
Precocious readers	Frequent	Sometimes
Phonological and syntactical skills	Frequent	Sometimes
Repetitive and irrelevant speech pattern	Rarely	Frequent
Doesn't respect other person's turn to speak	Rarely	Frequent
Difficulties in relationships with peers	Frequent	Always
Rigidity	Sometimes	Always
Poor empathy	Sometimes	Always
Lack of spontaneity	Frequent	Sometimes
Restricted interests	Rarely	Always
Stereotypy	Rarely	Frequent
Routines and rituals	Rarely	Frequent

Nld and the Attention Deficit Hyperactivity Disorder (Adhd)

One difference between ADHD and NLD is that while in ADHD the attention is significantly affected and constitutes one of the cores of the problem, in NLD it is not (although children with NLD seem inattentive). Rather than an attention deficit, individuals with NLD

have a strong tendency to hyperfocus the attention and direct it to a single subject while they isolate themselves from the environment [25]. While in ADHD impulsivity and hyperactivity are symptoms that provoke greater damage, in NLD impulsivity or hyperactivity are not normally present and are not defining characteristics. The behavior of boys and girls with ADHD tends to be disruptive and annoying both at school and home. In the case of boys and girls with NLD, their behavior is not problematic. Their calmness or slowness can be exasperating but not their disruptive behavior.

Fine motor skills and motor velocity are disrupted in children diagnosed with NLD. Similar difficulties have been observed in children with ADHD. Nevertheless, these functions are more disrupted in children with NLD [26]. Both children diagnosed with ADHD and NLD can have problems in social relationships. In the case of children with ADHD, their problems are a consequence of their impulsivity and hyperactivity: they annoy their classmates, so their classmates avoid them. The difficulties in children with NLD are a consequence of not being able to understand the nonverbal cues of a social relationship such as certain subtleties of interaction, double senses, looks, gestures or the capacity to empathize.

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Conflict of Interest

No conflict of interest.

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