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## Language Development and Psychomotor Development in Epileptic Children

### SUMMARY

Causes of epilepsy in childhood are also causes of language, motor and senses development disorders. Linguistic and communication competence in the evaluation of speech therapy should be assessed against the backdrop of psychomotor development. Logopedic standards in children epilepsy elude standards of conduct in particular language disorders.

**Key words:** epilepsy in childhood, psychomotor development, motor development, senses development.

### THE INFLUENCE OF EPILEPSY ON LANGUAGE DEVELOPMENT

In order to manage the emotions surrounding epilepsy and undertake early therapy activity, it is necessary to understand the influence of mechanisms connected with the disorder. The PRO-EPI 2013 research on the attitudes of the Poles towards epilepsy, conducted on the initiative of the Polish Society of Epileptology, revealed a disproportion between the so-called popular knowledge about epilepsy (possessed by more than 80% of the Poles) and the knowledge possessed by specialists providing epileptic children with education – school headmasters, tutors and teachers. The study showed that only 10% of teachers are aware of the influence of epilepsy on children's problems with learning, whereas an extremely high proportion of epileptic children experience various learning difficulties. The research conducted by Ewa Mojs shows that as many as 37% of epileptic children

have learning problems. The author claims that, by comparison, 4% of healthy children experience learning difficulties (Mojs, 2011). Being aware of and understanding the influence of epilepsy and its treatment on epileptic children's level of functioning in the school system guarantees optimization of educational and therapeutic measures. Seizure discharges and subclinical inter-ictal discharges may delay or stop children's development or even lead to the loss of the skills acquired earlier.

Developmental epilepsy which develops at the pre-lingual and peri-lingual period may lead to the diagnosis of alalia, aphasia-type speech development disorders, dyslalia, oligophasia, and dyslexia. In his most recent update on the logopedic classification of speech disorders, Stanisław Grabias included childhood epilepsies in the category of language disorders connected with undeveloped competence, despite the fact that, like autism, they are not language disorders but causes of language disorders (Grabias, 2015). The need to distinguish these entities from others results from their epidemiology, specificity and complexity and also from the fact that standards of logopedic treatment of in the case of these entities fall outside the standards of logopedic treatment for specific language disorders.

Autism, cerebral palsy and childhood epilepsies are developmental disorders, whose internal complexity and multidimensionality require that equally complex and multidimensional therapy activity should be conducted by specialists in different fields. The elimination of developmental disorders in individual spheres: intellectual, cognitive, emotional-motivational and motor ones, as well as the mutual integration of these spheres positively affect language development, since language is the most complex mental function that requires the integration of all the others.

## LANGUAGE DEVELOPMENT AGAINST THE BACKGROUND OF PSYCHOMOTOR DEVELOPMENT

Speaking is both a motor and cognitive process. Sensory and motor disorders determine, to a large extent, the development of cognitive skills, including language skills. In the context of developmental disorders in children with cerebral palsy, Mirosław Michalik writes, "abnormal motor experience and the disturbances in the functioning of the senses adversely affect brain development itself, thus contributing to the impairment of intellectual and cognitive abilities. Therefore, it is necessary to speak of neurobiology-based feedback, which is specific and crucial to the child's development. Language skills are an important element of this feedback; they depend on the development of gross and fine motor skills and of sense organs, but they also stimulate the development of intellectual

ability, or, structurally speaking, of the central nervous system (CNS).” (Michalik, 2015). One has to agree with this thesis – in developmental epilepsy one can speak of similar feedback although it appears to be more complex. In cerebral palsy brain damage is static and non-progressive while the developmental disorders have a progressive nature. In the case of developmental epilepsy, it cannot be assumed that structural damage will occur since in the majority of children the CNS disorder is of a functional nature and its evolution may proceed in different directions: from the improvement and normalization of functioning to permanent, dynamic organic damage. If epilepsy is related to the CNS damage, then the damage may be either the cause or the effect of epilepsy. Damage to the CNS may happen to have a dynamic nature, progressing towards neurodegeneration. This occurs especially in severe drug-resistant epilepsies, as a consequence of previously experienced status epilepticus or of skull and brain damage sustained during epileptic seizures and also as prognosis in some epileptic syndromes (for instance, in Lafora disease, in progressive North-European myoclonic epilepsy<sup>1</sup>).

In developmental epilepsy the clinical picture is characterized by continuous variability. “In the case of developmental pathology, there always occurs a combination of various mechanisms that hinder the child’s physiological development, an overlapping of primary and secondary symptoms of disturbances as well as of the effects of the work of adaptive-compensatory processes” (Kozłowska, Panasiuk, 2015). The occurrence of epilepsy at pre-lingual or peri-lingual age adversely affects the development of speech, which, in turn, manifests itself against the background of disorders in other areas of functioning. Diagnostic standards should take account of the approximate assessment of psychomotor development. The inspiration could come from Marta Bogdanowicz’s proposal that the diagnostic standards for developmental dyslexia should include an approximate assessment of psychomotor development, which consists of:

- cognitive functions (attention, perception, memory, imagination, speed of information processing) and metacognitive functions (visual-spatial, auditory and also language functions<sup>2</sup>);
- executive-motor functions (fine motor skills, gross motor skills, balance, lateralization of motor actions);
- perceptual-motor integration (inter-sensory and perceptual-motor);
- emotional-motivational functions, personality (Bogdanowicz, 2012).

The programming of logopedic therapy for epileptic children requires that the activity should focus on the disturbed elements in this integrated system. It needs to be emphasized that logopedists should always act according to the procedures

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<sup>1</sup> Epileptic syndrome is a disorder characterized by the co-occurrence of typical clinical and electrophysiological symptoms which may have the same cause and similar prognosis.

<sup>2</sup> The assessment of language, communication and cultural competence as well as realization skills constitutes a separate, the most probing stage of the process of logopedic diagnosis.

available to them and avoid taking measures that fall within the competence of other specialists or using tools which they are not authorized to use. A logopedist, as a specialist in the field of language, can identify disorders affecting motor skills, sensory development and cognitive development. One must agree with Stanisław Grabias that “language is determined by the same biological processes occurring in the brain that form the basis for all human mental functions: primarily the mechanisms for processing sensations, but also emotions, volition processes and memory” (Grabias, 2015:17).

### SENSORY DEVELOPMENT AND EPILEPSY

Disturbances in bioelectrical activity in epilepsy cause sensory disorders. These usually have a transient nature and are connected with the peri-ictal period – they occur before a seizure (as auras), during a seizure (they may its manifestation) and also after a seizure (the symptoms of the post-ictal state may continue for a few hours or even up to 5 days). Permanent sensory disorders, continuing for longer periods or frequently recurring, may lead to disturbances in the development of mental functions and intelligence. They are usually caused by subclinical seizure discharges, occur in severe epilepsies or constitute a consequence of the CNS damage. The clinical characteristics of a seizure, especially in its initial stage, may be connected with the location of the epileptogenic focus. Joanna Jędrzejczak claims that temporal lobes are the most frequent location of epileptogenic zones and lists auditory, visual, gustatory and olfactory hallucinations as the characteristic symptoms of this location. The symptoms characteristic of seizures located in the frontal lobe include, primarily, motor manifestations, posture disorders and gesture automatisms, while “negative symptoms of visual perception (scotomas, impaired vision, blindness) or, more frequently, flashes, flares and also symptoms like the turning of eyeballs with or without head turning” indicate seizures located in the occipital lobe (Jędrzejczak, 2017:22).

Sensory disorders are also the symptoms of some types of seizures: somatosensory and sensory seizures resulting from the irritation of somatosensory, visual or auditory cortex. Visual symptoms include: “visual hallucinations, macropsias, micropsias, or shape changes” as well as transient blindness. Auditory symptoms are single sounds, such as “whistling, buzzing”. Olfactory seizures consist in experiencing smells (usually unpleasant); similarly, gustatory seizures are connected with unpleasant taste experiences (Jędrzejczak, 2017:22). The symptoms may persist also during the peri-ictal period.

The correct functioning of the hearing organ is fundamental to the development of language competence. Hearing perception disorders are among the

most common perception problems in epileptic children; they usually concern the process of listening. Z. M. Kurkowski claims that it is necessary to differentiate between two phenomena: hearing and listening. "Hearing is determined by the normal structure and physiology of the hearing organ as well as by the characteristics of the auditory impulses reaching the ear", while listening "is connected with a person's mental activity. A listening person consciously readies him/herself for perceiving sounds, s/he is active, interested, focused and adopts an appropriate body posture." (Kurkowski, 2001:198). In many epileptic syndromes, for instance, in Rolandic epilepsy, central auditory processing disorders constitute the cause of learning difficulties in a high proportion of children.

Sensory impulses become a trigger for seizures in about 4–7% of epileptics, causing the so-called reflex epilepsies. The most common triggers include visual impulses (photogenic epilepsy, reading epilepsy), auditory impulses (musicogenic epilepsy, epilepsy induced by telephone conversations, startle epilepsy), gustatory and olfactory impulses (eating epilepsy, toothbrush epilepsy, seizures induced by hot water) (Motta, 2017). Another kind is epileptic syndromes with psychosensory seizures. These are complex focal seizures in the course of which the sufferer experiences sensations, often olfactory (in the peri-ictal period the child experiences smells, usually unpleasant ones) or gustatory (an unwelcome change in the taste of the food being eaten). If the epilepsy is connected with damage to the olfactory or somatosensory cortex, the symptoms may have a permanent nature.

### THE SENSE OF BALANCE AND PROPRIOCEPTION VERSUS LANGUAGE DEVELOPMENT DISORDERS IN EPILEPTIC CHILDREN

Neurological dysfunctions which cause epilepsy are also direct causes of speech development disorders. They result from a delay or disturbance in the development of the CNS, the indicator of which is neuromotor functioning:

*Neuromotor functioning provides one indication of maturity in the functioning of the central nervous system. It is also linked to functioning of the vestibular, proprioceptive and postural systems, which collectively provide a stable platform for centers involved in oculo-motor functioning, and subsequently visual perception. Individuals with neuromotor immaturity frequently experience difficulties with related skills such as balance, coordination and visual perception, which can affect behavior and educational performance in children and result in chronic anxiety and emotional sensitivity in adults (Blythe, 2014:3).*

When analyzing the influence of sensory development on the development of language it is necessary to emphasize the role which the postural, vestibular and proprioceptive systems play in it. An extremely important indicator of motor

development of gross and fine motor skills but also of cognitive and emotional development as well as educational performance is postural reflexes associated with the functioning of the otic capsule (bony labyrinth) and the vestibular system. While examining younger children in particular, logopedists often assess their primary orofacial area reflexes (suck and swallow reflexes, chewing, nipping and biting reflexes). If retained, the reflexes may impede language development, especially in terms of speech realization, because feeding actions stimulate the organs responsible for the sounds of speech.

From the logopedic perspective, the TLR, ATNR and STNR<sup>3</sup> are among the most important reflexes to be assessed since they affect the development of language competence. The Tonic Labyrinthine Reflex (TLR) develops in the prenatal period and is necessary for the child to be born. “Retention of the TLR beyond three and a half years of age is associated with problems with balance, muscle tone and control of the eye movements needed for reading, writing, copying and mathematics (...). Adults with evidence of a TLR usually experience generalized symptoms of insecurity linked to poor gravitational security and visual–perceptual problems” (Blythe, 2014:17).

The Asymmetrical Tonic Neck Reflex (ATNR) develops in the prenatal period and is inhibited between the 4th and 6th month of life. “Rotation of the head to one side elicits extension of the arm and leg on the side to which the head is turned and retraction of the opposite arm and leg. (...) In the school-aged child, a residual ATNR can interfere with activities which involve crossing the midline, especially writing position (...) writing grip (...) and control of the hand when writing” (Blythe 2014:12-13). The Symmetrical Tonic Neck Reflex (STNR) appears twice: it emerges at birth for the first time and re-emerges between the 5th and 8th month of life so as to prepare the baby for crawling. “If it fails to be suppressed by the time independent walking is established, distribution of muscle tone in the upper and lower halves the body can continue to be affected by head position or movement of the head through the mid-plane” (Blythe, 2014:14). “In addition to making sitting awkward and uncomfortable, retention of the STNR in the school-aged child can affect specific hand–eye coordination skills including control involved in bringing the hand to the mouth when eating. (...) It can also interfere with the development of specific oculomotor skills such as speed of accommodation needed to copy from the board or track an object approaching at speed (e.g. catching a ball)” (Blythe, 2014:16).

Disturbances in the bioelectrical activity heighten the risk of neuromotor immaturity. In the logopedic therapy for epileptic children, alleviation of bal-

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<sup>3</sup> The available screening tests of postural reflexes are only an approximate tool for a logopedist; they serve the purpose of identifying the children who need to be referred to a specialist for diagnosis and therapy.

ance and posture disorders can positively affect the development of language competence and the acquisition of school skills, especially in terms of reading and writing skills.

## MOTOR DEVELOPMENT AND EPILEPSY

“Epilepsy is a disorder which prevents the child from participating in natural fitness-building tasks. The neurobiological basis of the disease process causes diminished tolerance to the effects of impulses, especially strong and long-lasting ones. This results in the child’s withdrawal from any kind of activity.” (Kozłowska, Panasiuk, 2015). The motor development of epileptic children is impeded by biological, pharmacological and environmental factors. Motor disorders manifest themselves in all seizure types: generalized seizures and focal seizures, especially the ones in which the epileptogenic zone is located in the region of the motor cortex. Epileptic seizures whose epileptogenic zone is located in the region of the motor cortex are connected with disorders of a transient nature. The disorders are linked with the peri-ictal period; they may immobilize the sufferer, cause paralysis, ataxia of movements, and lack of coordination as well as muscle tone, balance and proprioception disorders.

Epilepsy as the cause of structural damage to the CNS may produce the aforementioned symptoms, but in this case they have a permanent nature. What is also crucial in the logopedic assessment is damage within the peripheral nervous system (PNS), especially damage to the cranial nerves, which results in the diagnosis of dysarthria. Particularly significant are muscle tone disorders, especially fine motor skills disorders – those affecting graphomotor skills, the movements of the mandible, tongue or eyeballs.

In some epilepsy syndromes, for instance, Landau-Kleffner syndrome (LKS), motor disorders may have a progressive nature and lead to disability. Epilepsy also co-occurs with many developmental neurological syndromes associated with motor disability, for example, cerebral palsy or Rett syndrome.

Environmental influences constitute a wide group of factors which hinder the motor development of epileptic children. The people closest to the child – family members and school community – may inhibit the child’s motor development instead of effectively stimulating it. The child withdraws from motor activity for neurobiological reasons alone but the added aspects of the environmental influence significantly worsen the conditions for motor development.

Research by M. Kozłowska and J. Panasiuk concludes that the majority of epileptic children are “exempt from Physical Education classes and peer play of a team character. They do not participate in extracurricular classes, school trips, camping trips and summer camps. Such limitations reduce proper stimulation

necessary for normal motor development. The children who are excluded from all physical exercise have poor results in fitness tests, are clumsy of movement and suffer from motor coordination and balance disorders.” (Kozłowska, Pana-siuk, 2015). Movement limitations adversely affect not only the development of language and communicative competence, but also the socialization process – the child becomes excluded from natural peer group relations in the playground, s/he avoids team games, cannot handle competition, cannot express emotions. Due to the inappropriate attitude of the parents, the child frequently does not build healthy relationships with his/her siblings. An epileptic child is treated differently from his/her siblings. On the one hand, she or he is rejected, compared to their siblings and seen as less clever and less resourceful, unaccepted; on the other hand, she or he is overprotected, relieved of their tasks, not given any chores. The parents’ care results from their eagerness to relieve the child’s nervous system, but in fact it overloads it and consequently deprives the child of his/her sense of agency and self-esteem. Inappropriate attitudes of the people around the child lead to serious disorders in the social-individual sphere.

### THE LOGOPEDIST’S COOPERATION WITH THE EPILEPTIC CHILD’S FAMILY

A logopedist is a specialist who meets the child patient regularly on a long-term basis. The child’s parents often participate in the therapy. Every logopedist is aware of the importance of the family’s cooperation, of their involvement in the therapy and of their stimulation of the child’s in everyday life. Obviously, it is necessary for the child to experience constant support in terms of language and competence development. Very often, however, home care recommendations are of a clinical nature and are not related to the family’s everyday functioning. In the context of the approach to logopedic therapy from the psychomotor perspective, what proves essential while stimulating the language development based on its inseparable connection with the motor and cognitive development is the stimulation of the child’s independence, primarily in terms of self-reliance:

- dressing and undressing him/herself;
- eating on one’s own;
- tidiness;
- personal hygiene;
- household duties.

Maria Montessori was one of the precursors of fostering independence as a way of preparing a child for life. M. Miksza quotes the ideas that constitute the motto of school: “help me do this myself”, “any unnecessary help hinders development” (Miksza, 98:22). The tasks should, obviously, be tailored to the

child's capabilities, determined by her or his age. A logopedist can use screening tests applied by teachers and doctors. The Denver Developmental Screening Test (DDST) indicates that as early as at 18 months of age a child should be able to undress him/herself and eat with a spoon on his/her own. When performed on one's own, these activities positively influence the child's emotions. They develop the sense of agency, foster self-esteem and the sense of self-reliance. Apart from the emotional aspect, everyday activities require the coordination of the whole body, improve balance, proprioception (including kinesthesia), attention, concentration and perception. Thus, they are an excellent way of facilitating psychomotor development and they also positively strengthen the nervous system (although some parents, especially the parents of sick children, relieve them of these activities, as they believe – mistakenly – that in this way they protect the child's nervous system from stress and frustration; in fact, they unconsciously increase these feelings in their children). From the logopedic perspective, it is also crucial that when children perform self-service activities or perform household duties, their language competence develops. The motor functions necessary for the normal realization of speech: kinesis, kinesthesia, and perceptive-motor functions, are improved during these activities.

The logopedic diagnosis should take into account the assessment of the degree to which the child is independent and his/her day schedule, while the tasks i.e. the so-called home duties recommended by the logopedist should meet the needs of the family's daily life and make real life part of the therapeutic process. Putting on shoes on one's own, washing socks and sitting at the table with the rest of the family can effectively stimulate a more harmonious development of the child.

## CONCLUSION

Epilepsy is a disorder which excludes the child from natural tasks that develop perception, thinking, speaking and fitness. The causes behind the limitations could be the neurological basis of the disorder and the influence of medication, which significantly decrease tolerance to the effects of impulses. Additionally, development may be hindered by environmental limitations, which add to the child's withdrawal from activity. Being aware of and understanding the influence of all these factors upon the level of functioning guarantee optimal educational and therapy measures, which, in turn, guarantee that epileptic children will enjoy a higher quality of family and social life.

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