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Relationship between social competence and neurocognitive performance in children with epilepsy

Triin Raud [a,b], Mari-Liis Kaldoja [a,c,d], Anneli Kolk [e,f,*]

[a] Institute of Psychology, University of Tartu, Tartu, Estonia
[b] Randvere School, Tallinn, Estonia
[c] Institute of Psychology, Tallinn University, Tallinn, Estonia
[d] Psychiatry Clinic, Tallinn Children's Hospital, Tallinn, Estonia
[e] Department of Neurology and Neurorehabilitation, Children's Clinic, Tartu University Hospital, Tartu, Estonia
[f] Department of Pediatrics, Faculty of Medicine, University of Tartu, Tartu, Estonia

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ABSTRACT

Epilepsy may affect a child's social skills and social cognition. The purpose of the study was to examine associations between sociocognitive skills and neurocognitive performance in children with epilepsy. Thirty-five children with epilepsy between the ages of 7 and 12 years (25 with partial and 10 with generalized epilepsy) and 30 controls participated. Theory of Mind (ToM) tasks, Social Cognition Questionnaire proposed by Saltzman-Benaiah and Lalonde (2007), and Social Skills Rating System were used to assess social competence and sociocognitive skills. Neurocognitive performance was assessed using the NEPSY battery. Children with epilepsy demonstrated more difficulties in understanding false belief ($p < .001$) and intentional lying ($p < .05$) and exhibited more behavioral problems ($p < .05$). Notably, their social skills were at the same level as typically developing peers. Children with epilepsy performed significantly worse in attention, executive, verbal, and fine motor tasks ($p < .05$). We found positive correlations between the understanding of false belief and in executive ($r = .6$, $p < .05$), verbal ($r = .45$–$.49$, $p < .05$), and visuospatial skills ($r = .34$–$.48$, $p < 0.01$). Children with generalized epilepsy had more problems in memory tasks ($p < .05$) and understanding of sarcasm ($p < .05$) compared with children with partial epilepsy. An age of onset over 9.1 years was positively associated with ToM skills ($r = .42$, $p < .05$). In conclusion, better ToM in children with better executive functions, and language and visuospatial skills was revealed. The type of epilepsy and age of onset significantly affected ToM skills.

1. Introduction

1.1. Epilepsy in children

Epilepsy, a chronic neurological condition characterized by recurrent seizures, is one of the diseases of the CNS most frequently accompanied by difficulties in academic work [1] as well as attention, behavioral, and social problems in children [2]. According to the ILAE, epileptic seizures can be classified either as generalized or partial [3]. Generalized epileptic seizures are conceptualized as originating at some point within and rapidly engaging bilaterally distributed networks. Such bilateral networks can include cortical and subcortical structures, but do not necessarily include the entire cortex. Partial epileptic seizures are conceptualized as originating within networks limited to one hemisphere. They may be discretely localized or more widely distributed [3].

The overall incidence rate for epilepsy in Estonia is 45:100,000 in children. However, the incidence rate is much higher for children from 1 month to 4 years of age (73:100,000) and declines remarkably after the age of 15 years [4]. Bearing this in mind, it is especially important to acknowledge that early injury to the developing brain may disrupt the acquisition of basic competencies, which provide the necessary foundations for later development. Furthermore, more devastating effects are thought to result if the seizure disorder starts at an early age, especially in patients with poor seizure control, in individuals who have had a long duration of disorder, and if the person exhibits multiple seizure types [5].

1.2. Social competence and sociocognitive functions in children with epilepsy

Childhood is a period of rapid development of social and cognitive skills. Most of the time, these skills develop naturally without any need for special attention. However, CNS diseases (such as epilepsy) can affect the development of age-appropriate social competences [6]

* Corresponding author at: Department of Neurology and Neurorehabilitation, Children's Clinic, Tartu University Hospital, N. Lunini 6, EE-51014 Tartu, Estonia. Tel.: +372 506 862.
E-mail address: anneli.kolk@kliinikum.ee (A. Kolk).

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and, therefore, have a negative influence on a child's behavior and mental health.

There is no agreement on the definition of social competence; numerous and heterogeneous definitions and models have been proposed [7]. There is a great extent of content areas beneath the umbrella of "social competence". According to Iarocci et al. [8], social competence involves the active and skillful coordination of multiple processes and resources available to the child to meet social demands and achieve social goals in a particular type of social interaction (e.g., parent–child, peer relations) and within a specific context (e.g., home, school). Social competence has many different aspects and subcomponents (e.g., social skills, also behavioral problems may be observable expressions of social competence deficits). Social skills include the abilities to (a) accurately select relevant and useful information from an interpersonal context, (b) use that information to determine appropriate goal-directed behavior, and (c) execute verbal and nonverbal behaviors that maximize the likelihood of goal attainment and the maintenance of good relations with others [9]. Cognitive aspects are important for successful social behavior. Social cognition is the ability to construct mental representations of social relations, thereby, helping to make sense of other people and interpersonal relationships and to properly use these representations to live flexibly in the social environment [10]. An important part of social cognitive skills is theory of mind (ToM) — the ability to understand other people's thoughts, intentions, and feelings [11]. Theory of mind assists in understanding what other people are thinking or feeling in a given social situation without it being said directly (examples are jokes, sarcasm, and irony). It is an important prerequisite to social behavior [12]. Previous research has indicated relations between false belief understanding and positive social skills in children, suggesting that ToM might be related to actual behavior [13]. Effective social interaction requires a complex combination of knowledge and interpretations to guide our actions. Ability to interpret social situations leads to effective peer interactions and is importantly associated with social competence. Therefore, misinterpretation is frequently the reason for inappropriate behavior [14]. These kinds of misinterpretations are fairly common in people with disrupted brain development. One of the reasons that people with epilepsy may have social dysfunction is the inability to understand other people's thoughts, because of the dysfunction of underlying neural mechanisms. The main brain regions associated with ToM are the medial prefrontal cortex, temporal lobes, temporoparietal junction, and superior temporal sulcus [15,16]. Adults with frontal lobe epilepsy have diminished ability to understand other's thoughts, humor, emotions, and eye gaze expressions [17]; adults with temporal lobe epilepsy also have diminished ability to understand other's thoughts and beliefs [18]. Children and adolescents with epilepsy are at risk of deficit in social cognition by having less ability to recognize facial expressions and to understand thoughts and motivations of others [19,20]. Unfortunately, ToM studies in children with epilepsy are very limited. Most of the studies in this field rely only on parents' and teachers' questionnaires and usually show that epilepsy is a limiting factor for social competence of children and adolescents [21,22].

Giovagnoli [23] emphasizes that there is a need to examine ToM in all patients with epilepsy. The study of ToM in epilepsy is important not only for advancing the understanding of its underlying neural network, but also in clinical care. The ToM tests are not homogeneous across studies. There are many different tests that measure ToM. A conventional neuropsychological test battery will not capture the concept of ToM, nor will conventional personality or psychopathological inventories [23]. Identifying ToM demands specially designed measures. First-order false belief is the easiest ToM test that evaluates a subject's ability to guess another person's mental state who is experiencing a situation that has changed unexpectedly, thus, revealing the capacity to focus on reality [23]. Second-order false beliefs use the same paradigm but are more complex and involve one character having a false belief about the belief of another character in a story [24]. The faux pas test requires distinguishing intentional and unintentional actions and related emotions in addition to the ability to recognize a person's mental state [12]. Rantanen et al. [7] put together a conceptual framework of social competence, its subcomponents, and hypothetical connections in childhood epilepsy. According to their framework, social competence is affected by both pathophysiological (i.e., CNS dysfunction or lesions) and environmental factors. This effect may be direct or mediated through epilepsy-related or/and neurocognitive factors, which in turn may also have an independent effect on the development of social competence. Epilepsy-related factors (for example, age of onset and seizure type) as well as cognitive factors can have a direct impact on the development of social competence. Therefore, the associations between epilepsy and social competence are complex. Previous studies have found associations between social competence and epilepsy type [22], early onset of epilepsy [22], epilepsy etiology [25], seizure types [25], and seizure frequency [26], as well as antiepileptic treatment [26]. Behavioral problems are more associated with early onset of epilepsy [19], generalized epilepsy type, and seizure frequency [27]. Early onset refractory temporal lobe epilepsy can compromise the development of recognizing facial expressions in children and adolescents and is associated with comprehension of affects and intentions. In patients with frontal lobe refractory epilepsy, the comprehension of mental states was predicted by disease duration [12]. Research in this field is still limited, especially in children with well-controlled seizures and children with newly diagnosed epilepsy. Therefore, there is a need for more precise studies using reliable methods (tests, observations, etc.) in order to clarify the nature of impairment in cognitive and social function in children with epilepsy, in addition to the study of the impact of epilepsy-related factors.

Similarly, Saltzman-Benaiah & Lalonde [14] have pointed out the need for more clinically suitable and appropriate assessment methods for children's social competence. More so, they emphasize the importance of overcoming the gap between research oriented and clinically appropriate patient- and intervention-oriented tools. Thus, they have developed and provided several tasks to assess different aspects of children's social competence. They have also provided normative data for their tasks. Therefore, some of the tasks and a questionnaire for parents developed by Saltzman-Benaiah and Lalonde [14] were also used in the present research.

1.3. Neurocognitive performance in children with epilepsy

In addition to psychosocial complications, children with epilepsy may face neurocognitive problems. Berg et al. [28] found that 73.6% of children with epilepsy have cognitive abilities similar to the control group. This means that one-fourth of children demonstrate impaired cognition. The nature of neurocognitive impairment in children with epilepsy is not clear — there are a large number of concomitant studies and results. Many studies have found dysfunction in attention [29–31], memory [32,33], and executive functions [29]. There are also studies that have found dysfunction in visuospatial [34] and verbal skills [30].

The purpose of carrying out the present study was to explore the association between sociocognitive and neurocognitive functions in children with partial and generalized epilepsies. In the current study, social skills and behavioral problems were studied as subcomponents of social competence. In addition, cognitive aspects of social behavior (including theory of mind) were examined. While social competence and cognition are widely studied among healthy children, there are still very few good studies about sociocognitive skills in the pediatric epilepsy population. In addition, most studies rely on parents' and teachers' questionnaires. That is an important limitation because parents and teachers may not always be adequate observers and objective. They also are not always able to correctly interpret children's mental states, thoughts, and intentions. In the present study, ToM tasks are used in addition to parent questionnaires to gain a broader knowledge of social competence in children with epilepsy.