

Original Article

Theory of mind in children with attention deficit hyperactivity disorder compared to controls

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Abstract

Introduction: Children with attention deficit hyperactivity disorder (ADHD) have serious social skill deficits and problems in relation with peers. This study aimed to compare theory of mind (ToM) in drug-naïve children with ADHD with those with no psychiatric disorders at the same age.

Methods: This cross-sectional study was established in child and adolescent psychiatry clinic of the Tabriz University of Medical Sciences (Tabriz, Iran). Drug naïve, male children and adolescents with a diagnosis of ADHD were enrolled as well as age and intelligence quotient (IQ) matched healthy controls. Kiddie Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version (K-SADS-PL), Child Symptom Inventory-4 (CSI-4), and Conner's Parents Rating Scales-Revised (CPRS) were used to measure psychiatric disorders and Sally-Anne False Belief Task, and The Reading the Mind in the Eyes Task (child) for components of ToM.

Results: A total of 30 children completed the study in each group. Half of children with ADHD could not give the expected answer in Sally-Anne False Belief Task, which was significantly lower than controls. They also showed a significantly lower performance in The Reading the Mind in the Eyes Task. Severity of ADHD was not correlated with a score of The Reading the Mind in the Eyes Task.

Conclusion: Children with ADHD have deficits in ToM compared with age and IQ matched controls in terms of social cognition and social sensitivity.

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Introduction

Children with attention deficit hyperactivity disorder (ADHD)¹ have a hyperactive state to a degree that is greater than other children of the same age, fail to keep consistency in finishing their duties and have deficits in self-regulation in their interaction with peers.² Comorbidity with a psychiatric diagnosis such as oppositional defiant disorder, conduct disorder, and internalizing disorders are also common in these children.

ADHD is recognized as a

neurodevelopmental disorder since 20th century. Neuroimaging studies in children with ADHD have revealed deficits in cerebellum and the frontal cortex of the brain which both have a fundamental role in planning, organization, decision making, time perception, inhibition, and thinking.^{3,4} Review of neuropsychological studies about frontal lobe also reports malfunction, especially in orbitofrontal and medial-frontal areas of their brain.⁵ Developmental delay or mentioned abnormalities of the frontal lobe has been

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suggested among etiological factors of ADHD.

On the other hand, children with ADHD are likely to face social, academic, familial, and occupational problems during their life. Studies have found that serious social skill deficits and problems in relation with peers have a fundamental role.⁶⁻⁹

Some researches consider ADHD as a social disability¹⁰ because of their behavioral patterns (such as attention deficit, difficulty in family functions, and social skill deficits). Moreover; these children are known to have a negative reputation among peers, several conflicts, and difficulty in overcoming the self-centeredness in social situations.¹¹⁻¹³ Several studies have demonstrated that ADHD is significantly associated with lower social skills and functioning.¹² This issue has a special importance as functional relations, and adequate social interactions with peers are fundamental keys to development of children.¹⁴ These findings emphasize the importance of social cognition for establishment an efficient social interaction. Appropriate social behavior (presented with the cooperation, sharing, and respect) is conducted over the values that one gives to individual and social consequences in interpersonal relations. Thus, social cognition includes thinking about thoughts, emotions, approaches, and behaviors of self and others.¹⁵

Social cognition is known as an essential concept for the theory of mind (ToM). The notion of ToM refers to the ability of a person to predict and define a behavior by attributing mental states (beliefs, desires, intents, understanding, and pretending) to oneself and to others¹⁶ and understanding that others have mental states that are different from one's own. Deficits involving prefrontal cortex of human brain influence ToM, thus any functional or structural problem in neural pathways of this region may decrease this fundamental ability for the social life.¹⁷ Clinical studies indicate that such patients may have impaired social and moral behavior, despite intact cognitive abilities.¹⁸ On the basis of mentioned findings, this study aimed to compare ToM in drug-naïve

children with ADHD with those with no psychiatric disorders at the same age.

Methods

This cross-sectional study was established in child and adolescent psychiatry clinic of Tabriz University of Medical Sciences (Tabriz, Iran). The procedure was approved by the regional Ethical Committee. A comprehensive explanation about the aim of the study was given to parents or care givers of participants and all gave written consent.

Drug naïve, male children and adolescents with a diagnosis of ADHD by a board certified child psychiatrist were enrolled. Any psychiatric diagnosis other than ADHD, a serious general medical condition (indicating a long-term treatment) and intelligence quotient (IQ) lower than 85 (based on Raven's Progressive Matrices test) resulted in the exclusion. The control group was selected from school boys of the same city, by cluster sampling from students of the same age. They were also matched to children with ADHD in term of IQ. All the participants were referred for a psychiatric interview as described later.

Kiddie Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version (K-SADS-PL)

K-SADS-PL is a semi-structural psychiatric interview for detecting psychiatric conditions in children based on criteria defined by Diagnostic and Statistical Manual for Mental Disorders, 4th edition (DSM-IV). The Farsi version of this standard toll¹⁹ was used to establish the diagnosis in participants, as well as defining excluded children.

Child Symptom Inventory-4 (CSI-4)

This is a screening scale for emotional and behavioral disorders based on DSM-IV criteria, including ADHD. A total of 18 items of this standard questionnaire are for ADHD symptoms, each scored on a Likert scale consisting of four choices. Scoring is done by adding the number of items rated as "sometimes" and "often" as a score of zero is given to items rated as "never" and "seldom." Scores are summed up for the diagnosis of

ADHD. The psychometric properties of the Farsi version are described elsewhere, and the retest reliability of the parent version of the CSI-4 (conducted in the present study as well) was reported to be 0.90 in Iran.²⁰

Conner's Parents Rating Scales-Revised (CPRS)

The 41-question version of this famous questionnaire²¹ with was used in this study, including five subscales: Oppositional, cognitive problems/inattention, hyperactivity, anxious, and psychosomatic. The test has a high reliability and constructs validity²² and has been successfully used in several studies in different populations worldwide. The scores for the CPRS were converted to T-scores.

Sally-Anne False Belief Task

A computer version of this well-known test of ToM was used, and the story was described to participants as below:

"Maryam and Ali were in the room. There are a box and bag. Maryam has a ball that after playing with it, she put it inside the box and walks out the room. After Maryam leaves, Ali takes the ball out of the box and puts it into the bag and left the room. Then, Maryam comes back."

Then, this question was asked from participants that: now that Maryam is back and wants her ball, where will she look for it first? The answer was scored as either correct or incorrect.

The Reading the Mind in the Eyes Task (child)

Computerized Version of The Reading the Mind in the Eyes Task was used to determine understanding social causality by participants. It is a series of 28 images of eyes depicting emotion states, and participants had to choose between four mental-state terms for each.²³

Data are described as mean (standard

deviation). Chi-square and Student's independent t-tests were used to compare sample means and differences and Pearson's correlation for detecting any link. Differences were considered to be statistically significant at $P < 0.05$.

Results

About 30 children with ADHD and 30 children without any psychiatric diagnosis completed the study, all were males. Data for age, IQ, and described scales are shown in table 1.

Half of children with ADHD could not give the expected answer in Sally-Anne False Belief Task, which was significantly lower than controls who gave the correct answer in 86.60% ($P = 0.005$). They also showed a significantly lower performance in The Reading the Mind in the Eyes Task ($P = 0.015$). The mean score of children with ADHD was 10.96 (3.25) while controls scored 14.85 (7.23).

In children with ADHD, severity of ADHD as measured either by CPRS ($P = 0.792$, Pearson correlation = -0.054) or CSI-4 ($P = 0.680$, Pearson correlation = -0.054) was not correlated with score of The Reading the Mind in the Eyes Task.

Discussion

This study compared ToM of boys with ADHD with normal age, and IQ matched controls and found that children with ADHD have lower performance on ToM tasks independent from severity of their ADHD symptoms.

ADHD, which is mainly an executive dysfunction, is associated with severe problems in social interactions. Social, behavioral, and peer relationship problems of children with ADHD are well documented, however the underlying mechanisms is not clearly understood.²⁴ During normal development, children start to get aware that

Table 1. Characteristics of the study population

Characteristics	Children with ADHD (n = 30)	Controls (n = 30)	P
Age (year)	8.31 (1.50)	9.08 (1.60)	0.128
IQ	104.69 (10.82)	109.50 (11.94)	0.076
Conner's Parents Rating Scales	44.69 (19.72)	7.96 (2.94)	< 0.005
Child Symptom Inventory	10.38 (4.28)	3.60 (1.44)	< 0.005

ADHD: Attention deficit hyperactivity disorder; IQ: Intelligence quotient

their own mental states are distinct from those of others around 18 months and normally attain ToM at 3-4 years.²⁵ Previous studies agree on the link between ToM impairments and poor interpersonal relationships in children with ADHD. There are several evidences that ToM development relates to executive control, impulsivity, and lack of ability to focus attention.²⁶

A review on 30-year period publications concludes that consistent with the fronto-striatal dysfunction, ADHD is clearly associated with social cognition impairments. This review highlights deficits in emotional face and prosody perception as well as providing some evidence for the ToM deficits and reduced empathy as well.²⁷ However; results of previous studies vary by diagnostic tools as well as the determined components of ToM. This variety may explain reported findings in part. In the present study, we used two well-known tasks: Sally-Anne test as a test of social cognitive test (ability to attribute false beliefs to other) and reading the mind in the eye task which is an advanced ToM test, examining social sensitivity. There are very limited data about performance of children with ADHD on these two tests. Presented data are compatible with our results though. In a study about social reciprocity in ADHD, children with ADHD showed lower performance in social reciprocity in ADHD compared to controls.²⁸

These children also exhibited a general deficit in decoding emotional facial expression, especially anger and sadness.²⁹ These results suggest that the social sensitivity lacks in ADHD. Social interactions in children with ADHD are inappropriate, and such social problems may originate from a failure to attend to the appropriate cues of affect. Together with a suboptimal nonverbal decoding ability, this will result in deficits in interpersonal relationships. Targeting this deficit may have

important implications for therapy.

The other test used in the current study was the ability attributing the false belief in this the Sally-Anne story, in which half of children with ADHD failed. Like Reading the mind in the eye task, previous researches connect the executive functioning with results of this test. Different disorders associated with impaired executive functioning have been associated with worse performance on this test like fetal alcohol spectrum disorder.³⁰ Failure to understand the perspective of others will result in poor social skills. While there are few evidences that show a beneficial effect of pharmacological treatment of ADHD on cognitive and affective ToM³¹ social stories,³² might also be an effective intervention for children who have difficulties understanding the perspective of others.

Limitations

The main limitation of this study was the strict inclusion and exclusion criteria (like gender and IQ level that could interfere with end results), which decrease the generality of the results. Further studies can include a wide range of participants, but need to include higher numbers.

Conclusion

This study demonstrated deficits in ToM of children with ADHD in terms of social cognition and social sensitivity. Beside a diagnostic value for these findings, children with ADHD might benefit from targeted treatments for such deficits.

Conflict of Interests

Authors have no conflict of interest.

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