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BRIEF REPORT

Brief Report: Attention Effect on a Measure of Social Perception

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Abstract A measure of social perception (CASP) was used to assess differences in social perception among typically developing children, children with autistic spectrum disorders (ASD), and children with Attention Deficit/Hyperactivity Disorder (ADHD). Significant between-group differences were found in recognition of emotions in video, with children diagnosed with ADHD or ASD performing more poorly than controls on measures of knowledge of nonverbal cues and emotional expression. The number of inattention symptoms was found to be a significant contributor to poorer video interpretation across diagnostic groups. An effect of attention on poor social perception was found that may be unique to the ASD group. Clinicians may overestimate the social deficits of children with ASD if they also have symptoms of inattention, while researchers may need to control for the effects of inattention in their studies.

Keywords Autism · Aspergers · ADHD · Attention · Emotion · Social perception

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Introduction

Social deficits are a primary symptom of several childhood disorders such as Asperger's disorder (AS), autism, and Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS). These disorders compose the diagnostic category of autistic spectrum disorders (ASD). The characteristics of children with high functioning autism (HFA), Asperger's, and PDD-NOS overlap considerably, and distinctions among them have not been clearly defined (Challman et al. 2003). Children with Attention Deficit/Hyperactivity Disorder (ADHD) also exhibit behavioral difficulties with social interaction, though it is unclear whether their problems arise from substrates similar to those with ASD. Common to both ASD and ADHD groups is difficulty managing novel and/or complex stimuli, difficulty regulating attention and emotion, and problems with organization and executive functioning (Barkley 2003; Ehlers et al. 1997; Ghaziuddin 2002; Griswold et al. 2002; Rourke and Tsatsanis 2000).

Further complicating the matter, attentional symptoms are often found in children with ASD, and many have diagnoses of both ASD and ADHD. Two distinct symptom clusters, inattention and hyperactivity/impulsivity, underlay the ADHD diagnosis (Barkley 2003). These are described by clinical subtypes of the disorder: ADHD:Predominantly Inattentive, ADHD:Hyperactive-Impulsive, and a combined subtype that includes symptoms of both. Comorbidity of ASD with ADHD is high, with estimates based on chart reviews to be between 49% (Goldstein and Schwebach 2004) and 78% (Lee and Ousley 2006). Clinical samples are similar, with estimates reported at 55%, equally divided among inattentive and combined subtypes based on clinical interviews and checklists (Gadow et al. 2006; Leyfer et al. 2006). This high level of

comorbidity has lead some to argue that ADHD symptoms should be considered as part of the diagnostic behaviors recognized as co-occurring in autistic spectrum disorders. It has been suggested that children with ASD have poor social behaviors related to deficits in social perception, while similarly poor social behaviors in children with ADHD are performance-related and associated with inattention and impulsivity (Semrud-Clikeman 2007).

The purpose of this study was to examine the effects of inattention on a direct measure of social perception, the Child and Adolescent Social Perception Measure (CASP, Magill-Evans et al. 1995). Children with ASD (including some with clinically significant symptoms of ADHD), children with a sole diagnosis of ADHD, and typically developing children were included. Children with ADHD were included to provide a clinical control group of children with symptoms of ADHD but not ASD. We expected that since we were focusing on perception of nonverbal cues, rather than the performance of social behaviors, children with ADHD would perform better than children with an ASD, but not as well as typically developing children.

Methods

Participants

Participants were children referred by parents, teachers, psychologists, and/or psychiatrists or recruited to a large university in the southwestern region of the U.S. for participation in a larger 8-year study examining social competence and developmental disorders. There were three groups identified for the purpose of this study: Children with ASD (HFA, Asperger Disorder, PDD-NOS), children with ADHD only, and typically developing children. Doctoral level graduate students in Educational Psychology and Psychology trained in administering a comprehensive neuropsychological battery individually assessed the participants. Diagnoses were determined by consensus of two independent sources, including licensed psychologists within the community or university, and advanced graduate students. Participants for whom a diagnosis was not unanimous were not included in the study. Exclusionary criteria included a history of seizure disorder, progressive neurological problems, traumatic brain injury, or any other serious medical condition. Those with comorbid psychopathology were also excluded from the sample, including participants with severe mood or conduct disorders. Only children with a Full Scale IQ (FSIQ) above 80 were included in the sample. Our confirmation of a diagnosis for ADHD required a T-score of 65 or higher on the Behavior Rating Scale for Children (BASC, Reynolds and Kamphaus 1992) inattention and/or hyperactivity scale as well as meeting criteria for DSM-IV diagnosis of ADHD using a semi-structured interview. Children with primary diagnoses on the autism spectrum were confirmed using DSM-IV criteria for Asperger's Syndrome, Autistic Disorder, or Pervasive Developmental Disorder Not Otherwise Specified using a semi-structured interview. An AD screener based on DSM-IV Asperger's Syndrome criteria developed at the clinic was used as a tertiary confirmation.

The final sample included 86 participants ranging in age from 6 to 15 years of age; 27 were female and 59 were male. Both clinical groups contained approximately 70% males, with the control group being 53% male. Nineteen children were in the control group, 37 in the ASD group, and 30 in the ADHD group. Reflecting the general population rates for ADHD-ASD comorbidity, 20 of the children in the ASD group also had a secondary diagnosis of ADHD. Ten had a diagnosis of ADHD: Combined subtype and 10 had an ADHD: Inattentive subtype diagnosis. In the pure ADHD group, 11 were diagnosed with ADHD: Combined subtype and 19 were diagnosed with ADHD: Inattentive subtype.

Instruments

CASP

The Child and Adolescent Social Perception Measure (CASP, Magill-Evans et al. 1995) was developed as a clinical tool for evaluating social perception using 10 videos of children interacting. The videos show social interactions between two or more child actors or a child and an adult, with each video vignette lasting approximately 1 min. Voice prosody can be heard, but the lexical content of the dialogs are obscured by distortion. The child is asked first to tell the story in his or her own words, is then prompted to tell what each of the characters was feeling (CASPem score), and finally to indicate how they could tell what the characters felt. Common examples of responses include, for example, "by mouth turned up in a smile," or "eyebrows were raised," or "voice went up." Thus, the child is asked to identify the nonverbal cues they used to recognize the stated emotions (CASPnv score) in an open question format. The emotions expressed in the video vignettes range from basic feelings (e.g., happy, sad) to complex (e.g., embarrassed, disappointed), with more points earned for more complex emotion recognition. Raw scores are calculated in number of emotions and nonverbal cues given by the child, and are then converted to standardized z-scores reflecting age differences in a normative sample.

ADHD Symptoms

The Structured Interview for Diagnostic Assessment of Children (SIDAC) is a semi-structured interview based on

DSM-IV diagnoses, modified and updated from the Kiddie-Schedule of Affective Disorders and Schizophrenia developed by Puig-Antich and Chambers (1978). The ADHD portion of the SIDAC interview was used in this study to determine the severity of ADHD symptoms based on the number of symptoms reported. Symptoms related to inattention, hyperactivity and impulsivity were included. This measure was also used as partial confirmation of parent-reported diagnosis of ADHD, as noted above.

Cognitive Development

The Wechsler Intelligence Scale for Children, Third Edition (WISC-III, Wechsler 1991) is a well-documented and utilized clinical and research battery for determining an estimate of intelligence. Intelligence estimates for this study were based on a two-subtest estimate (Vocabulary/Block Design) using Sattler's Full Scale short-form dyad deviation quotient (Sattler 1992, p. 1171).

Analyses

Analysis of variance (ANOVA) with Bonferroni-corrected multiple post-hoc comparisons was used to determine whether there were group differences based on age or estimated Full Scale IQ (FSIQ) in the sample. The general linear model (GLM) including univariate ANCOVA and Bonferroni-corrected pairwise post-hoc comparisons and with FSIQ controlled was used to evaluate group differences among the variables of interest: Emotion recognition variables CASPem (number of emotions identified) and CASPnv (number of nonverbal cues identified) and SIDAC symptom variables of inattention, hyperactivity and impulsivity. A regression of CASPem on SIDAC symptoms, with estimated FSIQ controlled, was used to assess whether the number of ADHD symptoms had an effect on CASPem scores. The change in R^2 when SIDAC Total Symptoms was added to the model was used as an estimate of effect size. To determine the relative influence of SIDAC Inattention, Hyperactivity, and Impulsivity symptoms, a simultaneous regression, with FSIQ controlled, was used. Finally, the amount of variance accounted for by inattention was calculated by the change in R^2 when inattention was added to a model with estimated IQ and the other SIDAC variables.

Results

Table 1 presents the group means and standard deviations for the sample age and IQ. No significant differences among groups for age were found ($p = .50$). There was a significant difference in the estimated IQ score with the control group scoring significantly higher than the ASD but not the ADHD group, $F(2, 83) = 5.57$, $p = .005$. The estimated IQ was entered into subsequent analyses to control for these group differences. Table 1 provides the means and standard deviations for each group on the variables of interest: CASP Emotion (CASPem), CASP Nonverbal Cues (CASPnv) and the SIDAC variables of Inattention, Hyperactivity and Impulsivity. Box's test of equality of covariance was not significant, indicating similarity of covariance across groups.

Table 1 Differences in means among groups for variables of interest

Variable	Control *M* (*SD*)	ASD *M* (*SD*)	ADHD *M* (*SD*)
Age (months)	119.58 (21.60)	128.14 (29.11)	124.47 (23.75)
WISC-IV V/BD FSIQ	116.47 (13.34)	104.16 (12.26)	107.87 (13.77)
CASPem	.5629 (1.42)	−1.29 (1.05)	−.765 (.83)
CASPnv	−.563 (1.03)	−1.71 (1.22)	−1.45 (.77)
SIDAC inattention	1.63 (2.0)	6.68 (2.20)	7.70 (1.18)
SIDAC hyperactivity	.74 (1.20)	2.27 (1.484)	3.43 (1.84)
SIDAC impulsivity	.58 (.902)	1.57 (1.10)	1.90 (1.10)

See text for significant differences

A significant main effect of diagnostic classification was found for the two CASP variables (Wilks' Lambda = .760, $F(4, 162) = 5.942$, $p < .001$). Diagnostic classification appeared to account for about 13% of the variance in the emotion recognition scores (Partial Eta Squared = .128). With FSIQ covaried, a significant main effect of diagnostic classification for the three SIDAC scores, inattention, hyperactivity and impulsivity, was also found ($F(6, 160) = 19.623$, $p < .001$). All three groups were significantly different, and group membership accounted for about 42% of the variance in the SIDAC scores with FSIQ controlled (Partial Eta Squared = .424).

Which Measures Best Discriminated the Groups?

In this sample, both of the CASP variables had significant effects of diagnostic classification (CASPem: $F(2, 82) = 12.80$, $p < .001$; CASPnv: $F(2, 82) = 3.60$, $p = .032$), suggesting that one or more groups had more difficulty identifying emotions and the nonverbal cues that signal the emotions. The CASPem variable accounted for 23.8% of the variance among groups (Partial Squared Eta = .238), while the CASPnv variable accounted for about 8% of the variance among groups (Partial Squared Eta = .081). Pairwise comparisons for the CASP variables indicated that control participants had significantly higher scores than did the participants in the ASD and ADHD groups (see Table 2). Differences were not significant

between the ASD and ADHD groups for the CASPem variable, indicating that both the ASD and ADHD groups scored lower than the control group, but similarly to one another. On the CASPnv variable, significant differences were found between the control group and the ASD group, but not between control participants and those with ADHD only.

The three SIDAC variables were also significantly different among groups (Inattention: $F(2, 82) = 59.8$, $p < .001$; Hyperactivity: $F(2, 82) = 16.6$, $p < .001$; Impulsivity: $F(2, 82) = 8.0$, $p = .001$). The number of inattention symptoms accounted for 59% of the variance among groups (Partial Squared Eta = .593). The number of hyperactivity symptoms accounted for 29% of the group variance (Partial Squared Eta = .288). Impulsivity symptoms accounted for 16% of the variance among groups (Partial Squared Eta = .163). Bonferroni-corrected post-hoc comparisons, shown in Table 2, indicated that symptoms of hyperactivity were significantly different among all three groups while inattention and impulsivity were different between the control group and each of the diagnostic groups but not between the ADHD and ASD groups. In this sample, children in the group with ADHD only were significantly more hyperactive than the group of children identified with an ASD. After Bonferroni correction, inattention was no longer significant between ADHD and ASD groups, but appeared to trend in that direction. No significant difference between ASD and ADHD groups for impulsivity was found in this sample, but both groups were significantly more impulsive than children in the control group.

Does Number of Attentional Symptoms Matter?

To test whether the number of attentional symptoms has an effect on CASPem, a regression of CASPem on SIDAC symptoms with estimated IQ controlled was performed (see Table 3). The model was significant ($R^2 = .521$, $F(4, 81) = 7.543$, $p < .001$), indicating that 52% of the variance in CASPem can be accounted for by estimated IQ and all SIDAC symptoms together. Examination of the coefficients indicated that only the number SIDAC Inattention symptoms contributed significantly to the variance in CASPem, such that one fewer symptom raised the CASPem score by about .16 z-score points ($b = -.156$, $\beta = -.363$, $p = .001$). Along with estimated IQ, inattention symptoms have the strongest influence on CASPem score in the presence of all symptom types, with a significant and moderate effect size found ($\Delta R^2 = .103$, $F(1, 83) = 11.55$, $p = .001$).

Table 2 Between-group pairwise comparison of CASP means and SIDAC means

Variable	Comparison	Mean difference (SE)	Significance p
CASPem	Control vs. ASD	1.59 (.31)	<.001
	Control vs. ADHD	1.15 (.32)	.002
	ADHD vs. ASD	.44 (.26)	.276
CASPnv	Control vs. ASD	.76 (.29)	.030
	Control vs. ADHD	.62 (.29)	.109
	ADHD vs. ASD	.14 (.24)	1.00
SIDAC inattention	Control vs. ASD	−4.98 (.56)	<.001
	Control vs. ADHD	−6.02 (.56)	<.001
	ADHD vs. ASD	1.05 (.46)	.080
SIDAC hyperactivity	Control vs. ASD	−1.55 (.47)	.004
	Control vs. ADHD	−2.71 (.47)	<.001
	ADHD vs. ASD	1.16 (.39)	.012
SIDAC impulsivity	Control vs. ASD	−.92 (.32)	.014
	Control vs. ADHD	−1.28 (.32)	<.001
	ADHD vs. ASD	.35 (.26)	.549

Table 3 Results of a simultaneous regression of CASPem on SIDAC symptoms of inattention, hyperactivity, and impulsivity, with FSIQ controlled

Variable	Unstandardized coefficient (b)	Standardized coefficient (β)	Significance (p)	Effect size (ΔR^2)
FSIQ	.030	.322	.002	
Inattention	−.156	−.363	.001	.103
Hyperactivity	−.021	−.030	.826	
Impulsivity	.156	.141	.288	

Similar results were obtained for the CASPnv score. The three SIDAC variables together accounted for 29% of the variance in the CASPnv with estimated FSIQ controlled ($R^2 = .285$, $F(4, 81) = 8.070$, $p < .001$). Inattention, but not hyperactivity and impulsivity contributed significantly to the model in the presence of all SIDAC symptoms and estimated IQ ($b = -.094$, $\beta = -.248$, $p = .020$). In this sample, better emotion recognition is significantly associated with less severe symptoms of inattention.

Discussion

This study compared children diagnosed with ASD, ADHD and those who are typically developing on their ability to interpret nonverbal social information from video vignettes of emotionally charged interactions. The results of this study suggest that typically developing children were better able to interpret and justify how they recognized the emotions they saw in the videos than were children with ADHD and ASD. Significant differences for emotion interpretation and verbalization between children with ADHD and ASD were not found. An effect of inattention was found in that a greater number of inattention symptoms was associated with poorer identification of emotions and nonverbal cues on the CASP, regardless of group membership. It appears that there may be an additional influence related to attention in impaired social perception that is distinct from having an ASD.

There are both clinical and research implications for this finding. Clinicians may overestimate the social deficits of children with ASD if they also have symptoms of inattention. There appear to be two influences on social perception impairment for such children: that of being diagnosed with ASD, and another of experiencing symptoms of inattention. For researchers, the high prevalence of attention difficulties in samples of children who are diagnosed with ASD suggest that inattention is an important factor to consider. Many researchers do not assess the presence of ADHD in their autistic spectrum samples, yet features of inattention may be influencing their findings. For researchers of ADHD in children, these findings suggest that social difficulties may be influenced by the number of inattention symptoms.

Limitations

This study was limited by the difficult problem of untangling symptoms of ASD and ADHD. It is difficult to find a "pure" ASD group, though the sample reasonably estimates the natural occurrence of attentional problems in the population. Further, this study necessitated grouping children within the high functioning autistic spectrum diagnoses into one group because diagnostic boundaries for these groups are so poorly established. Estimated IQ was entered into all of the statistical calculation to control for the fact that the control group had higher IQ scores than did the diagnostic groups, which is the conventional manner of coping with such disparities.

Conclusions

Attention appears to be important for performance on a video vignette task, indicating that the task is sensitive not only to poor social perception, but to attention as well. The data suggest that there is an effect of social competence beyond that of attention for the group of children who have an ASD. Researchers are cautioned to account for attentional difficulties in their studies involving children with social deficits. Finally, although this finding describes differences in behavioral performances, neuroimaging may tie such behavior to brain function. Research describing the neural pathways that truly distinguish the tasks and groups needs to be pursued.

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