



Assessment Of Severity And Associated Comorbidities Among Children With Autism Of Age Group 3- 12 years

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Abstract

Background: Comorbid conditions in children with autism spectrum disorders can exacerbate the core symptoms of autism and can cause a variety of other behaviors. The study was conducted to assess the severity and associated comorbidities among 3-12 years children with autism and to study the correlation between the severity of Autism and comorbid conditions

Methods: This hospital-based cross-sectional study was conducted on 30 children with autism in the age group 3-12 years attending the department of pediatric medicine at the tertiary care teaching hospital, Tirupati. After a detailed history and physical examination, they were assessed using the Indian Scale for Assessment of Autism (ISAA) to grade the severity of the diagnosis.

Comorbid conditions such as sleep problems, cognitive function, adaptive function, and attention deficit hyperactivity disorder were assessed using various scales such as Children Sleep Habits Questionnaire (CSHQ), Developmental Screening Test (DST), and Vineland Social Maturity Scale (VSMS), ADHD Rating scale respectively.

Results: Autism was more common in males with a male to female ratio of 4: 1. The most common age group in the present study was 3-5 years. Speech delay, poor eye contact, and hyperactivity were the most common behavioral problems. 76.6 % had sleep problems, 56.6 % had an intellectual disability and 43.3% had attention deficit hyperactivity disorder. 33.3 % had multiple comorbid conditions. Sleep problems and intellectual disability correlate with ISAA and the severity of Autism. Bedtime resistance, sleep behavior, and daytime sleepiness sub-scores of CSHQ were found to be positively correlated with ISAA and the severity of Autism. Social quotient scores were negatively correlated with ISAA. ADHD and intellectual disability serve as risk factors for sleep problems seen in children with Autism.

Conclusion: The present study recommends routine screening of autistic children for any comorbidities and their early intervention can improve the quality of life and learning opportunities in those children.

Keywords: Autism, Comorbidities, Behavior

Introduction

Autism spectrum disorder is a heterogeneous condition that includes — Autism, Asperger's

syndrome, Childhood disintegrative disorder, and pervasive developmental disorder - not otherwise specified as defined by the American Psychiatric

Association, Diagnostic and statistical manual of mental disorders¹. The Centre for Disease Control and Prevention in the US estimates prevalence as 1 in 54 children. Autism is 4.3 times more common in boys than in girls². In India, the prevalence rate is approximately 1 in 500 or 0.20 % of the population of more than 2,160,000 people. The Incidence rate is about 1 in 90,666 in India.

Comorbid conditions in Autism include medical comorbidities, comorbid psychopathology, and developmental comorbidity.

Comorbidity in Autism is an important topic for the field of Applied Behaviour Analysis (ABA) to study for a variety of reasons. Comorbid conditions can exacerbate the core symptoms of Autism and can cause a variety of other behaviors that are not the core symptoms of Autism. Multiple disorders present in the same child result in more frequent mental health referrals compared to children who have a diagnosis of only one disorder³ Comorbid conditions affect the quality of life for children by interfering with their learning opportunities. The study was conducted to better understand the co-occurrence patterns of comorbid conditions in autism and find any significant association between common comorbid conditions like sleep disturbance, intellectual disability, and ADHD with the severity of Autism

Material And Methods:

A cross-sectional study was conducted on all children aged 3 –12 years diagnosed with autism to assess the severity and associated comorbidities attending the tertiary care hospital, Tirupati after obtaining approval from the Institutional ethics committee, Sri Venkateswara Medical College, Tirupati.

Thirty patients were included in this study after obtaining written consent from their parents, over a study period of 12 months from April 2019 to March 2020. Children who are with visual defects, hearing difficulties, and acute medical conditions.

All the parents were asked to fill out a profile which collected details including age, gender, age at diagnosis, birth history, development history, presenting symptoms, type of education, etc. A clinical examination was done in detail.

All children were assessed using the Indian Scale for Assessment of Autism (ISAA) to grade the severity of the diagnosis.

Comorbid conditions such as sleep problems, cognitive function, adaptive function, and attention deficit hyperactivity disorder were assessed using various scales such as Children Sleep Habits Questionnaire(CSHQ), Developmental Screening Test(DST), and Vineland Social Maturity Scale(VSMS), ADHD Rating scale respectively.

All data entered in the data collection form were entered in an excel spreadsheet, and the data were analyzed using the statistical software, SPSS version 21. Qualitative data were analyzed by the Chi-square test. Quantitative data were analyzed by independent t-test, paired t-test, and one-way ANOVA. The relationship between quantitative variables was tested using correlation. p-value < 0.05 is taken as statistically significant.

Results:

A total of 30 patients were included in the study. The most common age group in the present study was 3-5years (53.4%) (Table 1). There was a male preponderance compared to females with a male to female ratio of 4:1. (Table 1). Speech delay, poor eye contact, and hyperactivity were common presenting complaints seen in the children with autism. Among 30 children with autism, 63.3 % were attending a special school, 16.7 % were attending regular school and 20 % were not attending either of the schools. (Table 2).

The Indian Scale for Assessment of Autism (ISAA) was used to assess the severity of autism. The mean ISAA observed was 105.88 in the age group between 3-5yrs, 107.86 in 6-8yrs, and 116.14 in 9-12yrs (Table 4). The mean ISAA observed was 108.42 in males and 110 in females. (Table 3). In this study, 76.6% had sleep problems, 56.6% had an intellectual disability and 43.3% had ADHD. Out of 30 autistic children, 33.3% have all three comorbidities sleep problems, intellectual disability, and ADHD.

Out of 30 Children in the study, 53.3% had mild autism, 40% had moderate autism and 6.7% had severe autism. (Table 1)

Mean score comparison of all domains of ISAA as per the severity of diagnosis shows significant differences in the mean scores among the severity of autism by one-way ANOVA. Social relationship and reciprocity ($F=19.75$; $p<0.001$; S); emotional responsiveness ($F=11.14$; $p<0.001$; S); speech language and communication ($F=5.04$; $p=0.014$; S); behavior pattern ($F=10.53$; $p<0.001$; S); Sensory aspect ($F=7.83$; $p=0.002$; S); cognitive component ($F=11.78$; $p<0.001$; S). (Table 5)

In this study, the prevalence of sleep problems in children with autism was 76.6% based on the children's sleep habit questionnaire. There was no statistically significant difference between age and sleep problems in this study ($p=0.161$; NS). There was no statistically significant difference between gender and sleep problems. ($p=0.66$; NS). (Table 5)

Mean score comparison of all domains of CSHQ by oneway ANOVA shows significant differences among the severity of autism. Bedtime resistance ($F=41.10$; $p<0.001$; S); sleep behavior ($F=47.33$; $p<0.001$; S); night waking ($F=2.65$; $p=0.089$; NS); daytime sleepiness ($F=4.11$; $p=0.028$; S) (Table 5)

In this study, individual domains of CSHQ scores positively correlated with total scores of ISAA. Bedtime resistance ($r=0.874$; $p<0.001$; S); sleep behavior ($r=0.853$; $p<0.001$; S); night waking ($r=0.428$; $p=0.018$; S); daytime sleepiness ($r=0.646$; $p<0.001$; S). Among these domains bedtime resistance, sleep behavior and daytime sleepiness strongly correlated with ISAA scores. (Table 5)

In this study, among those children associated with a sleep problem, 56.5% ($n=13$) had ADHD and 43.5% ($n=10$) does not have ADHD. Hence symptoms of ADHD have also been shown to be associated with sleep problems in children with autism.

Autism children associated with intellectual disability had more sleep problems as compared to children with normal intellectual capacity as evidenced by an independent t-test. Bedtime resistance, Sleepbehavior, and daytime sleepiness are affected more than other components.

In this study, 33.3% had normal intelligence, 10% had borderline intelligence, 16.7% had mild ID, 16.7% had moderate ID and 23.3% had severe ID. (Table 1)

There was a statistically significant correlation between intellectual capacity and severity of autism ($p=0.003$; S). There was a statistically significant correlation between intellectual capacity and ISAA in this study ($p<0.001$; S). In this study, 26.7% had dull normal SQ, 16.7% had borderline SQ, 16.7% had mild MR, 16.7% had moderate MR and 23.3% had severe MR. Social quotient scores were negatively correlated with autism severity scores ($t=-0.692$, $p<0.001$; S). Thus autism children with higher adaptive function have lesser severity scores. (Table 5)

The results of paired comparison t-test of IQ and SQ showed that adaptive behavior scores in the lower functioning autistic children were significantly higher than their IQ scores. Severe ID ($t=11.7$; $p<0.001$; S); Moderate ID ($t=1.192$; $p=0.355$; NS); Mild ID ($t=-1.764$; $p=0.153$; NS); borderline IQ ($t=-2.964$; $p=0.041$; S); Normal IQ group ($t=-3.221$; $p=0.018$; S). (Table 5)

There was no statistically significant correlation between autism severity and ADHD symptoms ($p=0.337$; NS) (Table 4)

Discussion:

This cross-sectional study was done in the Developmental clinic in the Department of Pediatric medicine, Sri Venkateswara Ramnaraian Ruia Government General Hospital, which includes 30 children diagnosed with autism as the study population.

In our study, the most common age group is 3-5 years and has a male preponderance with a male to female ratio of 4:1, matching with the previous studies. (Table 1)

In this study, there was no significant difference between male and female participants in autistic symptoms as assessed by ISAA comparable with previous studies.

Out of 30 autistic children in the present study, 53.3% constitute mild Autism, 40% were with moderate autism and 6.7% with severe autism (Table 1)

The common presenting problems which were observed in this study include Speechdelay, poor eye contact, and hyperactivity, accounting for about 60% of the complaints. In this study, 63.3% ($n=19$) of

children were attending special school, 16.7% (n=5) were going to regular school, and 20% (n=6) were not attending either of the school. (Table 2)

In the current study, the Indian Scale for Assessment of Autism (ISAA) was used to assess the severity of Autism. The mean ISAA was 105.88, 107.86, and 116.14 among age groups 3-5 years, 6-8 years, and 9-12 years, respectively. (Table 4) There was no significant correlation between mean ISAA and age. In a study, a small increase in all the components and total measurement was observed for the elderly age group participants as observed in our study.

However, these differences were not statistically significant. These could be due to the environment's influence on their characteristics⁴

Mean score comparison of all the domains of ISAA as per the severity of the diagnosis show that significant differences were observed in the mean scores among the severity of Autism. The problem behavior of severe Autism was higher than moderate and mild Autism matching the previous studies. The same phenomenon was also observed by Perumal et al. (2017) in their study⁴. The prevalence of sleep problems 76.6%, as seen in the current study, was comparable to the studies which have used CSHQ previously^{5,6} There was no significant difference between age, gender, and sleep problem in this study, as evidenced by another study. Similar to Perumal et al. (2017)⁴ and Aathira et al.⁷(2017) study, Sleep onset and maintenance problems resulting in reduced sleep duration were the most common concerns expressed by the parents of children with Autism in the current study. In the present study, all the children with Autism were co-sleeping with one of the parents. Consequently, one would expect them to have less bedtime resistance and more fragmented sleep.

In this study, there was a significant statistical correlation between sleep difficulties and autism symptom severity which was similar to the studies conducted by Samantha et al⁸ and Adams et al⁹, Mayes and Calhoun et al¹⁰. Bedtime resistance, sleep behavior, and daytime sleepiness were strongly correlated with the severity of Autism. The current study highlighted the fact that poor sleepers have significantly more behavioral problems than good sleepers.

The current study highlights the fact that sleep behavior and daytime sleepiness were more seen in autistic children with associated intellectual disability which was similar to Richdale and Prior et al¹¹, Studies have shown that compared to Intellectual Disability (ID) alone, ID with comorbidities has significantly more sleep-related problems. However, Kumar et al.¹², study found no significant differences between Autism patients with normal intellectual capacity and intellectual disability regarding sleep disturbances. The occurrence of different outcomes in the studies may depend on other factors affecting sleep quality and intellectual disability in autistic children, such as medications, family factors, psychotherapy, and behavioral therapy.

In the current study, children with Autism who has an associated ADHD has more sleep problem than those without ADHD similar to a study done by Gunes et al¹³, Devincent et al¹⁴. Medications often used to treat ADHD symptoms such as methylphenidate, are known to disturb sleep and might also contribute to enhancing sleep problems.

There was no significant correlation between poor cognition and age and gender in the current study, as supported by Postorino et al¹⁵. In a sample of 75 children with Autism drawn from the Special Needs and Autism Project (SNAP) cohort, Charman et al. reported the prevalence of Intellectual disability in Autism to be 55 %, similar to the current study¹⁶ The current study highlighted that children with severe Autism have lower IQ similar to the study done by Gotham et al¹⁷.

Recent research on intervention in this population by Dawson et al¹⁸ focusing on the efficacy of the Early Start Denver Model – an intervention program specifically targeting Autism symptoms in very young children – found that children who were undergoing this program experience significant gains on measures of cognitive development and adaptive behavior. Vivanti et al¹⁹. study on intellectual development in autism spectrum disorder showed children with greater Autism severity at an initial assessment were more likely to present with poorer cognitive outcomes at a later assessment, hence supporting the present study.

In this study, nearly half (56%) of autistic children had SQs less than 70, a little more than one-fifth have

SQs above 80, and 16.7% had SQs in the borderline range (Table 1)

In this study, adaptive behavior scores in the lower functioning autism children were significantly higher than their IQ scores, whereas for Autism children with borderline and normal IQ, the adaptive skills were significantly lower than their IQs. This finding is the same as a study conducted by Malhi and Singhi et al.²⁰, stating that higher functioning Autism children have SQs significantly lower than their IQs and lower functioning Autism children have SQs higher than their IQs. Various studies in concordance with these findings were: Perry et al.²¹ found that IQ was higher than the adaptive skills among the high functioning Autism children, while for the low functioning Autism children.

The prevalence of ADHD in the current study was 43.3%. The high prevalence rate was comparable to a few western as well as Indian studies. The most common subtype observed in this study was the hyperactive type of ADHD. Similar to a study by Manohar et al.²² done in south India (Puducherry). However, other studies have reported combined or inattentive type as a more common subtype^{23, 24}. The difference could be due to the fact Western literature predominantly included children with ADHD of the combined or inattentive subtype²⁵. Thereby, further research on varying clinical presentations of Autism with subtypes of ADHD is warranted.

In the current study, no significant correlation was found between autism severity and ADHD. Manohar et al.²² study also reported no significant association between autism severity and ADHD

Conclusion :

Autism was more common in males with the most common age group being 3-5yrs. Speech delay, poor eye contact, and hyperactivity were the most common behavioral problems. Sleep problems and intellectual disability positively correlate with the severity of autism. Individuals with severe autism symptoms had lower IQ, which concludes that autism characteristics and cognitive functioning are not entirely independent features. Associated ADHD and intellectual disability serve as risk factors for sleep problems seen in children with Autism.

Limitations Of The Study :

Follow-up of patients could not be done due to the short study period and another limitation is the reliance on parental reports. Parental problems may influence their perception of the child's condition

Ethics Committee Approval: This study was approved by the Institutional ethics committee Sri Venkateswara Medical College, Tirupati. (Lr. No-106/2019, date: 20-02-2019).

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children with autism and symptoms of attention-deficit hyperactivity disorder. J.

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TABLES: Table 1. Distribution of children with autism based on various demographic variables

Age group(Years)	Number	Percent (%)
3 – 5	16	53.4
6 – 8	7	23.3
9 – 12	7	23.3
Total	30	100
Gender		
Male	24	80
Female	6	20
Total	30	100
Type of education		
Special School	19	63.3
Regular School	5	16.7
No school	6	20
Total	30	100
Comorbid Conditions		
Sleep problem	4	13.3
Intellectual Disability	1	3.3
Sleep problem +Intellectual disability	7	23.3
Sleep problem + ADHD*	2	6.6
Sleep problem+ Intellectual Disability +ADHD*	10	33.3
No comorbidities	6	20
Based on Severity		
Mild	16	58.3
Moderate	12	40

Severe	2	6.7
Total	30	
Based on intellectual capacity		
Normal	10	33.3
Borderline	3	10
Mild ID ⁺	5	16.7
Moderate ID ⁺	5	16.7
Severe ID ⁺	7	23.3
Social Quotient		
Dull normal (80-89)	8	26.7
Borderline(71-79)	5	16.7
Mild MR [§] (50-70)	5	16.7
Moderate MR [§] (35-49)	5	16.7
Severe MR [§] (21-34)	7	23.3

Attention Deficit Hyperactivity Disorder,+ – Intellectual Disability, §- Mental Retardation

Table 2. Age-wise distribution of children with autism based on presenting complaints

Presenting complaints	Age intervals in years			Total
	3-6 N(%)	6-8 N(%)	9-12 N(%)	
SD [*]	5(62.5)	3(37.5)	0(0)	8(26.7)
SD,PEC ⁺	4(57.1)	1(14.3)	2(28.6)	7(23.3)
SD,PEC,HA [§]	1(33.3)	0	2(66.7)	3(10)
SD,PEC,SP	0	0	1(100)	1(3.3)
PEC,SP	2(100)	0	0	2(6.7)
SD,SB [¶]	0	1(100)	0	1(3.3)
SD,SP	1(50)	0	1(50)	2(6.7)
SD,PEC,SB	1(100)	0	0	1(3.3)
SD,HA,SP	0	2(100)	0	2(6.7)
SD,HA,SB	0	0	1(100)	1(3.3)
SD,PEC,HA,SB	2(100)	0	0	2(6.7)

*- Speech delay, +- Poor eye Contact, § – Hyperactivity, II- Solitary play, ¶- Stereotyped Behavior

Table 3. Gender-wise distribution of autistic children based on various assessment scales

ISAA*	Male	Female		
Mean	108.42	110		
Standard Deviation	23.739	11.243		
ADHD⁺ Rating scales			Total	
Hyperactive(HA) N(%)	6(25)	1(16.7)	7(23.3)	Chi-square – 1.359 df -3, p-value – 0.715
Inattention(IA)N(%)	3(12.5)	0(0)	3(10)	
HA/IA N(%)	2(8.3)	1(16.7)	3(10)	
No ADHD	13(54.2)	4(66.7)	17(56.7)	
	24(80)	6(20)	30	
CSHQ Score[§]				
Normal (<= 41) N(%)	6(25)	1(16.7)	7(23.3)	Chi-square – 0.186 df 1 p-value 0.66
Abnormal (>41) N(%)	18(75)	5(83.3)	23(76.7)	
Total	24(80)	6(20)	30	
Intellectual Capacity				
Normal N(%)	12(50)	1(16.7)	13(43.3)	Chi-square – 2.172 df 1 p-value 0.141
Abnormal N(%)	12(50)	5(83.3)	17(56.7)	
Total	24(80)	6(20)	30	

* – Indian Scale for Assessment of Autism, +- Attention deficit hyperactivity disorder, § – Children Sleep Habits Questionnaire

Table 4 . Age-wise distribution of autistic children based on various assessment scales

	AGE GROUP (Years)			Total	
	3-5	6-8	9-12		
ISAA*					
Mean	105.88	107.86	116.14		
Standard Deviation	21.156	23.968	22.079		
ADHD⁺ Rating Scale					
Hyperactive (HA)N%	3(18.8)	1(14.3)	3(42.9)	7(23.3)	Chi-square

Inattention (IA)N%	2(12.5)	1(14.3)	0(0)	3(10)	7.992 df – 6 p-value - 0.239
HA/IA N%	0(0)	1(14.3)	2(28.6)	3(10)	
No ADHD	11(68.8)	4(57.1)	2(28.6)	17(56.7)	
Total	16	7	7	30	
CSHQ Score[§]					
Normal (<= 41) N(%)	4(25)	3(42.9)	0(0)	7(23.3)	Chi-square – 3.647 df – 2 , p-value 0.161
Abnormal (>41) N(%)	12(75)	4(57.1)	7(100)	23(76.7)	
Total	16	7	7	30	
Intellectual capacity					
Normal N(%)	8(50)	2(28.6)	3(42.9)	13(43.3)	Chi-square – 0.911 Df 2 p- value 0.634
Abnormal N (%)	8(50)	5(71.4)	4(57.1)	17(56.7)	
Total	16(53.3)	7(23.3)	7(23.3)	30	

* – Indian Scale for Assessment of Autism, + - Attention deficit hyperactivity disorder, § – Children Sleep Habits Questionnaire

Table 5. Comparison table of various domains between mild, moderate, and severe autism children

ISAA*	Severity of Autism			F	p-value
	Mild Mean(SD) [¶]	Moderate Mean (SD) [¶]	Severe Mean (SD) [¶]		
Social relationship and reciprocity	22.06(4.98)	29.92(4.033)	40(2.82)	19.75	<0.001
Emotional responsiveness	11.3(2.77)	15.33(4.84)	24(5.65)	11.14	<0.001
Speech and language communication	22.56(4.39)	25.58(3.87)	31.5(2.12)	5.04	0.014
Behavior pattern	16.06(3.17)	21.75(4.59)	25(1.14)	10.53	<0.001
Sensory aspect	11.31(3.04)	14.5(3.11)	19(1.41)	7.83	0.002
Cognitive component	10.38(2.57)	13.5(2.54)	18.5(2.12)	11.78	<0.001
CSHQ[§]					
Bedtime resistance	16.69(3.87)	26.67(3.17)	34.50(0.70)	41.1	<0.001

Sleep behavior	10.88(1.70)	1642(2.42)	23(1.14)	47.33	<0.001
Night waking	4.69(1.19)	4.92(1.50)	7(1.41)	2.65	0.089
Daytime sleepiness	7.69(1.53)	9.42(2.06)	10(0.00)	4.11	0.028
Intellectual Capacity					
Normal	10(100)	0(0)	0(0)	10(33.3)	p-value 0.003
Borderline	2(66.7)	1(33.3)	0(0)	3(10)	
Mild Intellectual Disability	0(0)	5(100)	0(0)	5(16.7)	
Moderate intellectual disability	2(40)	3(60)	0(0)	5(16.7)	
Severe Intellectual Disability	2(28.6)	3(42.9)	2(28.6)	7(23.3)	
Total	16(53.3)	12(40)	2(6.7)		
Social Quotient					
Dull normal	8(100)	0(0)	0(0)	8(26.7)	0.004
Borderline	4(80)	1(20)	0(0)	5(16.7)	
Mild MR ^{II}	0(0)	5(100)	0(0)	5(16.7)	
Moderate MR ^{II}	2(40)	3(60)	0(0)	5(16.7)	
Severe MR ^{II}	2(28.6)	3(42.9)	2(28.6)	7(23.3)	
Total	16(53.3)	12(40)	2(6.7)		
ADHD⁺ Rating Scale					
Hyperactive(HA)	3(42.9)	3(42.9)	1(14.3)	7(23.3)	0.337
Inattention(IA)	1(33.3)	2(66.7)	0(0)	3(10)	
HA/IA	1(33.3)	1(33.3)	1(33.3)	3(10)	
No ADHD	11(64.7)	6(35.3)	0(0)	17(56.7)	
Total	16(53.3)	12(40)	2(6.7)		

* – Indian Scale for Assessment of Autism, ⁺ – Attention deficit hyperactivity disorder, [§] – Children Sleep Habits Questionnaire, ^{II} – Mental Retardation, [¶] – Standard Deviation