

Prevalence of Stuttering in Children with ADHD at Sohag University Hospital

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ABSTRACT

Background: The neurodevelopmental problem known as attention deficit hyperactivity disorder (ADHD), which affects both children and adults, may be related to stuttering, according to research. Some people refer to stuttering as stammering or childhood-onset fluency disorder, although it is also a possible symptom of ADHD.

Objective: To evaluate the prevalence of stuttering in children with ADHD to better understand the nature of stuttering and to improve the line of management in those patients.

Patients and methods: Cross-sectional observational study that included 100 patients with ADHD, 85 of them falls into ADHD without stuttering category. Conversely, 15 of them are classified as ADHD with stuttering.

Results: For the category of average scores on Conner's scale, group I exhibited higher percentages in hyperactivity (60.0%), impulsivity (66.7%), and inattention (60.0%) compared to group II with percentages of 32.9%, 48.2%, and 23.5%. The majority of the sample (40%) fell in the mild range. One third (33.3%) were very mild. Over a quarter (26.7%) scored in the moderate severity range on the stuttering severity instrument-3 SSI3.

Conclusion: There was a higher proportion of males in the stuttering group compared to the non-stuttering group, although this difference did not reach statistical significance. The stuttering group had higher percentages of hyperactivity and inattention on the Conner's scale, with a significant association observed. The severity of stuttering varied, with most participants falling in the mild range. The study did not find a significant difference in IQ scores between the two groups.

Keywords: ADHD, Intelligence quotient, Stuttering severity index third edition.

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is defined by developmentally inappropriate symptoms of inattention and/or hyperactivity/impulsivity, which cause impairment in social, academic, and professional settings. ADHD is one of the most common neurodevelopmental diseases worldwide, with an estimated prevalence of 5-7% in children/adolescents^(1,2) and ≈2.5% in adults^(3,4).

ADHD frequently coexists and overlaps with other childhood and adolescent neurodevelopmental and mental illnesses. The most common co-occurring conditions include learning difficulties⁽⁵⁾, autism spectrum disorder^(6,7), tic/Tourette's disorder, obsessive-compulsive disorder⁽⁸⁾, anxiety, depression disorders, Oppositional defiant disorder ODD and (conduct disorder (CD)^(9,10).

Developmental stuttering is a complex fluency disorder that alters the speech pattern. It is considered a neurodevelopmental disorder that typically manifests in early children⁽¹¹⁾. It was reported that various factors such as motor, sensory, emotional, linguistic, and motor processes, are probably involved in its development and maintenance. Cognitive functions including attention are also accused of having a major role in stuttering development and maintenance. There are several factors that contribute to developmental stuttering, and there is a lot of variation among stutterers. Some think that cognitive impairments might explain this⁽¹²⁾.

Numerous studies have shown that compared to their normally fluent classmates, children who stutter have a harder time with sustained focus and attentional flexibility, particularly when they are younger⁽¹³⁾. Children with stuttering also tend to be impulsive⁽¹⁴⁾, anxious⁽¹³⁾, and have trouble filtering out irrelevant information from their senses⁽¹⁵⁾.

Stuttering may result from physical brain abnormalities associated with ADHD. The frontal lobe of the brain may have smaller, later-maturing structures in those with ADHD. Language, planning, organizing, attention span, and decision-making are all aided by this domain. According to some research, people with ADHD may also have functional abnormalities in Broca's region of the brain in addition to anatomical variations in the brain. The frontal lobe region in question helps in speech processing and production. As a result, any interference with its operation may result in speech and communication problems⁽¹⁶⁾.

Therefore, our study aimed to evaluate the prevalence of stuttering in children with ADHD to better understand the nature of stuttering and to improve the line of management in those patients.

PATIENTS AND METHODS

This Cross-sectional observational study was conducted at Sohag University Hospital Pediatric Psychiatry Clinic, Pediatric Department and

Neurophysiology Clinic, Neuropsychiatry Department, and Phoniatic Unit after receiving the necessary ethical clearance from September 2022 to September 2023. All children with ADHD were involved in the study except children aged below 6 years old and ADHD with other behavioral and neurological disorders. The total number was 100 patients with ADHD 85 of them falls into ADHD without stuttering category. Conversely, 15 of them are classified as ADHD with Stuttering. All patients underwent the following:

Clinical history in the form of age, sex, place of residence, consanguinity, family history of comparable problem, prenatal and postnatal history, and length of the illness.

Clinical evaluation with an emphasis on a thorough neurological assessment^(17, 18) (Mental status, gait and motor function, sensory exam, muscle stretch reflexes in the older child and evaluation of the cranial nerves).

The total number of patients were divided into 2 groups: Group I included 85 patients as ADHD without stuttering. Group II involved 15 patients as ADHD with stuttering. These two groups underwent the following assessment scale: Assessment of ADHD severity by a Conners rating scale⁽¹⁹⁾. Assessment of IQ by Stanford-Binet test 5⁽²⁰⁾. This intelligence scale includes Full Scale IQ scores in addition to other scores.

Evaluation of stuttering-by-stuttering severity instrument- 3 (SSI-3)⁽²¹⁾.

Ethical consideration: the Institutional Review Board (IRB) of the School of Medicine at Sohag University authorized this study (IRB no. Soh-Med 22-05-13). All the children who participated in the research did so voluntarily and after their parents gave their written approval. The trial, with the identification NCT05383430, was prospectively registered in the ClinicalTrials.gov database. This work has been carried out in accordance with The Code of Ethics of World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

The data were analyzed utilizing IBM SPSS software package version 20.0 (IBM Corporation, Armonk, New York). Qualitative data were represented using numerical

values and percentages. The Kolmogorov-Smirnov and Shapiro-Wilk tests were employed to assess the normality of distribution. Quantitative data were characterized by range (minimum and maximum), mean, SD, median, and interquartile range (IQR). The importance of the acquired results was assessed at 5% threshold. Chi-square test for categorical variables to compare distinct groups. Fisher's Exact or Monte Carlo tests were used for adjusting of Chi-square analysis when over 20% of the cells exhibit an anticipated count of less than 5. Student's t-test for normally distributed quantitative variables to compare two examined groups.

RESULTS

The total number was 100 patients with ADHD, 85 of them fall into ADHD without stuttering category. Conversely, 15 of them were classified as ADHD with stuttering. As regards the IQ test results, there was no significant difference between group I and group II. Group I had a slightly higher mean of IQ (93.53) compared to group II's mean IQ of 91.76. However, it's crucial to note that both groups fall within the normal IQ range (80.0–108.0), with medians of 94.0 and 91.0, respectively. In summary, while there is a slight numerical difference in mean IQ scores, it is not statistically significant, and both groups exhibited comparable IQ levels within the normal range. As regard sex, percentage in male among stuttering group was higher than non-stuttering group respectively (93.3%, 67.1%).

As regards age, there was a slight variation, with group I had a marginally lower mean age (7.77 years) compared to group II (8.03 years).

However, there was no significant difference in the age means between the two groups. As regards the consanguinity status revealed a significant difference, with 73.3% of group I reporting positive consanguinity compared to 36.5% in group II. This table presented a comparison between group I (n=15) and group II (n=85) based on perinatal history, family history, and type of delivery. Both groups have 100% full-term births, suggesting a consistent perinatal history across the entire sample. As regards family history, 66.7% of group I and 80.0% of group II have no significant difference. Regarding the type of delivery, group I showed a lower percentage of Cesarean sections (CS) at 73.3%, while group II has a slightly higher rate at 74.1% (**Table 1**).

Table (1): Comparison between the two studied groups according to demographic data

		Group I with stuttering (n = 15)		Group II without stuttering (n = 85)		Test of Sig.	p
		No.	%	No.	%		
Sex	Male	14	93.3	57	67.1	$\chi^2= 4.275$	^{FE} p=0.061
	Female	1	6.7	28	32.9		
Age (years)	Min. – Max.	5.0 – 14.0		6.0 – 13.0		t= 0.474	0.637
	Mean ± SD.	7.77 ± 2.32		8.03 ± 1.90			
	Median (IQR)	7.0 (6.0 – 8.50)		7.60 (6.50 –9.0)			
Consanguinity	Negative	4	26.7	54	63.5	$\chi^2= 7.112^*$	0.008*
	Positive	11	73.3	31	36.5		
Perinatal history	Full term	15	100.0	85	100.0	–	–
Family history of stuttering	No	10	66.7	68	80.0	1.321	0.310
	Yes	5	33.3	17	20.0		
Type of delivery	CS	11	73.3	63	74.1	0.004	1.000
	NVD	4	26.7	22	25.9		

IQR: Inter quartile range. **SD:** Standard deviation. **t:** Student t-test. **χ^2 :** Chi square test. **FE:** Fisher Exact. **p:** p value for comparing between the two studied groups. *****: Statistically significant at $p \leq 0.05$.

As regards the comparison between group I (ADHD with stuttering) and group II (ADHD without stuttering), significant differences emerge in their Conner's scale scores. Notably, 66.7% of group I exhibited average scores on the total Conner's scale compared to 24.7% in group II. Furthermore, in the domain of Conner hyperactivity, 60.0% of group I demonstrated average scores, in contrast to 32.9% in group II with statistical significance. Although, no significant difference was observed in Conner impulsivity, the analysis revealed a noteworthy distinction in Conner inattention, where 60.0% of group I fell into the average category, while only 23.5% in group II did so. These findings underscored pronounced variations in ADHD-related parameters, emphasizing higher Conner's scale scores in group I, particularly in total ADHD symptoms and hyperactivity domains (Table 2).

Table (2): Comparison between the two studied groups according to ADHD Conner's rating scale.

		Group I (n = 15)		Group II (n = 85)		χ^2	p
		No.	%	No.	%		
Total Conner's scale	Average	10	66.7	21	24.7	10.626*	0.005*
	Super average	2	13.3	33	38.8		
	Severe	3	20.0	31	36.5		
Conner Hyperactivity	Average	9	60.0	28	32.9	6.389*	^{MC} p= 0.033*
	Super average	1	6.7	31	36.5		
	Severe	5	33.3	26	30.6		
Conner Impulsivity	Average	10	66.7	41	48.2	2.634	0.268
	Super average	0	0.0	9	10.6		
	Severe	5	33.3	35	41.2		
Conner Inattention	Average	9	60.0	20	23.5	8.106*	^{MC} p= 0.019*
	Super average	2	13.3	36	42.4		
	Severe	4	26.7	29	34.1		

χ^2 : Chi square test **MC:** Monte Carlo **p:** p value for comparing between the two studied groups. *****: Statistically significant at $p \leq 0.05$.

As regards the relation between SSI-3 degree among group I and the total Conner's scale, Conner's hyperactivity, Conner's impulsivity and Conner's inattention scores with no significant associations. As regards the examination of SSI-3 categories (Very mild, mild, and moderate) in relation to various parameters within group I, distinct patterns were discernible. Notably, for cases with "Very mild" stuttering, the distribution on the Total Conner's scale revealed 60.0% with average scores, 40.0% with super average scores, and no instances of severe scores. A parallel trend was observed in Conner' hyperactivity, with 40.0% exhibited average scores, 60.0% displayed super average scores, and no occurrences of severe scores. Similarly, in Conner' impulsivity, 60.0% manifested average scores, 40.0% showed Super average scores, and no instances of severe scores were recorded. Furthermore, for Conner' inattention, 60.0% demonstrated average scores, 40.0% exhibited super average scores, with no cases of severe scores among those with "Very mild" stuttering. Comparable patterns were evident for cases with "Mild" and "Moderate" stuttering, providing valuable insights into the nuanced relationship between stuttering severity levels and ADHD-related parameters in group I (Table 3).

Table (3): Correlation between stuttering severity index third edition (SSI-3) and ADHD Conner's rating scale

		SSI3						χ^2	MC p
		Very mild (n= 5)		Mild (n = 6)		Moderate (n = 4)			
		No.	%	No.	%	No.	%		
Total Conner's scale	Average	3	60.0	4	66.7	3	75.0	2.989	0.808
	Super average	2	40.0	1	16.7	0	0.0		
	Severe	0	0.0	1	16.7	1	25.0		
Conner Hyperactivity	Average	2	40.0	4	66.7	3	75.0	3.564	0.561
	Super average	3	60.0	1	16.7	1	25.0		
	Severe	0	0.0	1	16.7	0	0.0		
Conner Impulsivity	Average	3	60.0	5	83.3	2	50.0	1.495	0.513
	Super average	2	40.0	1	16.7	2	50.0		
	Severe	0	0.0	0	0.0	0	0.0		
Conner Inattention	Average	3	60.0	4	66.7	2	50.0	2.260	0.932
	Super average	2	40.0	1	16.7	1	25.0		
	Severe	0	0.0	1	16.7	1	25.0		

χ^2 : Chi square test. MC: Monte Carlo. p: p value for comparison between the studied categories.

As regards the distribution of studied cases in group I (ADHD with stuttering) based on the SSI-3, it was notable that among the 15 cases, varying levels of stuttering severity was evident. Specifically, 33.3% exhibited very mild stuttering, 40.0% had mild stuttering, and 26.7% fell into the moderate stuttering category. This breakdown offered valuable insights into the nuanced spectrum of stuttering severity within group I, providing a detailed perspective on the diverse manifestations of stuttering among individuals with ADHD in this cohort as illustrated in Figure (1).

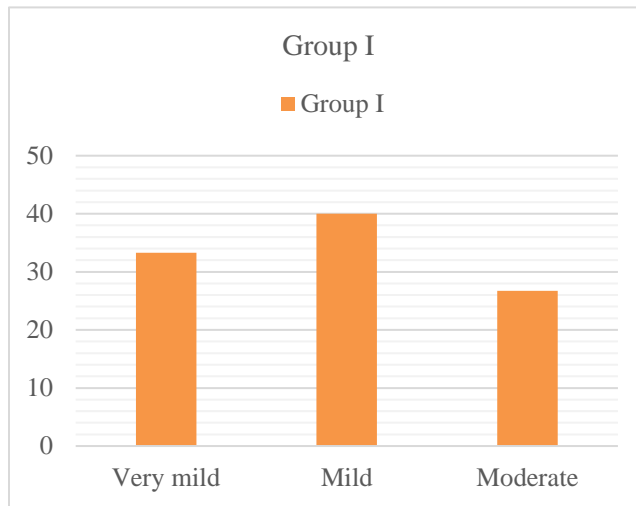


Figure (1): Correlation between SSI-3 and ADHD Conner's rating scale

DISCUSSION

The purpose of the current study was to assess the prevalence of stuttering in children with ADHD to better understand the condition and treat patients more effectively. This was a cross-sectional observational study that was conducted at Neuropsychiatry and Phoniatic units at Sohag University Hospital on 100 children with ADHD. The current study showed that the majority, comprising 85% of the sample was non-stuttering. In contrast, 15% of participants exhibited stuttering tendencies. This is lower than what was found in a recent study by **Spencer et al.** ⁽²²⁾ who aimed at assessing the prevalence of stuttering among ADHD patients. They reported that the prevalence was estimated to be 23.6% of participants (60/254). Based on these statistics, a significant portion of stutterers may have higher symptoms of ADHD, especially inattention-related symptoms. This may be due to a larger sample size than in our study.

It was reported that the gender-based stuttering prevalence was 2.50% in men and 0.94% in females, for a ratio of 2.4:1. This data suggests that stuttering is more common in men than in women. Stuttering was 1.32 times more common in men than in women, according to the results of the harmonic study. The tendency is leaning towards male preponderance, although it is not statistically significant. There is a 1.29:1 male-to-female ratio for stuttering in Iranian primary schools, according to one study. Iran and Egypt share many social and cultural traits ⁽²³⁾. Multiple investigations also reached similar conclusions ⁽²⁴⁾. Nevertheless, there are large disparities in the reported ratios of the sexes throughout age groups. For example, whereas the ratio was 3:1 in first grade, it rose to 5:1 in fifth grade. Since there were only a limited number of children stuttering across all age groups, this study did not look at how the male-to-female ratio varied. Consequently, the results of this study are consistent with those of other studies that have found that stuttering is more common in men than in women.

The current study showed that group I had an age range of 5.0 to 14.0 years, with a mean age of 7.77 ± 2.32 years. In contrast, Group II ranged from 6.0 to 13.0 years, displaying a slightly higher mean age of 8.03 ± 1.90 years. This slightly agrees with the results by **McKinnon et al.** ⁽²⁵⁾ who revealed a decrease in the prevalence of stuttering with an increase in the age.

The current study showed that for the category of average scores on Conner's scale, group I exhibited higher percentages in hyperactivity (60.0%), impulsivity (66.7%), and inattention (60.0%) compared to group II with percentages of 32.9%, 48.2%, and 23.5% respectively. Notably, there was statistically significant associations between hyperactivity and inattention. Conversely, for the severity categories (Severe and super average), the groups demonstrated varying distributions across the three dimensions, but only the severe category showed a

statistically significant hyperactive component on Conner's scale. Consistent with their goal of identifying the percentage of stuttering children exhibiting higher ADHD symptoms, **Druker et al.** ⁽²⁶⁾ found this to be the case. Nearly half of the stuttering youngsters (49.73%) in this study also showed signs of severe ADHD, according to the researchers. The researchers discovered a weak but statistically significant connections between the intensity of stuttering before treatment and ADHD symptoms. This agrees with studies that found more ADHD symptoms in stuttering children than in their typically developing classmates ^(27, 28).

The current study showed that according to relation between SSI-3 and different parameters, in the category of average on Conner's scale, there was no substantial difference in the percentages across severity levels. Similar trends are observed in the dimensions of hyperactivity, impulsivity, and inattention. Notably, the moderate severity level tended to have a higher percentages in some categories, such as average and super average, compared to very mild and mild severity levels.

The current study showed that the minimum and maximum IQ scores for both groups ranged from 80.0 to 104.0 for group I and 80.0 to 108.0 for group II. The t-test results indicated a non-significant difference in mean IQ scores between the two groups, with group I having a mean of 93.53 ± 5.64 and Group II having a mean of 91.76 ± 6.35 . The median IQ score for Group I is 94.0 with an interquartile range (IQR) of 91.0 to 97.0, while for group II, the median was 91.0 with an IQR of 86.0 to 96.0. These findings suggest that, based on the IQ test scores, there was no statistically significant difference between the two groups. Similarly, it was found that stutterer students demonstrated above average intelligence quotients (IQs) overall ⁽²⁹⁾. Although, it was reported that there was a statistically significant negative correlation between SSI-3 and standard of receptive, standard of expressive, and standard of total scores ⁽³⁰⁾.

LIMITATIONS

The study had a relatively small sample size, which may limit the generalizability of the findings. The study was conducted at a single hospital, which may introduce selection bias and restrict the representation of different populations. The reliance on self-report measures and subjective assessments may introduce response biases and affect the accuracy of the results. Other confounding factors, such as language abilities, and comorbid conditions, were not extensively explored in this study and should be considered in future research.

CONCLUSION

Our study found that the prevalence of stuttering in children with ADHD was 15%, with the majority (85%) not exhibiting stuttering tendencies. There was a higher proportion of males in the stuttering group compared to the

non-stuttering group, although this difference did not reach statistical significance. The age distribution did not significantly differ between the two groups. Positive consanguinity was associated with the stuttering group, while family history did not show a significant association. Head circumference was larger in the stuttering group compared to the non-stuttering group. The stuttering group had higher percentages of hyperactivity and inattention on the Conner's scale with a significant association. The severity of stuttering varied with most participants fell in the mild range. The study did not find a significant difference in IQ scores between the two groups.

Financial support and sponsorship: Nil.

Conflict of interest: Nil.

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