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## ORIGINAL CONTRIBUTIONS

### CLINICAL AND PSYCHOEDUCATIONAL PROFILE OF CHILDREN WITH SPECIFIC LEARNING DISABILITY AND CO-OCCURRING ATTENTION-DEFICIT HYPERACTIVITY DISORDER

SUNIL KARANDE, NITIN SATAM, MADHURI KULKARNI, RUKHSHANA SHOLAPURWALA, ANITA CHITRE, NILESH SHAH<sup>1</sup>

#### ABSTRACT

**BACKGROUND:** Almost 10% of school-going children have specific learning disability (SpLD) in the form of dyslexia, dysgraphia and/ or dyscalculia. Attention-deficit hyperactivity disorder (ADHD) occurs as a comorbidity in about 20% of these children. **AIMS:** To document the clinical profile and academic history of children with SpLD and co-occurring ADHD. **SETTINGS AND DESIGN:** Prospective observational study conducted in our clinic. **MATERIALS AND METHODS:** From August to November 2004, 50 consecutively diagnosed children (34 boys, 16 girls) were included in the study. SpLD was diagnosed on the basis of psychoeducational testing. Diagnosis of ADHD was made by DSM-IV-revised criteria. Detailed clinical and academic history and physical and neurological examination findings were noted. **STATISTICAL ANALYSIS:** Chi-square test or unpaired student's t-test was applied wherever applicable. **RESULTS:** The mean age of children was 11.4 years ( $\pm$ SD 2.5, range 7-17.1). Fifteen (30%) children had a significant perinatal history, 12 (24%) had delayed walking, 11 (22%) had delayed talking, 5 (10%) had microcephaly, 27 (54%) displayed soft neurological signs and 10 (20%) had primary nocturnal enuresis. There were no differentiating features between the two gender groups. Their academic problems were difficulties in writing (96%), inattentiveness (96%), difficulties in mathematics (74%), hyperactivity (68%) and difficulties in reading (60%). All children had poor school performance, 15 (30%) had already experienced class retention and 20 (40%) had developed aggressive or withdrawn behavior. **CONCLUSION:** Children with SpLD and co-occurring ADHD need to be identified at an early age to prevent poor school performance and behavioral problems.

**Key words:** Academic performance, attention-deficit disorder with hyperactivity, comorbidity, dyslexia, students

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Specific learning disability (SpLD) and attention-deficit hyperactivity disorder (ADHD) are two 'distinct' neurobehavioral developmental disorders that commonly occur in children and can be clearly distinguished from one another.<sup>[1-4]</sup> Both are believed to be genetically

inherited.<sup>[1-3]</sup> SpLD is manifested by significant difficulties in the acquisition and use of efficient reading ('dyslexia'), writing ('dysgraphia') and/ or mathematical ('dyscalculia') abilities despite conventional instruction, intact senses, normal intelligence, proper motivation and adequate sociocultural opportunity.<sup>[1,3]</sup> The prevalence of dyslexia in school children in USA ranges between 5 and 11%.<sup>[5]</sup> ADHD is characterized by persistent hyperactivity, impulsivity and inattention.<sup>[2,4]</sup> About 8-12% of school-going children in USA have ADHD.<sup>[6]</sup>

Dyslexia is the commonest and best-defined SpLD and represents a disorder of cognitive functioning.<sup>[2]</sup> In contrast, ADHD is defined by the child's behavior as perceived by the child's parents and teachers and refers to a disorder affecting primarily the behavioral domain.<sup>[2,4]</sup> SpLD and ADHD may co-occur in the same unfortunate child because of a shared genetic etiology.<sup>[7,8]</sup> About 20% of children with SpLD have associated ADHD as a comorbidity and vice versa.<sup>[1-4]</sup> Some researchers believe that each of these disorders has an independent etiology, while others believe that their frequent co-occurrence is the result of a 'generalized atypical brain development.'<sup>[9-11]</sup>

Both SpLD and ADHD are known to impair educational achievement and/ or social functioning.<sup>[1-4]</sup> We conducted the present study to document and analyze the clinical profile and academic history of children with 'SpLD and co-occurring ADHD (SpLD/ ADHD).'

#### MATERIALS AND METHODS

##### Selection of cases

The study sample was by necessity a

convenience sample, and the first fifty children who were consecutively diagnosed with SpLD/ ADHD were included in the study. This study was conducted from August to November 2004. All children had been referred to our clinic for assessment of poor school performance (academic underachievement or failure).

##### Consent and ethical approval

Our study was approved by the scientific and ethics committees of our institution. All parents had signed an informed consent form to participate in the study.

##### Diagnosis of SpLD/ ADHD

Each child was assessed by a multidisciplinary team comprising of pediatrician, counselor, clinical psychologist, special educator and psychiatrist before the diagnosis was confirmed.<sup>[1,3,4,12,13]</sup> Audiometric and ophthalmic examinations were done to rule out noncorrectable hearing and visual deficits, as children with these deficits do not qualify for a diagnosis of SpLD or ADHD.<sup>[1,3,12,13]</sup> The pediatrician took a detailed clinical history and did a detailed neurological examination. The socio-demographic characteristics of each child were noted. The modified Kuppaswami's classification was used to determine the child's socioeconomic status.<sup>[14,15]</sup> Each child's academic and behavioral problems, as described by the school principal/ classroom teacher in the referral letter, and a copy of the last few annual and/ or periodical examination mark sheets were documented.

The counselor interviewed the parent(s) to rule out that emotional problems due to stress at home were not primarily responsible for the child's poor school performance.<sup>[1,3,12]</sup> The

counselor also noted any behavioral problems that had developed in the child secondarily to the poor school performance. Children in whom behavioral problems were noted were evaluated by a psychiatrist to confirm these comorbidities. The clinical psychologist conducted the standard test, viz., Wechsler Intelligence Scale for Children-Revised (WISC) [Indian adaptation by MC Bhatt], to determine that the child's level of intellectual functioning was average or above average (Global Intelligence Quotient score  $\geq 85$ ).<sup>[16]</sup> Children with borderline intellectual functioning and mild mental retardation (Global Intelligence Quotient scores  $<85$ ) did not qualify for a diagnosis of SpLD.<sup>[1,3,12]</sup>

Curriculum-based assessment is a recommended method of diagnosing SpLD.<sup>[12,17]</sup> Employing a locally developed curriculum-based test, the special educator conducted the educational assessment in specific areas of learning, viz., basic learning skills, reading comprehension, oral expression, listening comprehension, written expression, mathematical calculation and mathematical reasoning. This test is a criterion-referenced test based on the state education board curriculum. Currently, SpLD cannot be conclusively diagnosed until the child is about 7-8 years old.<sup>[1,3]</sup>

The diagnosis of co-occurring ADHD was made by the pediatrician and confirmed by the psychiatrist by ascertaining that the child's specific behaviors met the diagnostic and statistical manual of mental disorders-IV-revised (DSM-IV-R) criteria.<sup>[13]</sup> These criteria define three subtypes of ADHD: (i) ADHD primarily of the inattentive type (ADHD-I); (ii) ADHD primarily of the hyperactive-impulsive

type (ADHD-HI); and (iii) ADHD, combined type (ADHD-C).<sup>[13]</sup> A child met the diagnostic criteria for ADHD by documentation of (i) presence of at least six of the nine behaviors described in the inattentive domain (ADHD-I) or at least six of the nine behaviors described in the hyperactive/impulsive domain (ADHD-HI) or six of the nine behaviors described in both domains (ADHD-C), and these behaviors were occurring 'often' and to a degree that was maladaptive and inconsistent with the child's developmental level; (ii) presence of these behaviors at home and at school for at least past 6 months; (iii) presence of some symptoms of ADHD before 7 years of age; (iv) clear evidence of clinically significant impairment in academic or social functioning or in both; (v) these symptoms not being better accounted for by a mental disorder (for example, schizophrenia or pervasive developmental disorder).<sup>[13]</sup>

### Data analysis

The data were analyzed using the Statistical Package for the Social Sciences program, version 11.0 for Windows (SPSS Ltd., Chicago, Illinois, USA). Results obtained were compared using the chi-square test (using Yates' correction where necessary) or the unpaired student's t-test, as applicable. Wherever appropriate, with bivariate analysis the odds ratio (OR) was calculated and 95% confidence interval (CI) was estimated around the OR. A two-tailed *P* value of  $<0.05$  was considered significant.

## RESULTS

The male: female ratio in the 50 (34 boys, 16 girls) children who participated in the study was 2.1:1. Majority (58%) of children

had a diagnosis of all three types of SpLD (dyslexia, dysgraphia and dyscalculia) with co-occurring ADHD-C (Table 1 for subgroups of study children). A large majority (37, 74%) of children were already studying in the secondary school section at the time of diagnosis [Table 2]. In spite of hyperactivity/impulsivity/inattentiveness/learning problems having been noticed in these children by the parent(s)/teachers, there was a delay (mean time period of 5.8 years) in making the diagnosis [Table 3]. Before referral to our clinic, all (100%) children had either fared poorly or

failed in their periodical and/or annual school examinations. Of these 50 children, 15 (30%) had already experienced class retention [Table 2]. Twelve (24%) children had experienced class retention once; and 3 (6%), twice.

All children were well nourished and belonged to either the upper or middle socioeconomic strata of society [Table 3]. On history [Table 4], 15 (30%) children had a significant perinatal history, namely, preterm delivery in 6, forceps delivery in 3, vacuum delivery in 2, birth asphyxia in 2 and meconium aspiration

**Table 1: Diagnosis of study children according to gender**

Diagnosis	All		Boys		Girls	
	n = 50	%	n = 34	%	n = 16	%
SpLD1+2+3 with ADHD-C	29	58.0	19	55.9	10	62.5
SpLD1+2+3 with ADHD-I	16	32.0	12	35.3	4	25.0
SpLD1+2+3 with ADHD-HI	2	4.0	1	2.9	1	6.2
SpLD1+2 with ADHD-C	2	4.0	2	5.9	0	0.0
SpLD1+2 with ADHD-I	1	2.0	0	0.0	1	6.2

SpLD - Specific learning disability: type 1 - dyslexia, type 2 - dysgraphia, type 3 - dyscalculia. ADHD - Attention-deficit hyperactivity disorder: I - Inattentive type, HI - Hyperactive-impulsive type, C - Combined type

**Table 2: Age and school standard distribution of study children according to gender**

Child characteristics	All		Boys		Girls	
	n = 50	%	n = 34	%	n = 16	%
Age (years)						
7-<8	4	8.0	3	8.8	1	6.2
8-<9	6	12.0	2	5.9	4	25.0
9-<10	2	4.0	2	5.9	0	0.0
10-<11	5	10.0	4	11.8	1	6.2
11-<12	8	16.0	5	14.7	3	18.8
12-<13	9	18.0	5	14.7	4	25.0
13-<14	4	8.0	4	11.8	0	0.0
14-<15	7	14.0	6	17.6	1	6.2
15-<16	5	10.0	3	8.8	2	12.5
Class in school						
2 <sup>nd</sup>	5 (2) <sup>a</sup>	10 (4.0) <sup>b</sup>	3 (1) <sup>a</sup>	8.8 (2.9) <sup>b</sup>	2 (1) <sup>a</sup>	12.5 (6.2) <sup>b</sup>
3 <sup>rd</sup>	4 (1)	8 (2.0)	2 (1)	5.9 (2.9)	2 (0)	12.5 (0.0)
4 <sup>th</sup>	3 (0)	6 (0.0)	2 (0)	5.9 (0.0)	1 (0)	6.2 (0.0)
5 <sup>th</sup>	10 (4)	20 (8.0)	6 (2)	17.7 (5.9)	4 (2)	25.0 (12.5)
6 <sup>th</sup>	9 (6)	18 (12.0)	6 (3)	17.7 (8.8)	3 (3)	18.8 (18.8)
7 <sup>th</sup>	4 (2)	8 (4.0)	3 (2)	8.8 (5.9)	1 (0)	6.2 (0.0)
8 <sup>th</sup>	1 (0)	2 (0.0)	1 (0)	2.9 (0.0)	0 (0)	0.0 (0.0)
9 <sup>th</sup>	6 (0)	12 (0.0)	6 (0)	17.7 (0.0)	0 (0)	0.0 (0.0)
10 <sup>th</sup>	7 (0)	14 (0.0)	4 (0)	11.7 (0.0)	3 (0)	18.8 (0.0)
11 <sup>th</sup>	0 (0)	0 (0.0)	0 (0)	0.0 (0.0)	0 (0)	0.0 (0.0)
12 <sup>th</sup>	1 (0)	2 (0.0)	1 (0)	2.9 (0.0)	0 (0)	0.0 (0.0)

Figures in parentheses indicate number<sup>a</sup> and percentage<sup>b</sup> respectively of children who had experienced class detention

**Table 3: Demographic data and IQ scores of study children according to gender**

Clinical feature	All (n = 50)	Boys (n = 34)	Girls (n = 16)	P value	df	OR <sup>a</sup>	95% CI
Mean age at diagnosis ± SD (yrs) (r)	11.36 ± 2.53 (7-17.06)	11.58 ± 2.52 (7-17.06)	10.89 ± 2.55 (7.10-15.07)	0.379*	48	-	-
Mean age problem noticed ± SD (yrs) (r)	5.55 ± 0.77 (4-6.10)	5.57 ± 0.75 (4-6.06)	5.52 ± 0.82 (4-6.10)	0.836*	48	-	-
Mean IQ scores ± SD (r)							
Verbal	97.32 ± 13.28 (71-127)	96.38 ± 13.73 (71-127)	99.31 ± 12.44 (81-127)	0.460*	48	-	-
Performance	108.50 ± 13.18 (78-146)	107.68 ± 12.77 (78-146)	110.25 ± 14.29 (89-136)	0.550*	48	-	-
Global	103.14 ± 11.37 (88-136)	102.12 ± 10.34 (88-133)	105.31 ± 13.42 (89-136)	0.406*	48	-	-
Socioeconomic status				0.510**	2	-	-
Upper	5 (10.0)	3 (8.8)	2 (12.5)				
Upper middle	41 (82.0)	27 (79.4)	14 (87.5)				
Lower middle	4 (8.0)	4 (11.8)	0 (0.0)				
Problem first noticed by				0.814**	1	1.5	0.4-5.4
Mother	37 (74.0)	26 (76.5)*	11 (68.8)				
Teacher	13 (26.0)	8 (23.5)	5 (31.2)				

r - range; <sup>a</sup>Percentages given in parentheses; df, degree of freedom; OR, odds ratio; CI - confidence interval; P < 0.05 significant.

\*student's t-test; \*\*  $\chi^2$  test, <sup>a</sup>OR calculated by bivariate analysis.

**Table 4: Clinical history and findings of study children according to gender**

Clinical feature	All (n = 50) (%)	Boys (n = 34) (%)	Girls (n = 16) (%)	P value <sup>a</sup>	df	OR <sup>b</sup>	95% CI
Significant perinatal history	15/50 (30.0)	12/34 (35.3)	3/16 (18.8)	0.390	1	2.4	0.6-9.2
Delayed walking	12/50 (24.0)	10/34 (29.4)	2/16 (12.5)	0.342	1	2.9	0.6-13.4
Delayed talking	11/50 (22.0)	8/34 (23.5)	3/16 (18.8)	0.988	1	1.3	0.3-5.4
History of medical illness							
None	30/50 (60.0)	19/34 (55.9)	11/16 (68.8)	0.578	1	0.6	0.2-2.0
Primary nocturnal enuresis	10/50 (20.0)	6/34 (17.7)	4/16 (25.0)	0.820	1	0.6	0.2-2.5
Epilepsy in past	6/50 (12.0)	4/34 (11.8)	2/16 (12.5)	0.941	1	0.9	0.2-4.9
Meningitis in past	5/50 (10.0)	4/34 (11.8)	1/16 (6.3)	0.920	1	2.0	0.3-14.2
Past febrile convulsions	1/50 (2.0)	1/34 (2.9)	0/16 (0.0)	0.488	1	- <sup>c</sup>	-
Head injury in past	3/50 (6.0)	3/34 (8.8)	0/16 (0.0)	0.557	1	- <sup>c</sup>	-
Microcephaly	5/50 (10.0)	4/34 (11.8)	1/16 (6.3)	0.920	1	2.0	0.3-14.2
Neurocutaneous markers	4/50 (8.0)	3/34 (8.8)	1/16 (6.3)	0.754	1	1.5	0.2-10.8
Flat feet	6/50 (12.0)	4/34 (11.8)	2/16 (12.5)	0.941	1	0.9	0.2-4.9
Handedness				1.000	2	- <sup>c</sup>	-
Right	42/50 (84.0)	28/34 (82.4)	14/16 (87.5)				
Left	6/50 (12.0)	4/34 (11.8)	2/16 (12.5)				
Ambidextrous	2/50 (4.0)	2/34 (5.9)	0/16 (0.0)				
Soft neurological signs	27/50 (54.0)	15/34 (44.1)	12/16 (75.0)	0.082	1	0.3	0.07-0.9
Behavioral problems	20/50 (40.0)	14/34 (41.2)	6/16 (37.5)	0.805	1	1.2	0.4-3.8
On CAM therapy	3/50 (6.0)	2/34 (5.9)	1/16 (6.3)	0.959	1	0.9	0.1-7.6
School class detention	15/50 (30.0)	9/34 (26.5)	6/16 (37.5)	0.427	1	0.6	0.2-2.1

df, degree of freedom; OR, odds ratio; CI, confidence interval; <sup>a</sup> $\chi^2$  test, P < 0.05 significant; <sup>b</sup>OR calculated by bivariate analysis.

<sup>c</sup>OR cannot be computed. They are only computed for 2 × 2 tables without empty cells. CAM - Complementary and alternative medication.

syndrome in 2. Of these, 4 children had a neonatal intensive care unit stay of more than a week. Parents (45 mothers, 5 fathers) gave history of delayed walking or delayed talking in less than a third of the cases; and majority (30,

60%) did not have any past illnesses. Thirty-three (66%) children had normal vision, and the remaining 17 (34%) had minor correctible refractive errors. Forty-two (84%) children had normal hearing, 7 (14%) had mild conductive

hearing loss and 1 (2%) had mild sensorineural deafness. On physical examination [Table 4], 45 (90%) children had a normal head circumference. Microcephaly, defined as a head circumference less than three standard deviations below the mean for age and sex, was detected in the remaining 5 (10%) children. Minor atypical physical features ('dysmorphic'); features such as hypertelorism, epicanthal folds, low-set pinna, flattened nasal bridge, high-arched palate, etc., were not present in any child. One-to-two small (2 × 2 cm) *café-au-lait* spots were present in 4 (8%) children. Gross examination of central and peripheral nervous system, including, assessment of power, tone and reflexes, was normal in all children. However, 27 (54%) children had presence of one or more soft neurological signs, namely, graphesthesia, dysdiadokokinesis, tandem walking, hopping and finger identification. Medical history and clinical examination did not reveal any differentiating features between the two gender groups [Tables 3, 4].

Behavioral problems were diagnosed in 20 (40%) children [Table 4]. Aggressive behavior even after minimal stressors was noted in 15 (30%) children: 12 boys and 3 girls. Withdrawn behavior was noted in another 5 (10%) children: 2 boys and 3 girls. None of the children's symptoms/ behaviors met the DSM-IV threshold for diagnosing anxiety disorder, depression, oppositional defiant disorder (ODD) or conduct disorder (CD).<sup>[13]</sup> Parents of 3 (6%) children had already started homeopathic medication to improve their child's poor school performance and/ or behavior. Difficulties in writing (repeated spelling mistakes, untidy or illegible handwriting with poor sequencing), inattentiveness (daydreaming, forgetfulness,

easily distracted by extraneous stimuli), difficulties in mathematics (inability to perform simple mathematical calculations, unable to comprehend algebra/ geometry), hyperactivity (fidgetiness, excessive talking, blurting out answer before question asked, disruptiveness) and difficulties in reading (slow, laborious, skipping words, guessing words) were the problems noticed in the children in the classroom [Table 5].

Lastly, no significant subgroup differences emerged in the study children with regard to age, IQ, clinical history and findings or problems noticed in the classroom.

## DISCUSSION

The present study documents that most children with SpLD/ ADHD have normal perinatal history, milestones, medical history and physical examination findings. Also, there is a delay in their diagnosis, which results in these children having poor school performance in spite of having normal intelligence. Many of them also experience class retention and develop behavioral problems. To the best of our knowledge, there is no study from India which has documented and analyzed the clinical profile and academic history of children with SpLD and co-occurring ADHD.

**Table 5: Problems noticed in study children in classroom**

Problems noticed	All (n = 50) (%)	Boys (n = 34) (%)	Girls (n = 16) (%)
Difficulties in writing	48 (96.0)	32 (94.1)	16 (100.0)
Inattentiveness	48 (96.0)	33 (97.1)	15 (93.8)
Difficulties in mathematics	37 (74.0)	25 (73.5)	12 (75.0)
Hyperactivity	34 (68.0)	21 (61.8)	13 (81.3)
Difficulties in reading	30 (60.0)	24 (70.6)	6 (37.5)

Most children had more than one problem



Recent reports indicate that both SpLD and ADHD (including its subtypes) occur in the community without any gender preference.<sup>[3,18,19]</sup> The higher number of male children in our study group may be explained by a referral bias, which is known to occur in clinical settings.<sup>[3,18,19]</sup> In the present study, about one-third of the children had a positive history and/ or presence of clinical features which are known to be associated with an increased prevalence of SpLD and ADHD [Table 4]. It is known that perinatal complications, delayed walking, delayed talking, nocturnal enuresis, epilepsy and head injury are associated with an increased prevalence of SpLD and/ or ADHD.<sup>[1,3,18,20,21]</sup> Microcephaly, flat feet, dysmorphic features, left-handedness and soft neurological signs have been reported to be clinical features which are found 'more often' in children having SpLD and/ or ADHD.<sup>[1,3,22]</sup> Although these findings in a child with poor school performance are of some importance, they are not diagnostic of either SpLD or ADHD.<sup>[3,4,18,23]</sup>

In the present study, difficulties in writing, inattentiveness and difficulties in mathematics were noted in 74-96% of children by the classroom teacher [Table 5]. It is known that children with SpLD/ ADHD have 'more severe' learning problems than children who have SpLD but no ADHD, and also 'more severe' attention problems than children who have ADHD but no SpLD.<sup>[24]</sup> Also, children with SpLD/ ADHD are known to develop behavioral problems such as aggressive and withdrawn behaviors because of a lack of self-esteem and frustrations due to their poor school performance.<sup>[25]</sup> Class retention, which had been experienced by 30%

of the study children, is also known to cause severe emotional stress and lead to aggressive/ withdrawn behaviors.<sup>[26]</sup>

What is the utility of the present study? We believe that the results of the present study will help generate awareness about children with SpLD/ ADHD among pediatricians and school authorities all over our country and result in their early identification and initiation of appropriate psychoeducational interventions, namely, remedial education and provisions (accommodations) for SpLD and behavioral and medical management for ADHD.<sup>[1,3,18]</sup> These interventions will help these children achieve school grades at a level that is commensurate with their intelligence.<sup>[1,3,18]</sup> This would help prevent not only poor school performance, class retention and development of behavioral problems in childhood but would also help these children develop into well-adjusted adults. Both SpLD and ADHD frequently persist into adulthood, and long-term consequences of their remaining undetected include an increased risk for developing substance abuse addiction and psychiatric disorders such as anxiety disorder, depression, ODD or CD.<sup>[3,18]</sup>

Our study has several limitations. First, considering the probable prevalence of children with SpLD and co-occurring ADHD in our city, the sample size is small. However, we still believe that these results are important as awareness about both SpLD and ADHD is still limited in our country and few children actually get diagnosed.<sup>[27,28]</sup> Second, the cross-sectional design of the present study limited us from drawing 'conclusive' cause-effect relationships between poor school performance/ class retention and development of behavioral

problems. Third, some data (perinatal history, age of walking/ talking, age when hyperactivity/ inattentiveness/ learning problems were first noticed) depends just on history, which may lead to memory bias. Fourth, children from the lower socioeconomic strata of society were not present in our study population. Possibly, non-availability of standardized psychological tests in vernacular languages led to this limitation. Fifth, certain socio-demographic parameters such as environment in neighborhood, parenting style and intelligence, which may influence development of comorbidities such as anxiety disorder, depression, ODD, CD in future, were not probed.<sup>[3,18]</sup> However, we do not believe that these limitations adversely affect the utility of our results. Both due to the limitations as outlined above and the general paucity of data on children having SpLD/ ADHD, the implications of the present study need to be determined by future studies.

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