PREVALENCE OF SEIZURE DISORDERS IN CHILDREN WITH COMMUNICATION DISORDERS- A PRELIMINARY STUDY

***Sangeetha Mahesh, & **Y. V. Geetha**

Abstract

The word "Epilepsy" is derived from a Greek word which means to seize. Jackson (1931) defines, "Epilepsy as sudden, excessive, rapid and local discharge of gray matter". Epileptic seizures are usually brief, lasting from second to minutes, and they are marked by the sudden appearance of behavioral manifestation that may be purely motor or that may affect other brain functions. It is known to co-exist or develop as a range of childhood conditions in which there is Central Nervous System (CNS) involvement. Seizures occur more frequently in children with communication disorders than in the general population. However, prevalence of epileptic seizures in children with communication disorders is not clearly understood. There is an urgent need for studies regarding prevalence of epileptic seizures in communication disorders. Hence the present study was planned. The subjects considered in the study included children below the age of 12 years, who had visited AIISH with the complaint of speech, language and hearing problems over a period of two years (Jan 2007- Dec 2008). Case files of these children were reviewed for the presence or absence of seizures and type of associated communication disorders. Results revealed that out of 6,101 children with communication disorders, who were registered during the period, 730 children had positive history of seizures. A total percentage of communication disorder having positive history of seizures was 11.96% whereas in general population it is about 3-5%. The gender wise distribution revealed that boys had 74.1% (541/730) and girls had 25.9% (189/730) history of seizures. It was noted that epileptic seizures are one of the most common neurological disorders occurring in children with communication disorders. The prevalence figure varied widely across the clinical population. These findings suggest measures to control seizures in the subgroups of communication disorders as the presence of seizures is a deterrent to physical and mental progress.

Key Words: Prevalence, Epileptic seizures, Communication disorders.

Epilepsy is an enduring condition or rather a group of conditions, in which epileptic seizures occur repeatedly without a detectable extracerebral cause (Gastaut, 1973). According to the Epilepsy Foundation of America (2010), Epilepsy is a physical condition that occurs when there is a sudden and brief change in how the brain works. When brain cells are not working properly, a person's consciousness, movement or actions may be altered for a short time. These physical changes are called epileptic seizures. Epilepsy is therefore sometimes called a seizure disorder. The epileptic discharge is a complex phenomenon resulting from the interaction of excitatory and inhibitory influxes network formed by multiple diverse neuronal sources. The main characteristics of the epileptic discharge are its high amplitude and its rhythmicity, both caused by the excessive synchronization of an abnormal number of potentials in a neuronal aggregate (Fenwick, 1983; Aird, Masland, & Woodbury, 1989). In the epidemiologic studies the occurrence of two seizures is accepted as the operational definition of epilepsy (eg., Sander & Sillanpaa, 1998). This definition, though convenient, is obviously arbitrary. In other studies (eg., Todt, 1984) the threshold for a diagnosis of epilepsy was about three attacks. It is

**Clinical Lecturer, Department of Clinical Services, All India Institute of Speech and Hearing, (AIISH), Mysore - 06,email: sangmahesh9@yahoo.co.in, & ** Prof, Department of Speech Language Sciences, AIISH, Mysore- 06, email: yvgeetha@yahoo.com.*

recommended that the guidelines established by the International League against Epilepsy (ILAE) commission in epidemiology and prognosis be followed in epidemiologic studies of epilepsy. According to these guidelines, a person with active seizures is one who has had at least one epileptic seizure in the previous five years, regardless of antiepileptic drug treatment.

a. Incidence & prevalence of epileptic seizures in general population

Epileptic seizures affect people in all nations and of all races. It is the second most common chronic neurological condition seen by neurologist. It is estimated that there are 55,00,000 persons with seizures in India, 20,00,000 in USA and 3,00,00 in UK. Three to five per cent of the population have active seizures (Sridharan, 2002). About two million Americans have seizures. Of the 125,000 new cases that develop each year, up to 50% are in children and adolescents (Freeman, Vining, & Pillas, 1997).

The prevalence figures of seizures among the general population (Indian data) per 1000 population ranged widely from as low as 1.28 in Baroda (Issac, 1987) to 11.92 in rural Bangalore (Sathishchandra, Gururaj, Devi, & Subbakrishnan, 1996). As India is a large country with diverse cultures and food habits, local figures for prevalence and incidence should not be extrapolated for the rest of the prevalence rates across the country.

b. Prevalence of epileptic seizures in children with communication disorders

Seizures occur more frequently in children with communication disorders than in the general population (Stephenson, 1999). The frequency and the severity of the epileptic syndrome are related more to the primary cause of communication disorder. In United states, the prevalence of mental retardation is approximately 0.3-0.8%, but 20-30% of children with mental retardation have seizures. Approximately 35-40% of children with seizures also have mental retardation (Alvarez, 1998). Rodin (1968) found a low intelligence in children with brain lesions whereas, in “pure” seizures, the Intelligence quotient (IQ) was within normal limits, although the curve of IQ was shifted to the left. In the whole group, a mild irregular downward trend was present and significant loss was seen in only some cases. Sillanpaa (2000) found some deterioration in IQ among 11% of the children.

Saemundsen, Ludvigsson, and Rafnsson (2007) suggested that the estimated prevalence of autistic spectrum disorders (ASD) is higher in children with history of seizure in the first year of life than in the general population. Thompson and Wasterlain (1997) found 25-35% of children with cerebral palsy having seizures and those with spastic hemiparesis and quadriparesis had the highest frequency. The study by Kudrjveev, Schoenberg, Kurland, and Grouver (1985) in Minnesota between 1950 and 1976, found 52% of those with severe cerebral palsy had developed seizures.

Broeders, Geurts, and Jennekens Schinkel (2009) explored pragmatic language deficits in children with seizures and if present, are discrete or associated with general intellectual functioning. Of children with seizures, 23% had pragmatic deficits, whereas only 3% of the children with various other neurological disorders and none of the typically developing children had these deficits. Van Riper (1971) found greater prevalence of stuttering among patients with seizures. These findings suggest a link between stuttering and seizures but do not enable one to specify the nature of the link. Review of literature indicates that the epileptic seizures are one of the most common neurological disorders occurring in children with communication disorders. It also suggests that the prevalence figure varied widely across the clinical population.

India has a large number of differentially abled population numbering about 100 million. The number is expected to increase substantially every year in view of the rapid changing demographic profiles and morbidity patterns. It is axiomatic that the coexistence of seizures and few types of communication disorders is usually not coincidental, but that both result from some underlying brain disorder. Speech language pathologists and Audiologists come across many children and adults with various communication disorders having a history of seizures or seizure disorders. Epileptic seizures consist of various types of clinical seizures and epileptic syndromes. The appearance rate or distribution of various types of epilepsies and epileptic syndromes in communication disorders has not been explored much. Hence there is need for studies regarding prevalence of epileptic seizures in communication disorders. The epidemiological findings are important not only for the public health but also for clinical practice. It would also be interesting to know the role of seizure

disorders in different clinical population in order to take suitable preventive measures and to provide rehabilitation. Since there is only limited Western data and no Indian data about the prevalence of epileptic seizures in children with communication disorders the present study was planned.

The objective of the study was to determine the prevalence of epileptic seizures in different subgroups of children with communication disorder.

Method

The study was planned as a retrospective analysis of case file data of children below the age of 12 years with the compliant of speech, language and hearing problems, who were registered at AIISH OPD during Jan 2007 to Dec 2008.

Materials: 1) Case files of children registered at AIISH as mentioned

2) A checklist to collect relevant information

3) SPSS software for the analysis of the data

Procedure: Case files of children were reviewed for the presence or absence of seizures. A checklist was prepared to collect the demographic data and other relevant information from the case files of children, selected as participants of the study. Demographic data included age, gender, contact address, socioeconomic status and education. Other relevant information included history of seizures like age of onset, associated speech, language, hearing and other disorders, family history, causes, type of seizure, frequency of occurrence, type and duration of medication and whether the seizures is under control with medications in children with communication disorders. The data was analyzed using SPSS software and equality of proportions to study the research objective.

Results

A. Prevalence of epileptic seizures in different subgroups of children with communication disorders

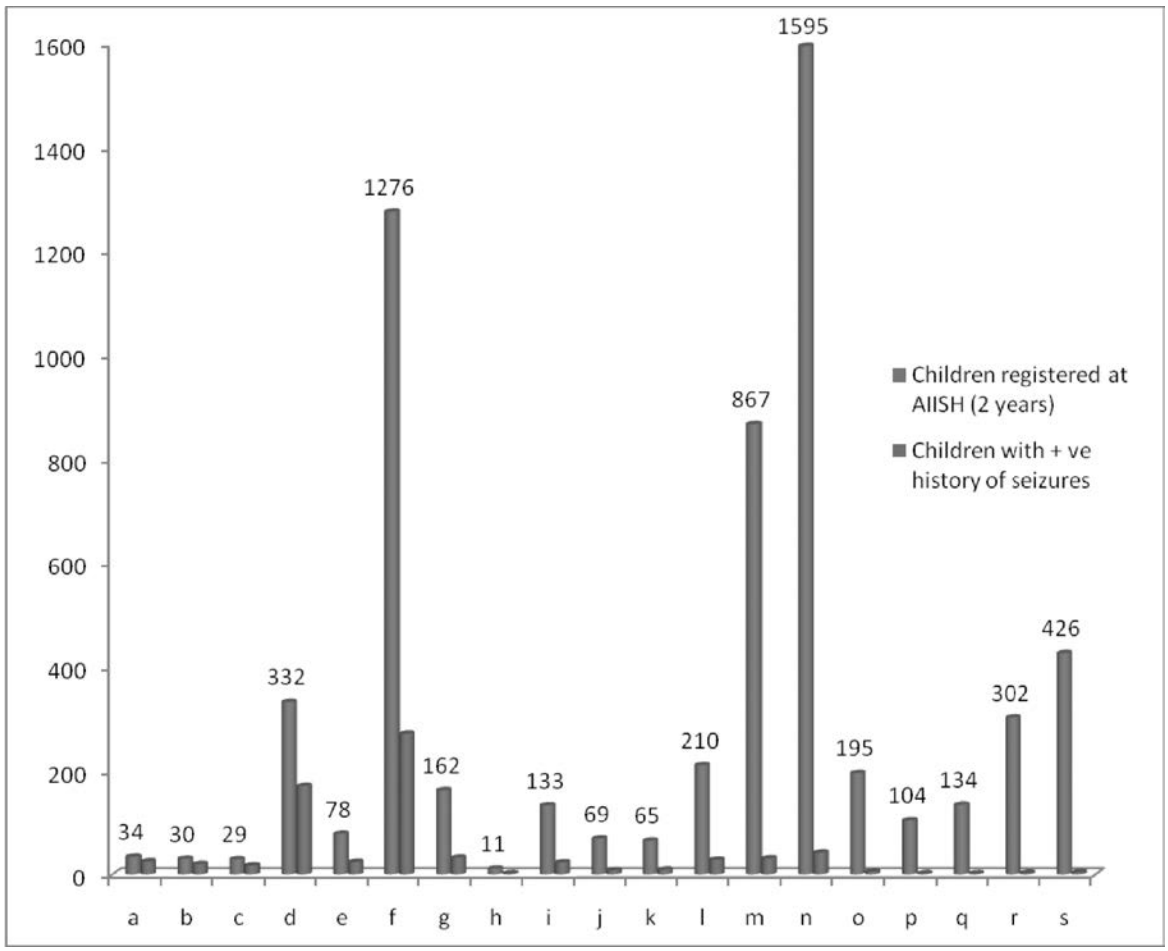
Children below the age of 12 years who visited AIISH over a period of two years (Jan 2007- Dec 2008) with the complaint of speech, language and hearing problems were found to be 6,101. Out of 6,101 children with communication disorders, 730 children had positive history of seizures. The total percentage of communication disorder having positive history of seizures was 11.96%. The prevalence of epileptic seizures in different subgroups of children with communication disorders are depicted in the following table 1 and figure 1.

Disorders	Clients registered at AIISH (2 years)	Clients with + ve history of seizures	Percentage
Borderline intelligence	34	25	73.53%
Speech regression	30	20	66.6%
Hearing loss with Cerebral palsy and Mental Retardation	29	17	58.62%
Mental Retardation and Cerebral palsy	332	170	51.20%
Development delay	78	24	30.76%
Mental retardation	1276	271	21.23%
Pervasive developmental disorders	162	32	19.75%
Apraxia	11	2	18.18%
Mental retardation and Hearing Loss	133	23	17.29%
Attention deficit hyperactivity disorder	69	8	11.69%
Hearing loss and cerebral palsy	65	9	13.48%
Cerebral palsy	210	28	13.33%
Delayed speech and language	867	31	3.53%
Hearing Loss	1595	42	2.63%
Learning disability	195	5	2.56%
Cleft lip and palate	104	2	1.92%
Dysarthria	134	2	1.49%
Misarticulation	302	3	0.99%
Stuttering	426	4	0.09%

Table 1: *Prevalence of epileptic seizures in different subgroups of children with communication disorders.*

The percentage of seizures in different subgroups of children with communication disorders are as follows. Higher prevalence rate (73.53%) of seizures was noticed in children with borderline intelligence and lowest prevalence rate was noticed in children with stuttering (0.09%). 20 children (66.6%) had speech regression due to epileptic sequelae. 17 children (58.62%) with multiple disability i.e, hearing loss with cerebral palsy and mental retardation had positive history of seizures.

In general, the percentage of seizures in children with borderline intelligence was 73.53%, followed by speech regression (66.6%), hearing loss with cerebral palsy and mental retardation (58.62%), mental retardation with cerebral palsy (51.20%), developmental delay (30.76%), mental retardation (21.23%), pervasive developmental disorders (19.75%), apraxia (18.18%), mental retardation with hearing loss (17.29%), cerebral palsy with hearing loss (13.84%), cerebral palsy (13.33%), attention deficit hyperactivity disorder (11.69%), delay in speech and language (3.53%), hearing loss (2.63%), learning disability (2.56%), cleft lip and palate (1.92%), dysarthria (1.49%), misarticulation (0.99%) and stuttering (0.09%).



a- Borderline intelligence, b- Speech regression, c- Hearing loss with Cerebral palsy and Mental Retardation, d- Mental Retardation and Cerebral palsy, e- Development delay, f- Mental Retardation, g- Pervasive developmental disorders, h- Apraxia, i- Mental retardation and Hearing Loss, j- Attention deficit hyperactivity disorder, k- Hearing loss and cerebral palsy, l- Cerebral palsy, m- Delayed speech and language, n- Hearing Loss, o- Learning disability, p- Cleft lip and palate, q- Dysarthria, r- Misarticulation, s- Stuttering.

Figure 1: Distribution of epileptic seizures in different subgroups of children with communication disorders.

B. Prevalence of epileptic seizures across gender in children with communication disorders

The percentage of seizures across gender was analyzed in children with communication disorders. Out of 730 children with positive history of seizures, 541 (74%) were boys and 189 (25.9%). The prevalence of epileptic seizures across gender in different subgroups of communication disorders are depicted in the following table 2.

Disorders	Boys with + ve history of seizures		Girls with + ve history of seizures		z values
	No. of children	Percentage	No. of children	Percentage	
Borderline intelligence	22	4.06	3	1.58	0.213
Speech regression	15	2.77	5	2.64	0.0044
Hearing loss with Cerebral palsy and Mental retardation	11	2.03	6	3.17	0.04
Mental retardation and Cerebral palsy	122	22.5	48	25.39	0.03
Development delay	15	2.77	9	4.76	0.05
Mental retardation	206	38.07	65	34.39	2.96*
Pervasive developmental disorder	22	4.06	10	5.29	0.36
Apraxia	2	0.36	0	-	0.085
Mental retardation and Hearing loss	15	2.77	8	4.23	0.51
Attention deficit hyperactivity disorder	7	0.29	1	0.52	0.013
Hearing loss and Cerebral palsy	5	0.92	4	2.11	0.037
Cerebral palsy	17	3.14	11	5.82	0.105
Delayed speech and language	24	4.43	7	3.70	0.022
Hearing loss	30	5.54	12	6.34	0.03
Learning disability	5	0.92	0	-	0.215
Cleft lip and palate	2	0.36	0	-	0.085
Dysarthria	2	0.36	0	-	0.085
Misarticulation	3	0.55	0	-	0.129
Stuttering	4	0.73	0	-	0.171

Table 2: *Prevalence of epileptic seizures across gender in children with communication disorders and results of equality of proportions*

In general, the percentage of seizures among boys was maximum of 206 (38.07%) in children with mental retardation and minimum of 2 (0.36%) in cleft lip & palate and apraxia. Similarly, the percentage of seizures among girls was maximum of 65 (34.39%) in children with mental retardation and minimum of 1 (0.52%) in children with attention deficit hyperactivity disorder. The present study revealed no history of seizures among girls in subgroup of communication disorders like learning disability, stuttering, misarticulation, dysarthria, cleft lip & palate, apraxia and in boys also it was <1%.

The percentage of seizures among boys and girls in subgroups of communication disorders was compared using the test of equality of proportions. There was no significant difference across gender at 95% confidence interval except for children with mental retardation ($z=2.96$, $p> 0.05$). The results indicated that the frequency of occurrence of seizures across gender was not significantly different from each other. However, only among children with mental retardation boys had significantly higher frequency of occurrence of seizures than girls.

Discussion

In the present study it was noted that epileptic seizures were one of the most common neurological disorders occurring in children with communication disorders. The percentage ranged from as high as 73.53% in children with mental retardation to as low as 0.09% in stuttering group. Findings suggest that the prevalence rate of seizures was more in children with brain damage as in borderline intelligence, cerebral palsy, mental retardation, developmental delay and pervasive developmental disorders.

A. Prevalence of Seizures in subgroups of children with communication disorders

1) Seizures in children with mental retardation

In the present study, the maximum percentage of seizures ranged from 73.56% to 21.23% in children with mental retardation indicating brain damage as the major cause for seizures. Children with developmental disabilities are at higher risk for seizures than the general population (Walsh, 1999). The frequency and the severity of the epileptic syndrome are related more to the primary cause of mental retardation than to the severity of mental retardation. However, there is a direct relationship between severity of intellectual disability, frequency and severity of chronic epileptic seizures. In United states, the prevalence of mental retardation is approximately 0.3-0.8%, but 20-30% of children with mental retardation have seizures. Approximately 35-40% of children with seizures also have mental retardation (Alvarez, Carvajal, & Begaud, 1998). Rodin (1968) found a low intelligence in children with brain lesions whereas, in “pure” seizures, the IQ was within normal limits, although the curve of IQ was shifted to the left. In the whole group, a mild irregular downward trend was present and significant loss was seen in only some cases. Sillanpaa (2000) found some deterioration in IQ among 11% of the children. The results of the present study indicate a much higher percentage of seizures in children with mental retardation compared to other studies.

2) Seizures in children with speech regression

Speech regression due to seizures was found to be 66.6% in the present study. This indicates that there might be greater amount of detrimental effects in children due to presence of seizures. Acquired epileptic aphasia (AEA) typically develops in healthy children who acutely or progressively lose receptive and expressive language ability coincident with the appearance of paroxysmal EEG changes. Population-based epidemiologic data related to AEA are limited. Many reports describe no correlation between EEG abnormality and language dysfunction (Menezes, 2010).

Those with neurological involvement and hence at risk for developing seizures constitute the tip of the iceberg. Frequent causes of seizures in young children are central nervous system (CNS) malformation, CNS injury from infection or accident and CNS malfunction caused by a metabolic error (Singh & Mehta, 1987). Seizures and speech regression may occur together and both may result from same underlying brain disorder. However, the causal association between seizures and language impairment is poorly documented due to constraints in epidemiological methods. The present study is a retrospective analysis and hence most of the information were considered from the casefiles as reported by the parents. Majority of the time information collected would depend on the type of understanding the parents have regarding the condition. The first epileptic seizure that involves abnormal body movements for a short duration may have greater significance for parents. Hence, there

is higher probability of parents to report as seizures being the causative factor for communication disorder.

3) Seizures in children with Pervasive developmental disorders (PDD)

In the present study the frequency of overt seizures among patients with Pervasive developmental disorders (PDD) was 19.75%. Tuchman and Rapin (2002) found that seizures was present in 14% of autistic children after they excluded patients with Rett's syndrome. Al-Salehi, Al-Hifthy, and Ghaziuddin (2009) examined a sample of 49 children (37 males and 12 females) diagnosed with an autistic spectrum disorder at a tertiary referral center in Saudi Arabia. They found 11 clients with a history of seizure disorder and one had chromosome abnormality. Saemundsen, Ludvigsson, and Rafnsson (2007) described autistic spectrum disorders (ASDs) in a cohort of children with history of unprovoked seizures other than infantile spasms in the first year of life. Eighty-four children (82.4%), 28 boys and 56 girls, participated in the study and 36.9% (31/84) were investigated for possible ASD. Twenty-four (28.6%) had at least one neuro-developmental disorder, 14.3% had mental retardation (MR) and six (7.1%) were diagnosed with ASD, all of whom also had MR and three of whom had congenital brain abnormalities. The results suggested that the estimated prevalence of ASD is higher in children with history of seizure in the first year of life than it is in the general population. The results of the present study are in agreement with other studies.

4) Seizures in children with multiple disability

The present study found children with multiple disabilities i.e., Hearing loss with Cerebral palsy and Mental retardation, Mental retardation and Cerebral palsy, Mental retardation with Hearing loss and Cerebral palsy with Hearing loss had prevalence rate of seizures of 58.62%, 51.20%, 17.29% and 13.84% respectively. This indicates that more the number of disabilities found, more prone the children are for epileptic seizures or its co-existence. This finding is in agreement with findings in many other studies. An association of mental retardation with cerebral palsy is also common in those with seizures. Earlier studies have investigated the prevalence rate of seizures in children with cerebral palsy and mental retardation. In a group of non institutionalized individuals, the prevalence of seizures was 20%, seizures and mental retardation was 43% and seizures associated with cerebral palsy was 33% (Hauser, Annegers, & Kurland, 1991).

5) Seizures in children with Cerebral Palsy (CP)

The present study found that children with cerebral palsy (CP) had 13.33% and Hearing loss with cerebral palsy (HLCP) had 13.84% of prevalence rate of seizures. Thompson and Wasterlain (1997) found 25-35% of children with cerebral palsy having seizures and those with spastic hemiparesis and quadriparesis had the highest frequency which support the results of the present findings. The dual handicap of seizures and cerebral palsy occurs in 1 in 1,000 live births. When the two disorders coexist, it is reasonable to assume that the etiology also is relatedthat is, that the same brain injury responsible for causing cerebral palsy also has caused the seizures. Davis (1977) reported seizures rates as high as 55-72% in cases of spastic hemiplegia to about 23% in the choreoathetotic or ataxic forms. The population-based study in Sweden by Hagberg, Hagberg, Olow, and Wendt (1996) found that 28% of people with CP also had seizures. An update of this study published in 2003 reported that 38% (55/146) developed seizures by 6 to 14 years of age (Carlsson, Hagberg, & Olsson, 2003). Similarly, the Danish cerebral palsy register reported that 27.1% of patients born with cerebral palsy between 1979 and 1986 also had seizures (Topp, Uldall, & Roos, 1997). Data from Western Australia (Stanley, Alberman, & Blair, 2000) from 1975 through 1994 record the incidence rate of seizures to be 37% (618 of 1,664). The rate of combined seizures and CP of 0.8 per 1,000 live births has remained constant over 25 years. The improvements in neonatal care during the last 20 years, the number of surviving premature and low birth weight babies has been increased with a concomitant increase in the rate of CP (Camfield, Camfield & Watson, 2001).

The study by Kudrjveev, Schoenberg, Kurland, and Grouver (1985) in Minnesota between 1950 and 1976, found 52% of those with severe cerebral palsy developed seizures. Conversely, seizures was present in 23% of those with mild to moderate CP. Watson and Stanley (as cited in Camfield et al., 2001) found that 65% of children with severe cerebral palsy born between 1975 and 1994 developed seizures, as compared with 24% of children with minimal, mild or moderate cases of CP. Hence it is concluded that children severely affected by cerebral

palsy seem to be more likely to develop seizures. However, the present study did not attempt to correlate the prevalence with severity of CP.

6) Seizures in children with other subtypes of communication disorders

The lowest prevalence rate of seizures was found in clients with speech and language delay (3.53%), hearing loss (2.63%), learning disability (2.56%), cleft lip and palate (1.92%), dysarthria (1.49%), misarticulation (0.99%) and stuttering (0.09%). Findings are probably because these communication disorders are not caused due to serious brain damage.

Broeders, Geurts, and Jennekens Schinkel (2009) explored pragmatic language deficits in children with seizures and if present, are discrete or associated with general intellectual functioning. They concluded that the pragmatic composite score distinguished between the two neurologically impaired groups, even after controlling for full-scale intelligence quotient (FSIQ). Of children with seizures, 23% had pragmatic deficits, whereas only 3% of the children with various other neurological disorders and none of the typically developing children had these deficits. When compared scale by scale with typically developing children, children in both clinical groups showed more structural language problems and problems of language use, but these differences disappeared when FSIQ was controlled for. Pragmatic deficits in communication are present in children treated for various neurological impairments, but more so in children whose seizures necessitate referral to a tertiary hospital.

Learning disabilities can be caused by damage to the brain. This damaged part of the brain can then become irritable and provide a focus for epileptic seizures. The resulting seizures, however, may not appear until many years after the damage occurred. Usually seizures does not cause learning disabilities. However, having many and/or severe seizures over a length of time can cause damage to the brain. This in turn can lead to learning disabilities. Learning difficulties of variable severity are present in 5% to 50 % of children with seizures (Schoenfeld, Seidenberg, & Woodard, 1999). Oromotor apraxia and speech problems may be congenital or they may develop or worsen with episodes of sustained spike and wave discharges during sleep (Scheffer, Jones, & Pozzebon, 1995).

Van Riper (1971) found greater prevalence of stuttering among patients with seizures. These findings suggest a link between stuttering and seizures but do not enable one to specify the nature of the link. There is an apparent relationship between stammering and seizures in the abnormality of the brain wave tracings. Interestingly brain wave tracings suggest that persons with stuttering may be functioning in a state of reduced consciousness (Lebrun & Fabbro, 2002).

B. Prevalence of seizures in children across gender in subtypes of communication disorders

The prevalence of epileptic seizures across gender revealed higher percentage of 74.1% among boys and lower percentage of 25.9% among girls. The present study considered prevalence rates of seizures in subtypes of communication disorders. The prevalence of seizures in Rochester, Minnesota was higher for males than females (Hauser et al., 1991). Among the Indian studies, Das and Sanyal (1996) found crude prevalence rate for seizures per thousand population was 3.06 in rural areas of Malda district, West Bengal. The age specific prevalence rate for males aged above 14 years was 3.75 and for 14 years and below was 2.60, corresponding figures for females being 3.53 and 1.94, respectively. Musa, Shon, and Kulkarni (2010) made a prospective and retrospective observational, cross sectional study involving data collection on a specially designed proforma with respect to seizure diagnosis, duration, co-existing medical conditions, precipitating factors if any, along with details of drug treatment. Data from a total of 336 patients with the diagnosis of seizures was collected and recorded over a period of one year of the study. Analysis of the data for gender wise distribution showed a distinct predominance of males (62%) over females (38%). The results of the present study are in consensus with the earlier studies.

The most profound difference between girls and boys is not in any brain structure per se, but rather in the sequence of development of the various brain regions. The different regions of the brain develop in a different sequence in girls compared with boys. This is the key insight from the past five years of neuroscience research in brain development. A most comprehensive study demonstrated that there is no overlap in the trajectories of brain development in girls and boys (Lenroot, Gogtay, & Greenstein, 2007). The study of epidemiology of seizures in communication

disorders is of immense value in understanding the prevalence, causes, gender difference, outcome and its prevention. It is also useful in planning proper services for clients with seizures and improving their quality of life. Since there is only limited data about the prevalence of seizures in children with communication disorders with reference to Indian context, the present study was planned. However, the long term effects of epileptic seizures in children with communication disorders are unknown. Future epidemiological research needs to be addressed on the characteristic features of seizures in children with communication disorders.

Conclusions

The present study was a retrospective analysis to determine the prevalence of epileptic seizures in children with communication disorders. It was noted that epilepsies are one of the most common neurological disorders occurring in children with communication disorders. The prevalence figure varied widely across clinical population. These findings determine the importance of identifying seizures in children. It also suggests measures to control seizures in the subgroup of communication disorders as the presence of seizures is a deterrent to overall development of the child.

References

Aird, R.B., Masland, R.L., & Woodbury, D.M. (1989). Hypothesis: the classification of epileptic seizures according to systems of the CNS. *Seizures Res, 3,* 77-81.

Al- Salehi, S.M., Al-Hifthy, E. H., & Ghaziuddin, M. (2009). Autism in Saudi Arabia. presentation, clinical correlates and comorbidity. Transcult *Psychiatry, 46*(2), 340-7.

Alvarez-Requejo, A., Carvajal, A., & Begaud, B. (1998). Under-reporting of adverse drug reactions. Estimate based upon spontaneous reporting scheme and a sentinel system. *Eur J Clin Pharmacol, 54,* 483-488.

Broeders, M., Geurts., & Jennekens-Schinkel, A. (2009). Pragmatic communication deficits in children with seizures. *Int J Lang Commun Disord, Dec* 8 [E pub ahead of print].

Camfield, C.S., Camfield, P.R., & Watson, L. (2001). Cerebral palsy in children with seizures. In O, Devinsky & L.E, Westbrook, (Eds). *Seizures and Developmental Disabilities.* Boston: Butterworth-Heinemann, 33-40.

Carlsson, M., Hagberg, G., & Olsson, I. (2003). Clinical and aetiological aspects of seizures in children with cerebral palsy. *Dev Med Child Neurol, 45,* 371-376.

Das, S.K., & Sanyal, S.K. (1996). Neuroepidemiology of major neurological disorders in rural Bengal. *Neural India. 44,* 47-58.

Davis, H. (1977). Cerebral palsy in children with seizures. In O, Devinsky & L.E, Westbrook, (Eds). *Seizures and Developmental Disabilities.* Boston: Butterworth-Heinemann.

Fenwick, P.B. (1983). EEG epileptic waveforms, their genesis and clinical correlates. In C. F. Rose, (Eds). *Research progress in seizures.* London: Pitman, 103-114.

Gastaut, H. (1973). *Definitions Dictionary of epilepsies.* Geneva, World Health Organization.

Hauser, W.A., Annegers, J.F., & Kurland, L.T. (1991). Prevalence of epilepsy in Rochester, (1940-1980) Minnesota. *Epilepsia, 32,* 429-445.

Hagberg, B., Hagberg, G., Olow, I., & Von Wendt, L. (1996). The changing panorama of cerebral palsy in Sweden: VII. Prevalence and origin in the birth year period 1987-90. *Acta Paediatr, 85,* 954-960.

Isaac, M.K. (1987). *Collaborative Study on Severe Mental Morbidity.* New Delhi, Indian Council Medical Research and Department of Science and Technology.

Kudrjavcev, T., Schoenberg, B.S., Kurland, L.T., & Gourie, D. (1985). Cerebral palsy: survival rates, associated handicaps, and distribution by clinical subtype (Rochester, MN, 1950-1976). *Neurology, 35,* 900-903.

Lebrun, Y., & Fabbro, F. (2002). *Language and seizures.* UK: Athenaeum Press.

Lenroot, R. K., Gogtay, N., & Greenstein, D. K. (2007). Sexual dimorphism of brain developmental trajectories during childhood and adolescence, *Neuroimage, 63,* 1065-1073.

Menezes, M. S. D. (2010). *Landau-Kleffner Syndrome.* Retrieved 5th February 2010 from http://emedicine.medscape.com/article/1176568-overview.

Musa, R. K., Shong, M., & Kulkarni, C. (2009). Preventable seizures: a prospective, cross

sectional study on the influence of pharmacological factors, *Journal of Clinical and Diagnostic Research, 3,* 1836-1840.

Rodin, E.A. (1968). *The prognosis of patients with seizures.* Springfield, IL: Charels C Thomas Publishers.

Sathishchandra, P., Gururaj, G., Gourie Devi, M., & Subbakrishnan, T. (1996). *Epidemiology of seizures in Bangalore urban and urban population*. Proceedings of the 4th Annual Conference of the Indian Academy of Neurology, Bangalore 27.

Saemundsen, E., Ludvigsson, P., & Rafnsson, V. (2007). Autism Spectrum Disorders in Children with a History of Infantile Spasms: A Population-Based Study, *Journal of Child Neurology, 22* (9), 1102-1107.

Scheffer, I.E., Jones, L., & Pozzebon, M. (1995). Autosomal dominant rolandic epilepsy and speech dyspraxia: a new syndrome with anticipation. *Annals of Neurology, 38*(4), 633-42.

Schoenfeld, J., Seidenberg, M., & Woodard, A. (1999). Neuropsychological and behavioural status of children with complex partial seizures. *Dev Med Child Neurol, 41,* 724-731.

Sillanpaa, M. (2000). Long-term outcome of epilepsy. *Epileptic Disorders, 2,* 79-88.

Singh, L.M., & Mehta, S. (1987). Monitoring of phenobarbitone in epileptic children. Indian *Journal of Pharmacology, Therapeutics and Toxicology, 25,* 15-22.

Sridharan, R. (2002). Current science, Special section: recent advances in seizures *Epidemiology of seizures, 82,* 664-670.

Stanley, F.J., Alberman, E., & Blair, E. (2000). The cerebral palsies: epidemiology and causal pathways. *Clin Dev Med, 151,* 208-211.

Stephenson, J.B.P. (1999). Cerebral palsy. In J.R. Engel., & T. A. Pedley. (Eds). *Seizures: A Comprehensive Textbook.* Philadelphia: Lippincott-Raven, 2571-2577.

Thompson, K., & Wasterlain, C. (1997). Lithium-pilocarpine status epilepticus in the immature rabbit. *Dev Brain Res, 100,* 1-4.

Topp, M., Uldall, P., & Langhoff-Roos, J. (1997). Trend in cerebral palsy birth prevalence in eastern Denmark: birth-year period 1970-89. *Pediatr Perinatal Epidemiology, 11*, 451-460.

Tuchman, R., & Rapin, I. (2002). Seizures and autism. *Lancet Neurology, 1,* 352-358.

Van Riper, C. (1971). *The Nature of Stuttering.* Englewood Cliffs, NJ: Prentice-Hall.

Walsh, C. A. (1999). Genetic malformations of the human cerebral cortex. *Neuron, 23,*19-29.

ACKNOWLEGEMENTS

We wish to gratefully acknowledge Dr Vijayalakshmi Basavaraj, Director, AIISH for permiting us to carry out the study as a part of ARF project. We thank Ms Vasantha Lakshmi, Lecturer in Biostatistics, for her timely help.