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Original Article

INTELLIGENCE QUOTIENT OF NEUROLOGICALLY IMPAIRED CHILDREN ATTENDING NEUROLOGY CLINIC IN A NIGERIAN TERTIARY INSTITUTION

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ABSTRACT

Background: The need to identify the intellectual capability of Neurologically impaired children dictates their educability which can be estimated through their intelligence quotient (IQ). Draw-a-man test for IQ estimation is available, easy and has been validated in Nigeria.
Method: Through a prospective, cross-sectional study that lasted 12 months (January-December, 2011), children aged 4 years and above attending neurology clinic were recruited once they have no severe motor or sensory limitations affecting their upper limbs, and can obey instruction to draw a person. Anthropometry was carried out on them and they were comfortably seated to draw a person. The parents or care givers were instructed not to make any suggestion or hint to them and no time limit was given. Their drawings were assessed using the 52 parameters of Ziler and interpreted accordingly. Ethical procedures were adhered to. Analysis was done using SPSS version 16 and an interactive calculation tool for chi-square tests of goodness of fit and independence.
Results: Seventy-five (45 male, 30 female) children met the inclusion criteria. Their clinical conditions were Epilepsy 48 (64%), Cerebral Palsy 6 (8%), ADHD 5 (6.7%), Down Syndrome 4 (5.3%), Speech/Hearing impairment 3 (4.0%), Hypothyroidism 2 (2.7%) and 7 (9.3%) others. Their ages ranged from 4 years to 16 years (mean±SD = 9.7± 3.8 years). Their IQ distribution were Normal 4 (5.3%), Borderline 12 (16.0%), Mild Mental Retardation 16 (21.3%), Moderate Mental Retardation 19 (25.3%), Severe and Profound Mental Retardation 24 (32.0%) with no significant difference in relation to their birth order.
Conclusions: Ninety-six percent of the study population had IQ below normal. Epilepsy was the commonest condition seen in the Paediatric Neurology clinic and all categories of IQ are seen among children with epilepsy.

Keywords: IQ; Neurologic; Impaired; Children; Nigeria

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INTRODUCTION

Intelligence quotient (IQ) is a numeric expression of a person's intellectual level as measured against the statistical average of his or her age group.[1-3] On several of the traditional scales, it is determined by dividing the mental age, derived through psychological testing, by the chronological age and multiplying the result by 100. An average IQ is considered to be 100.[1] It is normally distributed in the general populace.[2] Intelligence quotient increases with age up to about 18 years and then remains fairly static during most of adult life.[3,4] People with IQ over 130 are exceptionally intelligent, and with IQ below 70 are retarded in their ability to learn especially in the presence of mal-adaptive behaviour and onset prior to developmental age which is 18 years.[2-3] Mental retardation (MR) is characterized by significantly subaverage intellectual functioning, existing concurrently with related limitations in two or more of the following applicable adaptive skill areas: communication, self-care, home living, social skills, community use, self-direction, health and safety, functional academics, leisure and work.[3] Intelligence Quotient is educationally categorized as borderline if the IQ is 70-84, mild MR if the IQ is 55-69, moderate MR if it is 40-54, severe MR if the IQ is 25-39 and profound if it is less than 25 [4]
Children seen in neurology clinic are those with chronic neurologic conditions or on follow up for acute neurologic conditions. Examples of such conditions include epilepsy, cerebral palsy, sequelae of CNS infections, Attention Deficit Hyperactivity Disorder (ADHD), poliomyelitis, Duchenne muscular dystrophy, myasthenia gravis and neurocutaneous syndrome to mention a few. Some of these conditions may have significant negative impact on the higher function status of the brain while others may not. It is a common belief that any neurological disorder would have a negative effect on the cognitive ability of the child. There is a need to establish the baseline IQ of these diverse conditions as they may have impact on the educational needs of these categories of children. Knowing the IQ of these subjects would be a critical step in addressing their educational needs. Therefore, the objectives of this study included the determination of the IQ of these patients and describe the sociodemographic variables seen in these various conditions on follow up in our Neurology clinic.

Patients, Materials and Methods

A prospective, descriptive cross-sectional study carried out over a period of twelve months (January –December, 2011) in the Paediatric neurology clinic of University of Ilorin Teaching Hospital, Ilorin. Paediatric Neurology Clinic of UITH attends to children between ages 2 months to 16 years.

All children aged four to sixteen years were recruited into the study once they met the inclusion criteria which were ability to hear and understand simple instruction of "Draw a person", ability to use the hands and absence of visual impairment. The lower age limit for the tool is 4 years. Multiple entry of any child was avoided. With the aid of a self-designed, pre-tested questionnaire, information on sociodemographic, anthropometric characteristics and the diagnoses were documented. Each child was given a pencil, eraser and a plain sheet of paper and asked to draw a person. The drawing was assessed using the Ziler's 52 parameters and the scores were assigned as merited by the drawings.[5] These scores were converted to mental age by dividing by four, and a constant (3) was added. The formula: Mental age / Chronological age multiply by 100% was used to determine the IQ.[5,6] Approval for the study was obtained from the Ethics and Research Committee of UITH and written informed consent was obtained from the parents or the care givers.

Data was entered into microcomputer, and the analysis was done with SPSS version 16 software and an interactive calculation tool for chi-square tests of goodness of fit and independence.[7] Means of continuous variables were estimated using student t-test while those for categorical variables were determined using the Chi-square test. A *p*-value of ≤ 0.05 was considered significant.

RESULTS

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A total of 75 children who had complete entries were analysed. Of these, there were 45 males and 30 females giving a M:F of **1.5:1**. The minimum age recruited was 4 years while the maximum age was 16years.. Distribution of the sex, weight, OFC and height according to the age group is shown in Table I.

Table I: Demographic and anthropometric characteristics of the study population

Age group (years)	4—8	9-13	≥14	Mean± SD
Gender				
Male n=45	22	15	8	10.3± 4.4
Female n=30	13	14	3	9.3± 3.1
Total	**35**	**29**	**11**	**9.7± 3.8**
Weight (Kg)				
0-15	7	0	0	
16-30	26	13	1	
31-45	2	13	5	
46-60	0	2	5	
>60	0	1	0	
Total	**35**	**29**	**11**	**28.9±12.2kg**
Height (cm)				
90-106	7	1	0	
107-123	16	1	0	
124-140	11	11	2	
141-157	1	12	4	
158-174	0	4	5	
Total	**35**	**29**	**11**	**133.4±19.5cm**
OFC (cm)				
≤47	3	2	0	
48-52	20	11	4	
53-56	12	16	5	
≥57	0	0	2	
Total	**35**	**29**	**11**	**52.0±2.8cm**

Table 2: IQ range distribution and birth order of the study population

	IQ RANGE					
Birth order	**85-115**	**70-84**	**55-69**	**40-54**	**≤39**	**Total**
1st	1	4	6	8	9	28
2nd	1	3	7	5	2	18
3rd	0	2	1	2	5	10
4th	0	0	1	1	3	5
>4th	2	3	1	3	5	14
Total	**4**	**12**	**16**	**19**	**24**	**75**
Yates' Chi square	***7.35***					
Degree of freedom	***16***					
P	***0.97***					

Table 2 shows that there is no significant relationship between birth order and intelligence quotient (p=0.97). Epilepsy was the commonest clinical condition, accounting for 64% of the study population. Other conditions as well as their gender distribution are as shown in Table 3.

Table 3: Sex distribution and the clinical conditions

Clinical Diagnosis	Male n(%)	Female n(%)	Total n(%)
Epilepsy	30 (40.0)	18 (24.0)	48 (64.0)
Cerebral palsy	4 (5.3)	2 (2.7)	6 (8.0)
ADHD	1 (1.3)	4 (5.3)	5 (6.6)
Speech/Hearing impairment of unknown cause	3 (4.0)	0	3 (4.0)
Down syndrome	4 (5.3)	0	4 (5.3)
Hypothyroidism	1 (1.3)	1 (1.3)	2 (2.7)
Post Cerebral malaria	1 (1.3)	1 (1.3)	2 (2.7)
Mental retardation of undetermined cause	1 (1.3)	1 (1.3)	2 (2.7)
Ichthyosis	0	1 (1.3)	1 (1.3)
Tuberous sclerosis	0	1(1.3)	1(1.3)
Turner syndrome	0	1(1.3)	1(1.3)
Total	45 (60.0)	30 (40.0)	75(100)

Children with epilepsy were seen in all the ranges of IQ (Normal to severe/profound MR) while the 2 cases of Hypothyroidism had severe/profound MR.

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The overall distribution of the variation of IQ across the various aetiologic conditions is as shown in table IV.

Table 4: The intelligence quotient according to the different clinical conditions

Classification	85-115 (Normal)	70-84 (Borderline)	55-69 (Mild MR)	40-54 (Moderate MR)	≤39 (Severe and Profound MR)	Total
Diagnosis						
Epilepsy	3	11	11	12	11	48
Cerebral palsy			3	2	1	6
ADHD	0	1	1	0	3	5
Speech/Hearing impairment of unknown cause				3		3
Down Syndrome				1	3	4
Hypothyroidism					2	2
Post cerebral malaria	1			1		2
Mental retardation of undetermined cause			1		1	2
Ichthyosis					1	1
Tuberous sclerosis					1	1
Turner syndrome					1	1
Total (%)	**4 (5.3)**	**12 (16.0)**	**16 (21.3)**	**19 (25.3)**	**24 (32.0)**	**75 (100.0)**

Of the 48 children with epilepsy, 14 (29.2%) had Normal/Borderline IQ, while the remaining 34 (70.8%) had Mild to Profound MR. This observation is statistically significant ($\chi^2 = 4.88$, $p = 0.03$)

DISCUSSION

Epilepsy was the commonest disorder encountered (64%) in the paediatric neurology clinic. Similar prevalences of epilepsy have been documented in paediatric neurology clinics in other parts of Nigeria and it is the most common chronic neurologic disorder in children in developing countries.[8,9] About 70% of the patients with epilepsy in this study had some degree of mental retardation while another 23% had borderline IQ. Previous works have similarly documented reduced cognition in relation to epilepsy.[10-12] Walker *et al*,[10] found lower IQs in newly diagnosed children with epilepsy compared to healthy ones suggesting that mechanisms other than direct effects of recurrent seizures on the brain damage lead to cognitive deficits. In the same study, the IQ of the parents of children with epilepsy was similar to that of parents of healthy children ruling out a familial clustering and indicating that a diagnosis of epilepsy is related directly to low IQ.[10,13] A genetic locus linking low IQ with generalised epilepsy on chromosome 3p was discovered by Blair *et al*[14] suggesting a need to look more into genetic associations. Nuhu *et al*[15] in Kaduna, found a poor academic performance in children with epilepsy associated with school absenteeism, earlier age of onset of disease and poor seizure control. Ibekwe *et al*[16] found the academic performance of children with epilepsy to be comparable to normal children, however he noted underachievement in some subjects like Mathematics and English which may require multiple cognitive operations. Various factors considered to induce cognitive disabilities in them include age of onset, type of epilepsy, nature and frequency of the seizures and the effects of anti-epileptic treatment.[17, 18]

Cerebral palsy though described primarily as a disorder of posture and movement due to a non-progressive insult to the developing brain, has been associated with intellectual impairment in as high as 45% of patients.[19, 20] Part of the issues with assessing IQ for this group of patients is that many IQ assessments are developed and standardized for children without physical disabilities. Children with cerebral palsy have motor (100%), communication (60%) and visual impairments (37%).[19] All the 6 patients with cerebral palsy in this study had mental retardation of which three were mild. It is possible that this low IQ may not truly reflect their cognitive abilities but rather the limitation by their physical impairment on their performance in the test.[21] There is a need to assess the IQ of more patients with cerebral palsy as the six recruited for the study may not be enough to make a genaralizable statement. It may also be advisable to develop appropriate IQ tests that will not 'penalize' the deficits present in children with cerebral palsy.

It is a known fact that ADHD is associated with low IQ and this has been thought to be largely genetic.[22, 23] This was corroborated by the study investigating the contribution of genetic and environmental

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influences to the association of ADHD and IQ in a large number of five-year-old twins. The association with IQ was particularly stronger for inattentiveness and hyperactivity than impulsivity.[23] Three out of the five children in this study had profound MR and none of them had a normal IQ. This may be due to the hospital-based nature of this study as a child with just hyperactivity and apparently normal intelligence may not be presented for a medical care as it might not be recognized as a case desiring one.

The three children with speech/hearing impairment of undetermined origin in this study, had moderate mental retardation. Ferguson *et al*[24] consistently noted underperformance in cognition among children with auditory processing disorder or specific language impairment compared to mainstream school children. There was also no difference in performance between children in the 2 groups of disorders.[24]

A variety of genetic syndromes and congenital disorders were seen in this study responsible for low IQ with most of them having moderate to severe MR. These included patients with cutaneous manifestations like ichthyosis and tuberous sclerosis; Down and Turner's syndrome and hypothyroidism. All these conditions have been described to be associated with significant cognitive impairment[25-28]

Malaria caused by Plasmodium falciparum is one of the commonest causes of infection in sub-Saharan Africa. Cerebral malaria, one of its most severe form is usually associated with neurologic deficits. This has been associated with reduced cognition in 21% of children at six months and 26% at 24 months post discharge.[29, 30] This study looked at only two children with post cerebral malaria within six months of discharge. Bangirana *et al*[31], in Uganda in a case-control study of 62 children with malaria and neurological involvement did not find any differences with cognitive abilities and academic achievement scores in a three month follow up period. Perhaps such cognitive impairments may be seen in the long term and not necessarily in the short term as the latter study suggests. This study showed no significant variation in IQ with birth order of the children studied. This is similar to some earlier studies on IQ and birth order.[32-34] Longitudinal studies**,** which track individual families over time, usually demonstrate that there is no relationship between birth order and IQ.[32-34] Black *et al*[35] in their paper found a strong and significant effect of birth order on IQ, their results suggest that earlier born children have higher IQs and they estimated differences between first-borns and second-borns to be about one fifth of a standard deviation or approximately 3 IQ points. Their study was however on all Norwegian births over the period 1967 to 1998 obtained from the Medical Birth Registry of Norway.

CONCLUSIONS

Epilepsy is the commonest neurologic condition seen in Paediatric Neurology clinic in our institution. Overall, 5.3% of the patients seen in the Neurology clinic had normal IQ, majority of whom had epilepsy. Birth order did not affect the IQ of the children in this study.

RECOMMENDATIONS

The management of cognitive impairments and appropriate counseling on educational options should be part of the routine in the evaluation and follow up of these children so as to optimize their quality of education and subsequently, life. A more robust study is also advised so that a better appreciation of variation of IQ in each of the conditions can be better highlighted.

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