A cross-sectional study on the assessment of intellectual functioning in epileptic children

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Abstract

Background: Epilepsy in children is a commonly diagnosed phenomena and the requirement of accurate diagnosis and treatment seek great attention in recent research. The correlation between cognitive impairment and other factors such as ongoing seizures, antiepileptic syndrome, high seizure frequency, and the consequences of poly-medication has to be revealed.
Aim: To evaluate the intellectual functioning in the children affected with epilepsy and thereby assess the impact of epilepsy-associated variables on their IQ score.
Methods: A prospective study is conducted with 104 children in Baghdad in 2017. The study recorded clinical parameters like seizure types, the onset of a seizure, and details of antiepileptic drugs by Raven score.
Result: The prevalence of sub-normal IQ was observed to be 39.4% and the mean IQ level was 75.5%. Likewise, early-onset children had the lowest IQ level (64%) than late-onset children and 65.1% of symptomatic type with low mean IQ is observed when compared with the localized and idiopathic type. A high prevalence of mental retardation is found with mixed type of seizures and accordingly, the population with poor seizure control possess the lowest IQ (66%) than partial seizure control. Mental retardation prevalence was found to be 92%, 39.4%, and 10.9% in children with poor, partial, and good seizure control.
Conclusion: The study concluded that Childhood-onset epilepsy is considered a major risk factor for low IQ levels. Furthermore, the lowest IQ level is found under the following conditions such as early-onset, mixed type, symptomatic epilepsy, poor seizure control, and multiple drug therapy.

Keywords: Epilepsy, intellectual function, ILAE, seizure control, multiple drug therapy
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1. INTRODUCTION

Childhood epilepsy also termed the seizure disorder, is considered the most significant brain dysfunction[1]. Epilepsy could able to cause frequent seizures due to the sudden surge of electrical activity in a brain region. Appropriate care has to be exercised to avoid intermingling of the seizure and epilepsy classification. Inconsistent fashion of classification may lead to delay in treatment progression[2]. Despite ILAE classification, there is no room in the present diagnostic schema for accommodating the accurate electro-clinical types that have been utilized for three decades[3].

The following are the specific etiologies of cognitive dysfunction in which the rapport between epilepsy and intellect can be cleared out, once the etiology is acknowledged. Most of the pervasive outcomes on cognitive ability are in the etiology of epilepsy, in most epilepsy-related variables. People who were affected by epilepsy were impaired either behaviourally or intellectually which is identified in most of the cases, the major contributor to the difficulties are not recurrent seizures and the underlying brain disease. Low IQs were found in the patients with symptomatic epilepsy than the patients with idiopathic epilepsy[4].

This variation may lead to an increase in the chance of intellectual impairment in the children who were affected by symptomatic epilepsy. Even when the precise extent or source of the lesion is unidentified, the meantime it has a chance of an increased cognitive impairment for those who were affected by symptomatic epilepsy in the lead of cerebral lesion. Nearly,70% of children were taken under the survey who had presumed symptomatic or symptomatic epilepsy in that 76% were experienced learning glitches, where half of them are with standard IQs.Seizure genesis before age six and cerebral palsy is the main factor for mental retardation also primary drug treatment lead to a lack of response. How to produce a particular etiology on both mental retardation and seizures independently is illustrated in chromosomal disorders[5].

Down syndrome affected patients have a standard IQ of 43.5, which results that 99% of patients will have independent epilepsy and being mentally retarded.The mental subnormality is commonly inherited from the X-linked mental retardation.25% -50% of the mental handicap cases are associated with fragile X-chromosomes. Relationship to intellect was negligible, though 20% of patients were affected by seizures. The syndrome that is affected in the region of the long arm chromosome-15 by a microdeletion is Prader-Willi and Angelman syndrome. Angelman syndrome is an invariable component of seizures which occur only in 20% of children who were affected by Prader-Willi syndrome. The major feature of both the syndrome is subnormal intellect. In Epilepsy, cerebral palsy and mental retardation are idiosyncratic combinations caused by the symptomatic etiology in the specific of perinatal asphyxia epilepsy. Perinatal asphyxia in infants will lead to later epilepsy and cerebral palsy, it was revealed by NCPP. A finding from subsequent research confirmed that there was no relationship between various measures obtained in perinatal asphyxia and the epilepsy occurrence at age of 7-12 years in the non-presence of cerebral palsy.

Accordingly, Anti-epileptic drugs are used to reduce the tendency for seizures by decliningneuronal excitability or by enhancing inhibitory neurotransmission, and cognitive side effects are produced by these similar mechanisms. Physical side effects such as somnolence, insomnia, dizziness, or sedation might affect the different aspects of cognition. Specific aspects of cognition are more directly impacted by some other effects like reduced vigilance, language impairment, psychomotor slowing, memory impairment, and distractibility. Daily functions are significantly impacted by these side effects.

A negative relation between acuity of quality of life and self-reported adverse effects of AEDs is shown strongly. AEDs effects are distinguished between "newer" drugs and "traditional" drugs by most of the reviews. The availability of traditional category drugs is

from the period of 1990s which includes valproate, primidone, phenytoin, carbamazepine, ethosuximide, and phenobarbital.

Clinical significant side effects are associated with these mentioned drugs. Behavioral consequences and adverse cognitive are mostly associated with phenobarbital, including conduct disturbances, attentional deficits, reduced short-term memory and hyperactivity, and intellectual function drop is associated with phenytoin.

Patients with severe epilepsy, drug toxicity, and coexisting neurobehavioral disorders are mostly affected by the mentioned effects. These findings are based on clinical experience and trials with adults, and the outcomes mentioned may not be generalized for all age groups.

Reducing cognitive efficiency like aggression, hyperactivity in children, and depression in adults are some of the age-specific side effects of AEDs. The well-designed AED drug trials require pressing for both children and the elder. Different metabolic and absorption rates may be found in elders than in younger adults, the metabolism of AEDs is influenced by age-related physiological changes, and the medical conditions are higher for the elderly.

Developing and adult brains may have a different effects on AEDs; Children can be particularly devastated by long-term consequences of AEDs, and even modest intellectual impairments may have collective consequences if they affect limits and learning.

The main contribution of the article is to determine the intellectual functioning in the children affected with epilepsy and thereby assess the impact of epilepsy-associated variables on their IQ score. The variables assessed in this study are the type of epilepsy, age of epilepsy onset, gender, frequency, types, and control of seizure.

Paper Organisation:

The structure of the paper is as follows. Section1 of the article presents a comprehensive introduction to childhood epilepsy and the need for the present study. Section 2 provides the information about state of art methods as per the presented study. Section 3 describes the patients and methods of the performed research. The next section demonstrates the results and discussion. Finally, the last section concludes the study.

2. LITERATURE REVIEW

This section provides various information on the research conducted on childhood epilepsy and its classification based on various factors.

[6]aimed to estimate the time taken for intellectual modifications after pediatric focal respective epilepsy surgery and also to determine their predictors. The study included 81 school-eligible children affected by intractable seizures and focal epilepsy, and who were performed with focal resection from 2000 to 2018. These evaluations were done before and after the epilepsy surgery within the year gap of 1-5 years. As a result among the 81 children, 45 of the children have enhanced in any one of the five Wechsler intelligence scale domains after the surgery. The core prognostic features that cause an impact on the intellectual outcome of post-epilepsy surgery are temporal lobe localization and postoperative seizure freedom. Young age children who have gone through surgery probably don't have a postoperative IQ drop. Except for the verbal comprehension index, all the other intellectual domain growth may lead to five years delay. After epilepsy surgery, during first two years may lead to intellectual decline and this was replicated in full-scale intelligence quotient and working memory index.

[7] this study explained the Tuberous sclerosis complex which is a multisystem genetic disorder, caused by the mutation of TSC1 or TSC2. Therefore,80%-90% of people were affected by epilepsy in their lifespan, vigabatrin is particularly shown effective in children who were affected by TSC and develop epileptic spasms. For the growth of intellectual impairment in TSC, the epileptic spasms and epilepsy severity are steady signs of risk. In the prior survey, intellectual impairment in TSC was demonstrated as a bimodal distribution; the modern proposes a unimodal distribution which leads to a change in IQ distribution over a period. Three UK

cohorts of TSC were compared, that show varied distributions in intellectual ability. The later-born child has a high frequency of reported spasms and a high probability of vigabatrin but these intellectual impairments are likely profound to the early-born child. This proposes that epileptic spam was not detected in the early born and they were not treated, which leads to profound impairment in a high range, whereas the later-born had treated better. This states the importance of early diagnosis and treating seizures in TSC.

[8]aimed to estimate the intellectual skills of children who were affected by epilepsy and also to investigate whether the influence of age, gender, an antiepileptic drug, and type of epilepsy also place a role For this study, 158 patients the aged of 6-14years were enlisted. Using the Standford-Binet 5th edition/Arabic version, the IQ test was conducted on all the enlisted patients. As a result, in a full-scale IQ test nearly 88 patients scored on an average scale, forty-four of them have scored below average. Eighteen of them are delayed scores. Epilepsy-affected children had a normal FSIQ. The Overall memory and FSIQ are affected by the uncontrolled seizure. To upkeep, the children affected by epilepsy should emphasize school psychosocial domains and epilepsy management.

[4] Patients with temporal lobe epilepsy are widely explored with epileptic syndromes. This study examines the presurgical intellectual outline of patients and juveniles with drug-resistant PCE (posterior cortex epilepsy). Both the juveniles and children are diagnosed with PCE. This assessment was carried out from 2003 to 2019. Patients are diagnosed with temporal and frontal lobe epilepsy for the comparison of intellectual profiles. For the general intelligence assessment, Wechsler Intelligence Scale was used. As a result, there was an effect on the working memory index in the brain region; patients with FLE and PCE are significantly lower than the patients with TLE. It also demonstrates that PCE patients are inclined to perform inferior in the processing speed index when compared to patients with TLE. The perceptual reasoning indexes, full-scale intelligence quotient, and verbal comprehension did not have any difference in the brain region. The memory and processing speed impairment is significantly demonstrated for both children and juveniles with PCE. The observed FLE was similar to the cognitive dysfunction pattern in PCE. This proves the participation of frontoparietal networks in intellectual proficiency. [9] examined the clinical and neuroimaging variables correlated with cognitive impairment after childhood epileptic surgery. The study included 52 children for evaluating their epileptic surgery followed by re-assessment after 7.7 years. This research treated 39 participants with focal surgery and 13 participants with pharmacological methods. Neuroimaging results indicate that left anterior temporal resections constrain the development of verbal cognition, whilst simultaneously cortical growth after surgical treatment can support improvements in IQ.

[10] For progenies who were affected with refractory focal-lesional epilepsy, the most operative treatment is epilepsy surgery. From this, the seizure freedom exceeds seventy percent after 2 years of surgery. By epilepsy surgery, Cognitive results are upgraded predominantly in young children with arrest, even regression of development delay. Prior surgery will not only lead to greater seizure freedom but also progresses post-operative developmental results. In conclusion that focal-lesional epilepsy affected children should be raised initial, for the evaluation of epilepsy surgery.

[11] This study identified predictors of developmental quotients and post-operative intelligence. Also, validated and developed clinically related IQ/DQ prophecy replicas. Neuropsychological results are analyzed retrospectively. Separate analyses were done for the patients with IQ and the patients only with DQ. Prophecy models are developed based on pre-surgical factors to forecast dichotomized levels of a recital.IQ/DQ data of 492 patients were analyzed before and after two years of surgery, where the development was significantly higher. Bethel cohort is used in two IQ models development. Utrecht cohort is used for external validation. For DQ, models were developed in the bethel cohort.

Prediction should be good in the allowed models. High accuracy and excellent discrimination were found in the external validation of IQ models.

[12] The utilization of pediatric epilepsy surgery is very low. Less than 11% of an infant with drug-resistant epilepsy experience surgery. A systematic review was conducted for the articles published in EMBASE, Web of Science, and PubMed to examine the underutilization of surgery-related factors and also the impact caused on the healthcare system and individuals. Multiple factors which lead to underutilization were demonstrated, including lack of knowledge, health disparities, and misconceptions about epilepsy surgery. Epilepsy surgery cost is significant. To increase access to pediatric epilepsy surgery families, the healthcare system, and providers are needed to be involved. Timely interventions are needed to improve Cognitive results and seizures.

[13] Epilepsy surgery results were influenced by multiple factors. Prognostic indicators are varied from imaging findings, clinical characteristics, and ictal. Surgical outcomes are linked to the activity of interictal electrophysiology. This review focused on the role of epilepsy histopathology in the post-surgical result. Specifically focused on the cognitive outcomes and seizure results. Existing literature was reviewed to provide the relation between surgical outcomes and etiology. Finally, concluded that with a call to the histopathology and epilepsy surgery community to thrust a mechanistic sympathetic of the pathology result interface and also identified the biomarkers and actionable knowledge that could notify patients upkeep in a sensible mode.

[9] This study identified predictors of developmental quotients and post-operative intelligence. Also, validated and developed clinically related IQ/DQ prophecy replicas. Neuropsychological results are analyzed retrospectively. Separate analyses were done for the patients with IQ and the patients only with DQ. Prophecy models are developed based on pre-surgical factors to forecast dichotomized levels of a recital.IQ/DQ data of 492 patients were analyzed before and after two years of surgery, where the development was significantly higher. Bethel cohort is used in two IQ models development. Utrecht cohort is used for external validation. For DQ, models were developed in the bethel cohort. Prediction should be good in the allowed models. High accuracy and excellent discrimination were found in the external validation of IQ models.

Research Gap

Finally, it shows that children who attained liberty from seizures after epilepsy surgery are the children leading in postoperative intellectual growth. This is a long-term process. But, before the intellectual drop is proven. In this evaluation, psychometric tests are not regular because of using retrospective design for the estimation of a particular function. Different domains of Wechsler's intelligence scales are only examined. Terms of educational achievement and day to day functions of the patients are essential in characterizing learning and memory deficits. Irrespective of the temporal lobe epilepsy part, pediatric patients with temporal lobe epilepsy may affect verbal memory, and children who were secured more than baseline are also at the risk. These results might change the cognitive results in temporal lobe epilepsy patients. The cognitive result of post epilepsy surgery can be defined better with the evolution of post-operative with a particular function. Also, pediatric cohorts are often used with extratemporal categorization; in this analysis, it is represented as a heterogeneous group in form of localization, etiology, and extent of epilepsy. The practice of increasing IQ might be affected if the risk factor is minimized, higher cut-offs are used than the mentioned. But, the statistical properties of the test particularly reliability are controlled better with the reliable change index (RCI). Likewise, the cognitive change should be noted over a while post epilepsy surgery for the prospective longitudinal study with a particular group and specific patients with the match epilepsy characteristics and IQ level.

III. PATIENTS AND METHODS

The methodology of the research has been briefly elaborated in this section

Study Design

Study area: This prospective study has been conducted at two locations which are

- Outpatient epilepsy Clinic (Baghdad Teaching hospital)
- Neurology Clinic (Children Welfare Teaching Hospital)

Study Duration: January 1 to December 31 of the year 2017

Sample size: 104 epilepsy-affected children who visit the study area for follow-up.

Inclusion Criteria: The study included the children belonging to the age group of 6 to 15 years. The study included the children whose IQ measure was recorded with a routine medical examination and neurological assessment. Further, those children who were completely followed up during the study duration through EEG data were only included in this study.

Exclusion Criteria:

The study excluded the children with progressive neuro diseases.

Further, the participants with an already known reason for mental retardation gross mental abnormality were also excluded from this study except for fragile X syndrome and Down syndrome.

Meanwhile, the children associated with behavioral and psychological abnormalities like Autism disorder and ADHD were also eliminated in this study.

Variables Recorded:

The following variables are seriously considered for the study for statistical analysis.

- Demographic variables like Name, Age, and Gender
- Age during epilepsy onset
- An anti-epileptic drug used during the disease evolution
- Frequency of seizure and control of seizer
- Good, partial, and Poor control (No seizure during the past 6 months is considered as good, one seizure during the past 6 months and < one attack per month) is regarded as the partial control and at least a seizure/month is considered as poor control).
- Epilepsy classification in accordance to medical data, semiology, seizure, ictal EEG, and interictal with the utilization of ILAE (International league against epilepsy).

The study recorded EEG and analyzed the evidence of partial or generalized epileptiform discharge. Followed by this analysis classification based on ILAE was also evaluated through a concordance of the above-described parameters.

Classification of Epilepsy syndrome has been categorized into symptomatic and idiopathic epilepsy in which IE has been further divided into localized and generalized epilepsy. Certain cases cannot be categorized and considered as unclassified types. Agreement formalities are as follows.The patients and the corresponding family members were pre-informed about the benefits of the research before participation. Meanwhile, oral consent was also obtained from every participant and their family members.

Intellectual Testing:

The children belonging to this study were subjected to IQ tests by a specialized and experienced psychologist with the Raven matrices test. This test is a kind of non-verbal group test characteristically utilized in educational simulations. It is generally a 60 item test for the estimation of abstract reasoning and is considered the non-verbal measure of fluid intelligence. This test is the popular and common test administered at a young age (5 years) to the elder groups and is made of sixty multiple-choice questions sectioned in the difficulty order. IQ is described as the individual mental age divided by the chronological age times. The normal distribution of IQ in the general population is with a mean of 100 and SD of 15. Thereby 2.3% of the study population possess an IQ ≤ 70. By the definition of IQ and mental retardation, an IQ score of 70 or less is considered for indicating mild mental retardation.

Statistical Analysis:

The data were initially entered into the MS-Excel sheet and transferred for descriptive inferential statistics into SPSS version 24 and are used for the determination of significance

level. The continuous variables are presented as mean with standard deviation and the discrete variables are presented as percentages and numbers. The T-test for two independent variables was utilized for the testing of the significance in mean value.ANOVA (Analysis of variance) is a test used to test the significant difference among the groups if the p-value is smaller than 0.05 then it is shown that respondents differ significantly in this study Chi-square test has been utilized to analyze the significance of the correlation between the discrete variables.

IV. RESULTS

This section demonstrated the results and discussion in detail.The age group of the enrolled 104 study participants ranges from 6 to 15 years with an average age of 10 (± 3) years. Those who are aged 6 to 10 years were 63 children (60.6%) and older children (11-15 years) were 41 (39.4%) (Table 1). Table 1 and Figure 1 state that the male population constituted 61 children (58.7%) of the sample and females were 43 (41.3%) consequently the M: F (male: female) ratio is 1.4.

Age at onset of epilepsy varied from one month to 14years. The mean onset age was 6.0±4.3 years. Those who developed epilepsy in infancy were 19 children (18.3%), while those who developed epilepsy between the age of one to six were 41 (39.4%), and those who developed epilepsy at seven years or older were 44 (42.3%)(Table 1, figure 2).

Regarding Seizure Control:

Medicines given for treatment were only one in 47 children (45.2%), two in 28(26.9%), three in 18(17.3%), and more than three in 11(10.6%) (Table 1). The control of seizures was found to be good in 46(44.2%), partial in 33(31.7%), and poor in 25(24.0%).

Table 1: Demographic profile of the study population

Characteristic features	N (%)
Age Group	
• 6-10 y	63(60.6%)
• 11-15 y	41(39.4%)
Sex of children	
• Male	61(58.7%)
• Female	43(41.3%)
Age at onset	
• Infancy	19(18.3%)
• 1 – 6 y	41(39.4%)
• ≥ 7 y	44(42.3%)
Number of Medicines	
• 1	47(45.2%)
• 2	28(26.9%)
• 3	18(17.3%)
• ≥ 4	11(10.6%)
Seizure Control Level	
• Good Control	46(44.2%)
• Partially Controlled	33(31.7%)
• Poorly Controlled	25(24.0%)
Total	**104(100.0%)**

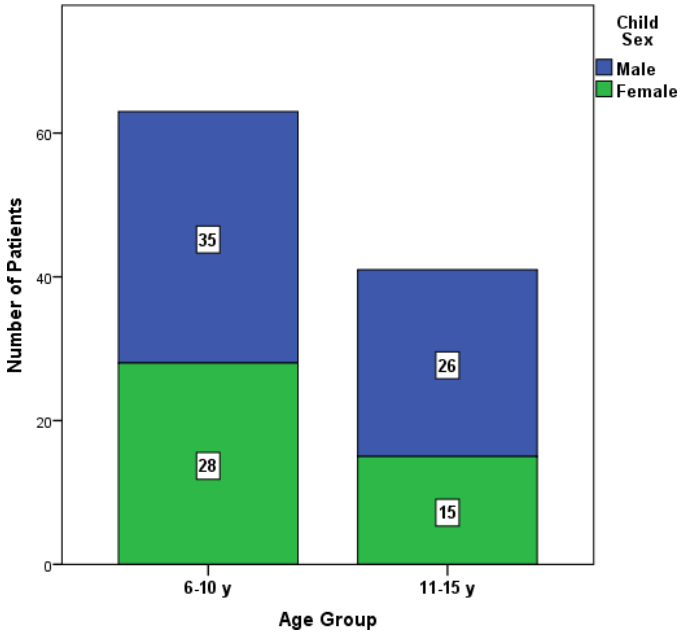

Figure 1: Number of sampled children according to their age and sex

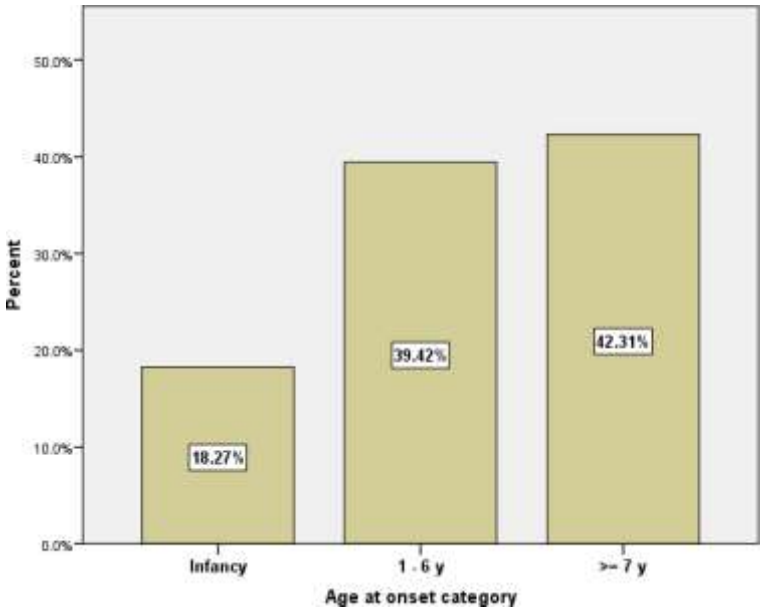

Figure 2: Distribution of the sampled children according to the onse

t age

The seizure types are discussed below in which the Generalized Tonic-Clonic was observed in 14(13.5%), Complex Partial in 16(15.4%), Absence in ten (9.6%), Simple Partial in ten (9.6%), Simple-Partial with Secondary Generalization in seven (6.7%), Complex-Partial with Secondary Generalization in four (3.8%), and mixed in 43(41.3%). (table 2, figure 3). Epileptic syndromes encountered in this study were: Localization Related in 31(29.8%), Idiopathic Generalized in 29(27.9%), Symptomatic in 17(16.3%), and Unclassified in 27(26.0%). (Table 2, figure 4). Further detailed classification of the observed epileptic syndrome is illustrated in table three.

Table 2: Epileptic disease features among the study population

Features of Epilepsy	N (%)
Seizure Type	
Generalized Tonic Clonic	14(13.5%)
Complex Partial	16(15.4%)
Absence	10(9.6%)
Simple Partial	10(9.6%)
Simple Partial with Secondary Generalization	7(6.7%)
Complex Partial with Secondary Generalization	4(3.8%)
Mixed	43(41.3%)
Epileptic Syndrome	
Localization Related	31(29.8%)
Idiopathic Generalized	29(27.9%)
Symptomatic	17(16.3%)
Unclassified	27(26.0%)
Total	**104(100.0%)**

Table 3: Epileptic disease syndrome among the study population

Epileptic Syndrome	N (%)
Generalized Epilepsy	11(10.6%)
Ronaldic Epilepsy	11(10.6%)
Benign Occipital Epilepsy	9(8.7%)
Childhood Absence Seizure	8(7.7%)
Progressive Myoclonic Epilepsy	6(5.8%)
AD Frontal Lobe Epilepsy	6(5.8%)
Lennox-Gastaut Syndrome	5(4.8%)
Juvenile Myoclonic Epilepsy	5(4.8%)
Temporal Lobe Epilepsy	5(4.8%)
Juvenile Absence Epilepsy	3(2.9%)
WEST Syndrome	3(2.9%)
Landau-Kleffner Syndrome	3(2.9%)
Myoclonic Astatic Epilepsy	2(1.9%)
Undetermined	27(26.0%)
Total	104(100.0%)

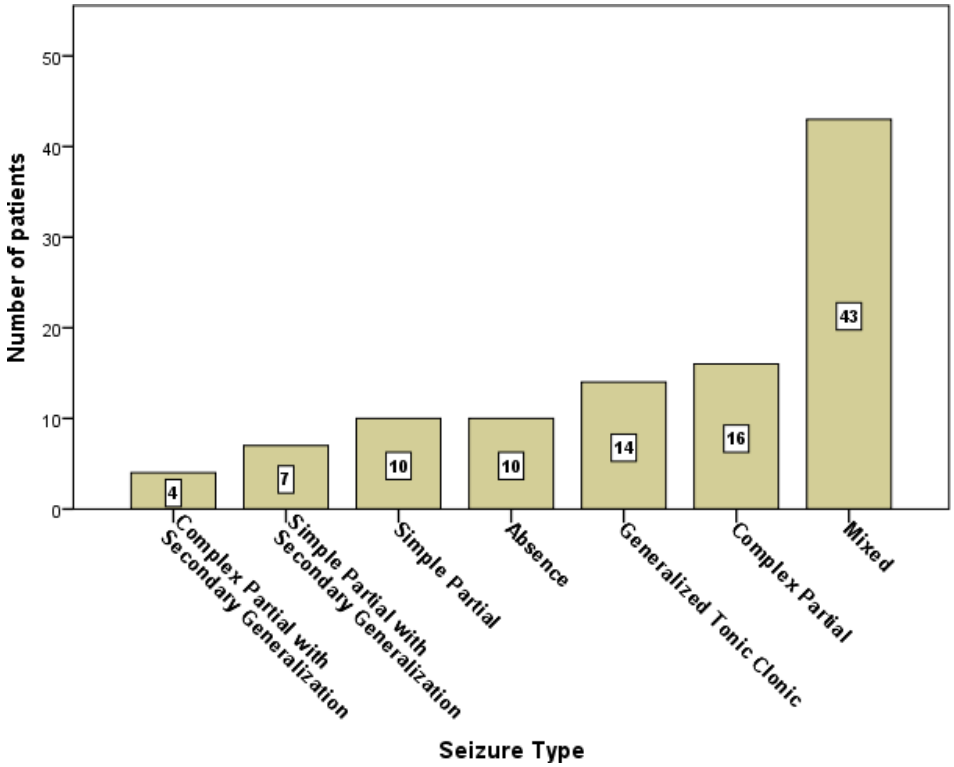

Figure 3: Observed seizure types in sampled children.

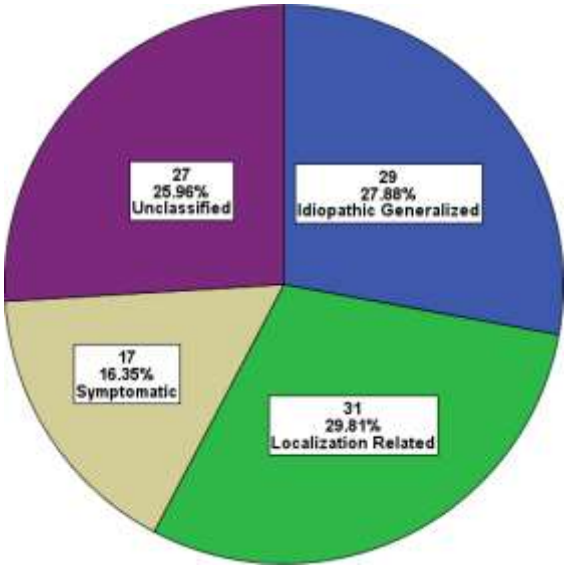

Figure 4: Epileptic syndrome wise distribution of the study population

IQ of the study population

The IQ of the study population ranges from 60 to 100 with a mean value of 75.60. Likewise, 39.4% of the population was affected with mental retardation with mild effects as shown in figure 5. The mean value of IQ increased with the age of the children as shown in table 4. Further, in table 4, it is also shown that child sex did not affect the mean IQ value.

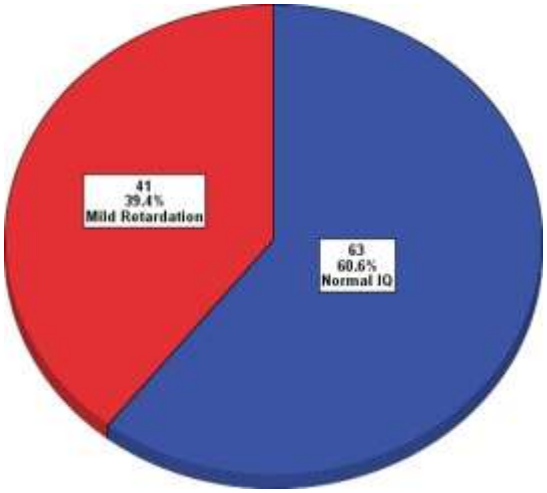

Figure 5: Mental retardation prevalence among the study population

Table 4: Mean IQ of the study population

Characteristic	N (%)	IQ Mean (SD)	P value
Age Group			**0.005**
• 6-10 y	63	73.4(9.4)	
• 11-15 y	41	79.0(9.9)	
Gender			0.501
• Male	61	75.0(10.6)	
• Female	43	76.4(9.0)	
Age at onset			**<0.001**
• Infancy	19	64.0(3.0)	
• 1 - 6 y	41	75.8(9.5)	
• ≥ 7 y	44	80.4(8.1)	
Number of Medicines			**<0.001**
• 1	47	82.2(7.2)	
• 2	28	72.8(7.0)	
• 3	18	70.1(10.8)	
• ≥ 4	11	63.6(3.2)	
Seizure Control Level			**<0.001**
• Good Control	46	82.8(7.1)	
• Partially Controlled	33	72.8(6.7)	
• Poorly Controlled	25	66.0(7.9)	
Total	**104(100.0%)**	**75.6(9.9)**	---

A similar relation was found between mean IQ and the number of anti-epileptic medicines given for treatment the higher mean IQ (63.3±3.2) was for those on one epileptic treatment (82.2±7.2) and the lower mean IQ was for those on four or more anti-epileptic medicines. (P < 0.05, table 4)
Similarly, Mean IQ significantly decreased from 82.8±7.1 in children known to have good seizure control, to 72.8±6.7 in children with partial seizure control to 66.0±7.9 in poorly controlled children. (P < 0.05, table 4) This study observed the following significant variation in means of IQ according to seizure type, from higher to lower: 87.1±3.1 in Absence, 81.3±9.3 in Generalized Tonic-Clonic, 80.9±9.3 in Complex Partial, 78.1±7.0 in Simple Partial, 77.9±7.9 in Simple Partial with Secondary Generalization, 76.0±2.7 in Complex Partial with Secondary Generalization, and 68.1±7.1 in Mixed type. (P

< 0.05, table 5) This study as well, found a significant variation of mean IQ according to epileptic syndromes: 79.6±6.7 in Localization Related, 81.4±8.6 in Idiopathic Generalized, 65.1±4.7 in Symptomatic and 71.3±9.9 in Unclassified (P < 0.05, table 5). Further description of mean IQ according to subtypes of the epileptic syndrome is expressed in table 6

Table 5: The mean IQ for the study population based on seizure characteristics

Features of Epilepsy	N (%)	IQ Mean(SD)	P value
Seizure Type			**<0.001**
Generalized Tonic Clonic	14	81.3(9.3)	
Complex Partial	16	80.9(9.3)	
Absence	10	87.1(3.1)	
Simple Partial	10	78.1(7.0)	
Simple Partial with Secondary Generalization	7	77.9(7.9)	
Complex Partial with Secondary Generalization	4	76.0(2.7)	
Mixed*	43	68.1(7.1)	
Epileptic Syndrome			**<0.001**
Localization Related	31	79.6(6.7)	
Idiopathic Generalized	29	81.4(8.6)	
Symptomatic	17	65.1(4.7)	
Unclassified	27	71.3(9.9)	
Total	**104(100.0%)**	**75.6(9.9)**	

Table 6: Mean IQ for sampled children according to seizure syndrome:

Epileptic Syndrome	N (%)	IQ Mean(SD)
Generalized Epilepsy	11	81.7(8.8)
Ronaldic Epilepsy	11	80.2(6.40
Benign Occipital Epilepsy	9	80.9(5.3)
Childhood Absence Seizure	8	85.0(7.3)
AD Frontal Lobe Epilepsy	6	78.7(7.10
Progressive Myoclonic Epilepsy	6	65.5(4.3)
Juvenile Myoclonic Epilepsy	5	81.2(7.2)
Temporal Lobe Epilepsy	5	77.4(9.9)
Lennox-Gastaut Syndrome	5	62.4(3.3)
Juvenile Absence Epilepsy	3	82.0(6.1)
WEST Syndrome	3	63.0(3.0)
Landau-Kleffner Syndrome	3	70.7(5.1)
Myoclonic Astatic Epilepsy	2	65.5(0.70
Undetermined	27	71.3(9.9)
Total	104	75.6(9.9)
P value		**<0.001**

Table 6: Mean IQ for sampled children according to seizure syndrome:

Characteristic	N (%)	IQ Mean (SD)	P value
Age Group			**0.005**
• 6-10 y	63	73.4(9.4)	
• 11-15 y	41	79.0(9.9)	
Gender			0.501
• Male	61	75.0(10.6)	
• Female	43	76.4(9.0)	
Age at onset			**<0.001**
• Infancy	19	64.0(3.0)	
• 1 - 6 y	41	75.8(9.5)	
• ≥ 7 y	44	80.4(8.1)	
Number of Medicines			**<0.001**
• 1	47	82.2(7.2)	
• 2	28	72.8(7.0)	
• 3	18	70.1(10.8)	
• ≥ 4	11	63.6(3.2)	
Seizure Control Level			**<0.001**
• Good Control	46	82.8(7.1)	
• Partially Controlled	33	72.8(6.7)	
• Poorly Controlled	25	66.0(7.9)	
Total	**104(100.0%)**	**75.6(9.9)**	---

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Table 7 it is shown the significant correlation between the analyzed factors and the mental retardation (MR). The MR of young-aged children was high (47.60%) than elder children (26.80%). Likewise, the study found that earlier onset affects mental retardation and mixed type is frequent. More anti-epileptic drugs affect mental retardation to a great extent. When control decreases, MR increases. Table 8 deliberates the correlation between the subtypes and MR. However no significant difference in MR and Child sex.

Table 7: Relation between observed mild mental retardation and studied patients' characteristics:

		IQ Category		
	Total	Mild Retardation	Normal	P
Characteristics	N (100%)	N (%)	N (%)	value
Age Group				0.034
• 6-10 y	63	30(47.6%)	33(52.4%)	
• 11-15 y	41	11(26.8%)	30(73.2%)	
Gender				0.229
• Male	61	27(44.3%)	34(55.7%)	
• Female	43	14(32.6%)	29(67.4%)	
Age at onset category				<0.001
• Infancy	19	19(100.0%)	0(0.0%)	
• 1 - 6 y	41	14(34.1%)	27(65.9%)	
• ≥ 7 y	44	8(18.2%)	36(81.8%)	
Seizure Type				<0.001
• Complex Partial	16	1(6.3%)	15(93.8%)	
• Generalized Tonic-Clonic	14	3(21.4%)	11(78.6%)	
• Simple Partial	10	2(20.0%)	8(80.0%)	

• Absence	10	0(0.0%)	10(100.0%)	
• Simple Partial with SG	7	2(28.6%)	5(71.4%)	
• Complex Partial with SG	4	1(25.0%)	3(75.0%)	
• Mixed	43	32(74.4%)	11(25.6%)	
Number of Medicines				<0.001
• 1	47	5(10.6%)	42(89.4%)	
• 2	28	12(42.9%)	16(57.1%)	
• 3	18	13(72.2%)	5(27.8%)	
• ≥ 4	11	11(100.0%)	0(0.0%)	
Seizure Control Level				<0.001
• Good Control	46	5(10.9%)	41(89.1%)	
• Partially Controlled	33	13(39.4%)	20(60.6%)	
• Poorly Controlled	25	23(92.0%)	2(8.0%)	
Epileptic Syndrome				<0.001
• Localization Related	31	4(12.9%)	27(87.1%)	
• Idiopathic Generalized	29	1(3.8%)	25(86.2%)	
• Symptomatic	17	14(82.4%)	3(17.6%)	
• Unclassified	27	19(70.4%)	8(29.6%)	
SG; secondary generalization				

Table 8: Relation between observed mild mental retardation and epileptic syndrome:

	Mild Mental Retardation		Normal IQ
Epileptic Syndrome	**N (100%)**	**N (%)**	**N (%)**
Generalized	11	2(18.2%)	9(81.8%)
Ronaldic Epilepsy	11	0(0.0%)	11(100.0%)
Benign Occipital Epilepsy	9	1(11.1%)	8(88.9%)
Childhood Absence Seizure	8	0(0.0%)	8(100.0%)
Progressive Myoclonic Epilepsy	6	5(83.3%)	1(16.7%)
AD Frontal Lobe Epilepsy	6	2(33.3%)	4(66.7%)
Juvenile myoclonic Epilepsy	5	0(0.0%)	5(100.0%)
Temporal Lobe Epilepsy	5	1(20.0%)	4(80.0%)
Lennox-Gastaut Syndrome	5	5(100.0%)	0(0.0%)
WEST Syndrome	3	3(100.0%)	0(0.0%)
Landau-Kleffner Syndrome	3	1(33.3%)	2(66.7%)
Juvenile Absence Epilepsy	3	0(0.0%)	3(100.0%)
Myoclonic Astatic Epilepsy	2	2(100.0%)	0(0.0%)
Undetermined	27	19(70.4%)	8(29.6%)
P < 0.001 but could be invalid as the minimal expected cell count in this table is less than one.			

IV. DISCUSSION

Intellectual function in epileptic children can present in severity depending & on different patterns of frequent factors included in this syndrome like age, etiological variability, sex, age of onset, epileptic syndrome & type of seizure. Our study was designed to examine the level of IQ in epileptic patients and correlated with epilepsy variable risk factors. The 104 children involved in this study have varied ages from 1 to 15 years, where the mean age is 9.9±3 yrs. The mean IQ of our sample is 75.55+ 9.9 this result was comparable to Sheriff Alshazli's study (in Egypt 2013) which mentioned in his study mean IQ of 77.96+_13 The prevalence of

mental retardation in our study is 39.4 This result is higher than that reported in previous literature; Sheriff Alshazli study (in Egypt 2013) [54] reported that 33.3% of children with epilepsy have mental retardation, while Murphy et al study in [8] reported that 30%of children with epilepsy have mental retardation, while [14]in (USA 2008)reported that one out of four children (26.4%)had subnormal cognitive function. The possible explanation for the difference in the prevalence of mental retardation in epileptic children can be due to different sample sizes and different methods of IQ determination differences in management, education, and rehabilitation system.

Regarding sex: This study shows no significant effect of sex on IQ in epileptic children (58.7%) of our sample are male and (41.3%) are female, The ratio between male and female is 1.4, the mean IQ for female children is 76.40%(P>0.05) & the male children has 75%. This finding agrees with [15] study that concluded that gender had no impact on IQ among epileptic children.[16] show no significant difference in mean IQ between male (75.5%) and female (74.4%), while [17] said sex affect IQ significantly with female gender was associated with a low IQ of 72.77% than male 82.2%, the p-value of 0.005 significant.

Regarding the age of the child;Our study show mean IQ significantly increases with children's age, mean IQ is 73.4% in age (6-11) while 79% in children aged between (11-15). p-value <0.005. These findings agree with [16] which shows that IQ increases with age at examination, the mean IQ was 76.5% in age (6-11) while 79.5 in age between (11-16), p-value <0.005. While [17] mention that IQ in epileptic children less than 9 years was 78.34 and 76.10% in those older than 9 years

Regarding the age of onset: This study shows that the earliest onset of epilepsy is a risk factor for intellectual dysfunction with a mean IQ of 64 in epileptic children with onset at infancy, 75.8 With age at onset between (1-6) and 80. 4 in epileptic children with onset at age over 7 years. This result agrees with [16]which revealed a significant decrease in mean IQ with earlier age of onset of epilepsy, With mean IQ at infancy 65.8, 80.6 in 4-7 years, and 73.6 in epileptic children with onset of epilepsy at an age older than 7 years. While [17]found that age of epilepsy onset is not a risk factor for intellectual dysfunction.[14]mention that children with an age of onset <5 years show significantly lower IQ regardless of epilepsy classification. This result may be attributed to the fact that younger age at onset is strongly associated with symptomatic causes and epileptic encephalopathy, both associated with intellectual impairment.

Regarding the type of epileptic syndrome Our study found a significant variation of mean IQ according to epileptic syndromes: 79.6±6.7 in Localization Related, 81.4±8.6 in Idiopathic Generalized, 65.1±4.7 in Symptomatic, and 71.3±9.9 in Unclassified with significant t (P < 0.001). This result agrees with [18]that finds a higher IQ observed in idiopathic generalized (83.7) followed by localized related(81.2) And the lowest IQ in symptomatic epileptic syndrome (65.3) .p value 0.001.[16]had found that the mean IQ in idiopathic generalized epilepsy was 83.7, localization-related epilepsies 81.2Symptomatic epilepsy 65.3, and 67.5 in unclassified epilepsy and syndrome.

While [17]found that epilepsy types were not found to affect the IQ. Regarding seizer type: This study showed significant variation in mean IQ according to seizer type with higher IQ in absence seizer 87.1 followed by GTC with mean IQ of 81.3, while mean IQ In complex partial with secondary generalization is 76, the lowest result found in the mixed type of seizer in which mean IQ 68.1. (P < 0.05). In [17]found that there was no significant difference in the mean IQ between generalized(74.66), partial (79.38), and other types of seizer. Regarding antiepileptic drugs Our study found that 47 % of epileptic children receive one drug with a mean IQ of 82.2, 28% of our sample receive 2 drugs with a mean IQ of 72.8, while children who received more than 3 antiepileptic drugs had the lowest IQ 63.3.p<0.001 This result agrees with [16]found that the mean IQ was 79.6 in those who received one drug,73.9 with 2 antiepileptic drugs & 65.4 in epileptic

children on 3 and more antiepileptic drugs with significant variation. While [18]found that the mean IQ was 77.85 in those who receive one drug,77.16 in those with two antiepileptic & 80.44 in patients with 3 antiepileptic drugs with no significant variation. This result may be due to epilepsy and the epileptic syndrome itself in which symptomatic and encephalopathic epilepsy is associated with low IQ and higher seizer frequency which induce polytherapy.

V. CONCLUSION

Cognitive dysfunction and low IQ are in dramatically increase the risk of epilepsy affecting children even with the lack of mental retardation. The risk factor of subnormal intelligence is the age of onset of a seizure. The prior onset of seizure found with low IQ, the first year of life has an ominous prognosis for those affected by the onset of epilepsy. Epilepsy type and subtype affect intellect proportion at a high risk of mental retardation and subnormal intelligence for epilepsy affected children those with epileptic encephalopathy and symptomatic type than those with localized type and idiopathic. The risk factor for subnormal intelligence and low IQ are multiple anti-epileptic drugs. IQs are low for those who controlled seizures poorly as the IQs are higher for those who controlled seizures properly.The sex of children with epilepsy is not a risk factor for intellectual dysfunction.

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