The Egyptian Journal of Hospital Medicine (October 2020) Vol. 81 (1), Page 1307-1313

Prevalence and Risk Factors of Intellectual Disabilities in Children

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ABSTRACT

Background: Intellectual disabilities in childhood constitutes a major health problem throughout the world and a handicapping illness with long term costly treatment and bad impact on the family. It constitutes a major problem in Egypt affecting the quality of life of children and the welfare of their families.

Objective: To identify the prevalence and risk factors of intellectual disabilities in children aged 2-16 years in the Pediatric Neurology Out-patient Clinic, Al-Azhar University Hospital, Assiut.

Patients and Methods: The present study included one thousand (1000) children randomly selected and examined for the presence of intellectual disabilities from patient attending the clinic, ninety of them (9%) (63 males - 27 females) had intellectual disabilities. The present study has been conducted at the pediatric neurology out-patient clinic of Al-Azhar University in Assiut from 1/11/2018 to 30/6/2019.

Results: There was a significant statistical attachment between intellectual disabilities and family's socioeconomic profile in terms of residence, maternal and paternal education, and Father's job and parent's consanguinity. In the present study the total number of cases was 90, 63 males 27 females, 76% of cases were coming from rural areas while 24% of cases were coming from urban areas. As regards the investigation, neuro-imaging (CT-MRI) was not done in (41.1 %) while normal in (38.9 %), (11.1%) with brain atrophy, (6.7%) with focal lesion and congenital brain malformation represent (2.2 %).

Conclusion: Mentally retarded cases are more common in rural areas and male sex. Socioeconomic factors like education of parents and parental consanguinity play a role in the occurrence of MR.

Keywords: Intellectual Disabilities, Risk Factors, Children

INTRODUCTION

Intellectual disability refers to a group of disorders that have in common deficits of adaptive and intellectual function and an age of onset before maturity is reached [(1)].

The prevalence of intellectual disability depends on the definition, the method of ascertainment, and the population. According to statistics, 2.5% of the population should have intellectual disability, and 75% of these individuals should fall into the mild to moderate range. Rates vary across populations. Globally, the prevalence of intellectual disability has been estimated to be approximately 16.41/1,000 persons in low-income countries, approximately 15.94/1,000 for middle-income countries, and approximately 9.21/1,000 in high-income countries. Overall, intellectual disability occurs more in boys than in girls: 2: 1 in mild intellectual disability and 1.5: 1 in severe intellectual disability. In part, this may be a consequence of the many X-linked disorders associated with intellectual disability, the most prominent being fragile X syndrome [(2)].

Early diagnosis of intellectual disability facilitates earlier intervention, identification of abilities, realistic goal setting, easing of parental anxiety, and greater acceptance of the child in the community. Most children with an intellectual disability first come to the pediatrician's attention in infancy because of dysmorphisms, associated developmental disabilities, or failure to meet age-appropriate developmental milestones. There are no specific physical characteristics of intellectual disability, but dysmorphisms may be the earliest signs that bring children to the attention of the pediatrician. They might fall within a genetic syndrome such as Down syndrome or be isolated, as in microcephaly or failure to thrive. Associated developmental disabilities include seizure disorders, cerebral palsy, hypotonia, and autism; these conditions are seen more commonly in conjunction with intellectual disability than in the general population [(3)].

Children with intellectual disability have higher rates of vision, hearing, neurologic, orthopedic, and behavioral or emotional disorders than do typically developing children. These other problems are often detected later in children with intellectual disabilities. If untreated, the associated impairments can potentially adversely affect the individual's outcome more than the intellectual disability itself [(4)].

Prevention of intellectual disabilities includes: Increasing the public's awareness of the adverse effects of alcohol and other drugs of abuse on the fetus, Preventing teen pregnancy and promoting early prenatal care, Preventing poisonings by teaching parents about locking up medications and potential poisons, Encouraging safe sexual practices to prevent the transmission of diseases and Implementing immunization programs to reduce the risk of

Received:19 /6 /2020
Accepted:18 /8 /2020

intellectual disability caused by encephalitis, meningitis, and congenital infection [5].

Each child with an intellectual disability needs a medical home with a pediatrician who is readily accessible to the family to answer questions, help coordinate care, and discuss concerns. Pediatricians can have effects on patients and their families that are still felt decades later. The role of the pediatrician includes involvement in prevention efforts, early diagnosis, identification of associated deficits, referral for appropriate diagnostic and therapeutic services, interdisciplinary management, provision of primary care, and advocacy for the child and family. The management strategies for children with an intellectual disability should be multimodal, with efforts directed at all aspects of the child's life: health, education, social and recreational activities, behavior problems, and associated impairments. Support for parents and siblings should also be provided [6].

Our study aimed to study the various presentations of mental retardation among children attending the pediatric neurology clinic at Al-Azhar University hospital in Assuit and to identify potential risk factors possibly associated with mental retardation.

SUBJECTS AND METHODS

The present study included one thousand (1000) children randomly selected and examined for the presence of intellectual disabilities from patients attending the clinic. Ninety of them (9%) (63 males - 27 females) had intellectual disabilities. The present study has been conducted at the Pediatric Neurology Out-patient Clinic of Al-Azhar University in Assiut from 1/11/2018 to 30/6/2019.

Inclusion criteria: Children aged 2-16 years and children with intellectual disabilities according to (DSM-V).

Exclusion criteria: Patients less than 2 years and more than 16 years and patients with reading (Dyslexia) or writing disorders.

Ethical consideration:

Oral and written consent was taken from parents or guardians of the patients. The aim of the work was explained to the parents before collection of the data. The privacy of all data collected will be assured. **The work was approved by Al-Azhar Assiut University committee.**

All children included in this study were subjected to:

1- A thorough history was taken from their mothers including the following items:

- Age, residence, and parity and occupation of the mother.
- Age, gender, and order in the family of the child.
- Socioeconomic status.
- Consanguineous marriage.
- Pregnancy condition including (drug intake, smoking, seizures in pregnancy, hospitalization in early pregnancy, severe anemia, frequency of prenatal visits, prior fetal death, birth interval).
- Medical history of the child: age at which mental retardation is diagnosed, history of brain trauma or encephalitis, delivery condition (prematurity, low birth weight, birth at home, breech delivery, difficult birth, perinatal resuscitation), neonatal breathing difficulties, and neonatal diarrhea.
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2- Full clinical examination :

- General examination.
- Systemic examination.
- Neurological examination.
- Investigations: IQ. CT and MRI if needed. Karyotyping if needed. Extended metabolic screen if needed.

Statistical analysis

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

- Independent-samples t-test of significance was used when comparing two means.
- Chi-square (x^2) test of significance was used to compare proportions between two qualitative parameters.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. The p-value was considered significant as the following:
- Probability (P-value)
- P-value <0.05 was considered significant.
- P-value <0.001 was considered highly significant.
- P-value >0.05 was considered insignificant.

RESULTS

Table (1): Demographic distribution of the studied children with intellectual disabilities.

Characteristics	Mental retardation			Total	P-value
	Mild (N=51)	Moderate (N=31)	Severe (N=8)		
Age/year Mean ± SD	5.03±3.58	7.06±4.19	3.38±1.06	5.59±3.82	0.02
P1=0.01, P2=0.61, P3=0.02					
Sex					
Female	16 (31.37%)	10 (32.26%)	1 (12.50%)	27 (30.00%)	0.53
Male	35 (68.63%)	21 (67.74%)	7 (87.50%)	63 (70.00%)	
Residence					
Rural	33 (64.71%)	27 (87.10%)	8 (100%)	68 (75.56%)	0.02
Urban	18 (35.29%)	4 (12.90%)	0	22 (24.44%)	
P1=0.03, P2=0.04, P3=0.28					
Parent Consanguinity					0.045
No	34 (66.67%)	15 (48.39%)	2 (25.00%)	51 (56.67%)	
Yes	17 (33.33%)	16 (51.61%)	6 (75.00%)	39 (43.33%)	
P1=0.10, P2=0.047, P3=0.43					

P-value compared the three groups. A pairwise comparison was done if the p-value was significant (<0.05). P1 compared mild & moderate, P2 compared mild & severe, and P3 compared moderate & severe MR.

The total number of cases was 90, 63 males and 27 females, 76% of cases were coming from rural areas while 24% of cases were coming from urban areas.

Table (2): Distribution of the studied children according to post-natal risk factors.

	Postnatal risk factors	Cases	%
NICU admission	Yes	23	14.4
	No	67	75.6
Respiratory distress	Yes	14	17.8
	No	74	82.2
Seizures	Yes	5	6.7
	No	84	93.3
Poor feeding	Yes	3	10
	No	87	90
Intestinal obstruction	Yes	1	1.1
	No	89	98.9

The presence of problems in the postnatal period such as NICU admission represent (14.4), respiratory distress (14 %), seizures (6.7%), poor feeding represent (10%) and others such as surgical problems (Intestinal Obstruction) represent (1.1 %) were considered risk factors of mental retardation.

Table (3): Distribution of studied children according to the results of the general examination.

Characteristics	Mental retardation			Total	P-value
	Mild N=51	Moderate N=31	Severe N=8		
Dysmorphic features					
No	46 (90.20%)	29 (93.55%)	7 (87.50%)	82 (91.11%)	0.82
Yes	5 (9.80%)	2 (6.45%)	1 (12.50%)	8 (8.89%)	
Head circumference					
Normal	39 (76.47%)	23 (74.19%)	3 (37.50%)	65 (72.22%)	0.07
Below -2 SD	12 (23.53%)	8 (25.81%)	5 (62.50%)	25 (27.78%)	
Visual impairment					
No	51 (100%)	31 (100%)	7 (87.50%)	89 (98.89%)	0.09
Yes	0	0	1 (12.50%)	1 (1.11%)	
Hearing impairment					
No	47 (92.16%)	30 (96.77%)	8 (100%)	85 (94.44%)	0.52
Yes	4 (7.84%)	1 (3.23%)	0	5 (5.56%)	

P-value compared the three groups. A pairwise comparison was done if the p-value was significant (<0.05). P1 compared mild & moderate, P2 compared mild & severe, and P3 compared moderate & severe MR.

Table (4): Distribution of studied children according to their investigation.

Characteristics	Mental retardation			Total	P-value
	Mild N=51	Moderate N=31	Severe N=8		
Neuroimaging(CT\MRI)					
Not done / normal	44 (86.27%)	25 (80.65%)	3 (37.50%)	72 (80.00%)	
Brain atrophy	3 (5.88%)	4 (12.90%)	3 (37.50%)	10 (11.11%)	0.04
Focal lesion	3 (5.88%)	1 (3.23%)	2 (25.00%)	6 (6.67%)	
Congenital brain malformation	1 (1.96%)	1 (3.23%)	0	2 (2.22%)	
P1=0.65, P2=0.01, P3=0.04					
Electro-Encephalogram (EEG)					
Not Done	46 (90.20%)	23 (74.19%)	2 (25.00%)	71 (78.89%)	
Normal	5 (9.80%)	4 (12.90%)	5 (62.50%)	14 (15.56%)	<0.0001
ECG changes	0	4 (12.90%)	1 (12.50%)	5 (5.56%)	
P1=0.03, P2<0.0001, P3=0.01					
Karyotyping is done					
No	47 (92.16%)	30 (96.77%)	7 (87.50%)	84 (93.33%)	0.57
Yes	4 (7.84%)	1 (3.23%)	1 (12.50%)	6 (6.67%)	
Metabolic screening is done					
No	43 (84.31%)	31 (100%)	8 (100%)	82 (91.11%)	0.04
Yes	8 (15.69%)	0	0	8 (8.89%)	
P1=0.02, P2=0.58, P3=1.00					

P-value compared the three groups. A pairwise comparison was done if the p-value was significant (<0.05). P1 compared mild & moderate, P2 compared mild & severe, and P3 compared moderate & severe MR.

Neuro-imaging (CT-MRI) was not done in (41.1 %) while normal in (38.9 %), (11.1%) with brain atrophy, (6.7%) with focal lesion and congenital brain malformation represent (2.2 %). Regarding karyotyping, 93.3% of cases were not done, while 6.7% done and reveal Down syndrome, The same study revealed that only 8.9% of cases did the metabolic screening.

Table (5): Distribution of studied children according to their causes and associated disorders.

Characteristics	Mental retardation			Total	P-value
	Mild N=51	Moderate N=31	Severe N=8		
Down syndrome	4 (7.84%)	1 (3.23%)	1 (12.5%)	6 (6.67%)	0.57
Hypothyroidism	1 (1.96%)	1 (3.23%)	0	2 (2.22%)	0.84
Phenylketonuria	1 (1.96%)	0	2 (25.00%)	3 (3.33%)	0.001
P1=1.00, P2=0.046, p=0.04					
Cerebral palsy	4 (7.84%)	3 (9.68%)	0	7 (7.78%)	0.66
MR with epilepsy	1 (1.96%)	2 (6.45%)	0	3 (3.33%)	0.47
Post CNS infection	2 (3.92%)	1 (3.23%)	0	3 (3.33%)	0.85
Brain trauma	1 (1.96%)	1 (3.23%)	1 (12.50%)	3 (3.33%)	0.30
Unexplained etiology	37 (72.55%)	22 (70.97%)	4 (50.00%)	63 (70.00%)	0.43

P-value compared the three groups. A pairwise comparison was done if the p-value was significant (<0.05). P1 compared mild & moderate, P2 compared mild & severe, and P3 compared moderate & severe MR.

The causes and associated disorders among children with mental retardation; cerebral palsy represented (7.8%) of cases with mental retardation, unexplained cause represented (70%), Down syndrome represented 6.7%, hypothyroidism represented 2.2%, phenylketonuria represented (3.3%), brain trauma represented 3.3%,post-CNS infection cases represented (3.3%), and MR associated with epilepsy (3.3%).

Table (6): Distribution of studied children according to parameters of their IQ test.

IQ test	Mental retardation			Total	P-value
	Mild N=51	Moderate N=31	Severe N=8		
Vocabulary	9 (17.65%)	10 (32.26%)	8 (100%)	27 (30.00%)	<0.0001
P1=0.13, P2<0.0001, P3=0.001					
Comprehension	9 (17.65%)	11 (35.48%)	0	20 (22.22%)	0.048
P1=0.07, P2=0.20, P3=0.047					
Verbal relation test	6 (11.76%)	7 (22.58%)	0	13 (14.44%)	0.19
Abstract visual reasoning	1 (1.96%)	0	0	1 (1.11%)	0.68
Quantitative reasoning	12 (23.53%)	0	0	12 (13.33%)	0.005
P1=0.003, P2=0.19, P3=1.00					
Bead memory test	3 (5.88%)	1 (3.23%)	0	4 (4.44%)	0.70
Memory for sentences	2 (3.92%)	1 (3.23%)	0	3 (3.33%)	0.85
Short term memory	9 (17.65%)	1 (3.23%)	0	10 (11.11%)	0.08

P-value compared the three groups. A pairwise comparison was done if the p-value was significant (<0.05). P1 compared mild & moderate, P2 compared mild & severe, and P3 compared moderate & severe MR.

Table (7): Distribution of studied children according to their degree of mental retardation.

Mental retardation	Number (%)
Mild (IQ = 69 – 50)	51 (56.67%)
Moderate (IQ = 49– 35)	31 (34.44%)
Severe (IQ = 34 – 20)	8 (8.89%)

Intelligence Quotient (Stanford Binet test) was estimated for the cases; Mild mental retardation was the most common (56.7 %) while moderate MR (34.4%) and severe MR (8.9%).

DISCUSSION

In the present study, the total number of cases was 90, 63 males and 27 females, 76% of cases were coming from rural areas while 24% of cases were coming from urban areas.

This is in agreement with a study done in Pakistan which found that the prevalence was higher in the rural than in urban areas and in children whose mothers have no formal education (58.3%) versus some formal education [(7)].

There is a definite male predominance among patients diagnosed to have mental retardation. This male predominance was documented in many other studies. The gender ratios for mortality and morbidity did not differ in the severe/profound ranges of cognitive impairment (i.e., male-to-female ratio, 1.2:1in the severe range of mental retardation and 1.4:1 in mild mental retardation) [(8)].

Also, in a study conducted in Assuit Governorate, Egypt among cases with mental sub-normality, The sample comprised 3000 randomly selected subjects from three localities: one urban (Assuit City) and two adjacent rural villages, the prevalence varied in the three locations: 3.4% in Assiut City, and 3.8% and 4.4% in two rural locations [(9)].

In the present study, the higher percentage of consanguinity was found among the families of cases (43.5 %).

This is in agreement with a study conducted in Pakistan, where consanguinity was found more in cases with mental retardation (60.9%) [(7)].

In contrast, a study conducted to investigate the parental consanguinity among mentally retarded children; it was found that (63%) were born to non-consanguineous marriage [(10)].

In a study conducted in Assiut Governorate, Egypt Parental consanguinity was found in 65% of the total sample, which emphasizes the role played by that factor in the etiology of mental subnormality in Egypt [(9)].

Guidelines from the American Academy of Pediatrics recommend that the evaluation of a child with MR/ID includes extensive family history, with particular attention to family members with mental retardation, developmental delays, consanguinity, psychiatric diagnoses, congenital malformations, miscarriages, stillbirths, and early childhood deaths. The clinician should construct a pedigree of 3 generations or more [(11)].

In the present study the presence of problems in the postnatal period such as NICU admission represent (14.4), respiratory distress (14 %), seizures

(6.7%), poor feeding represent (10%) and others such as surgical problems (Intestinal Obstruction) represent (1.1 %) were Considered risk Factors of Mental Retardation.

In other study evaluated the contribution of prenatal, perinatal, neonatal, and postnatal factors to the prevalence of cognitive disabilities among children aged 2-9 years in Bangladesh, neonatal seizures (1%), neonatal infection (9.3%), and postnatal brain infection (1.3%) are associated with mental retardation [12].

As regards the general examination, in the present study, dysmorphic features represent (8.9 %), head circumference below -2 SD represents (27.8%), Visual impairment (1.1 %), and impaired hearing (5.6 %).

In another study, they found that 42% of the children with MR had 3 or more minor anomalies [11].

In another study, the MR children were found to have a higher number of minor anomalies per child. In their group predominated those with four or more anomalies (56.9%), whereas among healthy children only 7.7% had four anomalies or more [13].

Several physical disorders have increased association with intellectual disability, and these rates are generally higher among those with severe-profound severity levels. About 10% of children with an intellectual disability or have a hearing impairment [14].

In another study done by Murphy and his colleagues. Sensory deficits are present in 2% of children with milder degrees of MR and 11% of children with severe MR [15].

In other studies, occult visual and auditory deficits were found in 5% of those with MR/ID, particularly when refractive errors are considered [8].

As regards the investigation, neuro-imaging (CT-MRI) is not done in (41.1 %) while normal in (38.9 %), (11.1%) with brain atrophy, (6.7%) with focal lesion and congenital brain malformation represent (2.2 %). Regarding karyotyping, 93.3% of cases are not done, while 6.7% done and reveal Down syndrome, The same study revealed that only 8.9% of cases done metabolic screening.

In another study, Clinical history and examination gave important clues to the etiology in (72.9%) patients. Neuroimaging was abnormal in 91 out of 114 children (79.8%), with aetiological findings in 48 children [12].

In a study conducted by Moeschler and Shevell inborn errors of metabolism were considered a rare cause of DD/MR (approximately 1%) [16].

Van Karnebeek *et al.* reported on 9 studies of the use of MRI in children with mental retardation. The mean rate of abnormality found was 30%, with a range of 6.2% to 48.7%, and more abnormalities were found in children with moderate to profound mental retardation versus borderline to mild mental retardation (means of 30% and 21.2%, respectively) [17].

In the present study, the causes and associated disorders among children with mental retardation; cerebral palsy represent (7.8%) of cases with mental retardation, unexplained cause represented (70%), Down syndrome represented 6.7%, hypothyroidism represent 2.2%, phenylketonuria represent (3.3%), brain trauma represent 3.3%,post-CNS infection cases represent (3.3%), and MR associated with epilepsy (3.3%).

In a study conducted in Saudi Arabia From the medical history, possible factors predisposing to mental retardation were classified as follows: meningitis (15.3% of cases), cerebral palsy (13.5%), Down syndrome (12.2%), mother's exposure to X-rays (8.0%), hydrocephalus (5.4%), brain trauma (4.5%), unknown etiology (41.1%) [18].

In a study conducted in Assiut Governorate, Egypt, Clinico-genetic classification revealed the following: idiopathic mental subnormality (MS) 27.6%, Multiple congenital anomalies/mental retardation (MCA/MR) syndromes 24.1%, primary CNS defect 12.9%, Fragile X syndrome 10.3%, inborn errors of metabolism 9.5%, teratogenic and environmental causes 5.2%, MS and epilepsy 4.3%, chromosomal disorders 3.4% and MS associated with psychiatric disorder 2.6% [9].

In a study done by Harbour and Maulik, most cases were of unknown etiology (30-50%). Down syndrome is the most common known cause and accounts for about 5-20% of all cases. Congenital hypothyroidism accounts for 1-2% of cases [19].

Different studies in the review showed that among children with mental retardation, autism is present in about 25%, ADHD in about 10%, and cerebral palsy in 7-30%, depending on the severity of mental retardation [20].

Intelligence Quotient (Stanford Binet test) was estimated for the cases; mild mental retardation was the most common (56.7 %) while moderate MR (34.4%) and severe MR (8.9%).

In agreement with our study, a study done by Reynolds and Dombeck revealed that mild mental retardation was the most common (85%) and profound mental retardation was the least common (1% - 2%of patients) while the moderate 10% and severe 3% - 4% [21].

In contrast, in a study conducted in Saudi Arabia, 157 (29.1%) of the children had mild, 189 (35.0%) moderate and 194 (35.9%) severe mental retardation, giving a population prevalence's of 2.6, 3.1, and 3.2 per 1000 population for mild, moderate and severe retardation respectively [18].

CONCLUSION

Mentally retarded cases are more common in rural areas and male sex. Socioeconomic factors like

education of parents and parental consanguinity play a role in the occurrence of MR. Among important risk factors of MR are duration and complication during delivery as well as the occurrence of exposure to drugs, respiratory distress, seizures, change in Consciousness, and others as trauma. Meningitis, umbilical hemorrhage. The most common mental retardation type in our study group was mild mental retardation.

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