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ORIGINAL ARTICLE

Inetellectual disabilities in children

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Abstract

Mental retardation, more appropriately known as intellectual disability (ID), is a common neurologic condition in childhood and adolescence. The clinical deficits involve cognition and adaptive behavior, and its onset occurs before 18 years of age. There is a number of etiologies, ranging from prenatal, perinatal and postnatal factors to cases of genetic origin. Many genetic syndromes are associated with ID. There is no specific treatment. General care requires the participation of several professionals, while the pediatrician acts as the coordinator of referrals to a range of specialties, according to the needs of the clinical picture.

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INTRODUCTION

Mental retardation is one of the most common neuropsychiatric disorders in children and adolescents.[1]

The concept of intellectual disability (ID) has been modified over several years with numerous definitions and terminologies such as intellectual disability, mental retardation, and mental disability. According to Krynskis et al. (1969), ID has a complex clinical spectrum resulting from different etiologies and is characterized by insufficient intellectual development[2].

The definition of mental retardation is based on the classification systems reported below[3,4].

The term "intellectual disability" corresponds to mental retardation in the International Code of Diseases (ICD)-10, which uses the intelligence quotient (IQ) as the most important defining aspect, according to the following classification system:

Mild Mental Retardation (F70)
Moderate Mental Retardation (F71)
Severe Mental Retardation (F72)
Profound Mental Retardation (F73)

Despite numerous criticisms of the system of standardization and assessment of intelligence, the statistical criteria for the practical classification of mental retardation proposed by the World Health Organization (WHO) are shown below:

Mental Retardation	IQ	ICD
MILD	50–70	F70
MODERATE	36–50	F71
SEVERE	20–35	F72
PROFOUND	<20	F73

The average IQ in the general population is 70.

Another classification can be found in the Diagnostic and Statistical Manual of Mental Disorders (DSM), which is in its fifth version. In the DSM-V, mental retardation is replaced by intellectual disability, beginning in the developmental period with functional deficits in both intellectual and adaptive strategies in the conceptual, social, and practical domains[5,6].

Deficits in intellectual functions are confirmed by clinical assessment and standardized and individualized intelligence tests are performed on children starting from age 5 years, whereas adaptive deficits limit the performance of one or more daily activities, thus compromising communication, the social aspect with repercussions in various environments including home, school, and work[5,6].

ID is a clinical condition characterized by obvious limitations in intellectual function and adaptive behavior (the latter expressed as conceptual adaptive, social, and practical skills), and limitations must be detected before age 18 years[7].

ID should be diagnosed after age 5 years, when intelligence can be measured through IQ testing. Before this stage, a term which is widely used but very controversial is delayed neuropsychomotor development[8].

An IQ of <68 on the Stanford–Binet scale or <70 on the Wechsler test indicates the presence of intellectual dysfunction[9].

DEFINITION OF INTELLIGENCE[8,9]

It is a general mental ability. It includes reasoning, planning, problem solving, abstract thinking, understanding of complex ideas, quick learning, and learning from experience[2,9].

The concept of IQ was first established by Binet and Simon from data relating chronological age and mental age.

In the DSM-V, mental retardation was replaced by intellectual disability. The IQ is not the central criteria for diagnosis; instead, diagnosis is based on the level of adaptive functions in the domains of social, conceptual, and practical skills. There are four levels of severity: mild, moderate, severe, and profound, based on the three areas of adaptive behavior[6].

ADAPTIVE BEHAVIOR[10]

Adaptive behavior brings together the conceptual, social, and practical skills learned to function in daily life (Table 1)[10].

Table 1. Examples of Adaptive Skills.

CONCEPTUAL: Language (receptive and expressive), reading and writing, mathematical reasoning (ex: concepts of money), self-direction, and memory
SOCIAL: Interpersonal, responsibility, self-esteem, following rules, obeying laws, and credibility
PRACTICAL: Includes daily life activities such as eating, using the bathroom, dressing, sphincter control, and movement; instrumental activities of daily life such as preparing meals, taking care of the house, taking medications, dealing with money, using the phone, and shopping

EPIDEMIOLOGY[11,12]

The prevalence of ID in the general population is 1%–3%, according to epidemiological studies. It is more frequent in males and in less privileged socioeconomic classes.

ETIOLOGICAL FACTORS OF MENTAL RETARDATION[8,13,14]

Numerous factors cause ID, including genetic and teratogenic factors, such as alcohol use during pregnancy, infectious agents, and congenital defects of the central

nervous system (CNS), which despite being congenital are not necessarily genetically determined (Table 2). The genetic causes responsible for ID include numerical or structural chromosomal aberrations, microdeletions or microduplications, or gene defects (monogenic or oligogenic); ID may also result from a combination of genetic and environmental factors in the case of multifactorial inherited diseases (Table 3). Innate metabolic errors account for 1%–5% of ID cases.

Genetically determined causes of ID may occur in an isolated manner (non-syndromic) or associated with other signs and physical symptoms (syndromic) that suggest a specific picture, i.e., in addition to the ID, the patient presents features that characterize a syndrome, e.g., Down syndrome or trisomy 21. Whether the ID is syndromic or not, patients and their families are negatively affected.

Several studies have demonstrated the main etiological factors of ID. One study in Colombia evaluated 239 patients with ID and found that the main causes were prenatal (infections and prematurity), perinatal (hypoxia and hyperbilirubinemia, HIV, and congenital hypothyroidism), and postnatal factors (CNS infections and head trauma). In this study, the most frequent causes of definitive diagnosis was environmental (36.4%), followed by genetic (23.8%) and multifactorial (4.2%), and the remainder had no definite diagnosis (23.8%)[13].

Table 2.[13] Diferent factors on Intellectual Disability.

ENVIRONMENTAL FACTORS: (prenatal, perinatal, and postnatal) These are extrinsic factors that affect the development of the CNS:
PRENATAL FACTORS: Congenital infections: toxoplasmosis, rubella, cytomegalovirus, syphilis, intrauterine malnutrition, brain malformations, maternal exposure to radiation, poisoning from alcohol abuse during pregnancy (fetal alcohol syndrome), use of drugs such as cocaine during pregnancy, diseases such as diabetes, and thyroid alterations
PERINATAL FACTORS: Perinatal anoxia, childbirth trauma (labor dystocia), encephalopathy (hypoxic ischemic), hypoglycemia, prematurity, low birth weight, birth infections, and hemorrhages
POSTNATAL FACTORS: Infections of the central nervous system such as meningoencephalitis and encephalitis, cranioencephalic trauma, demyelination (primary or secondary causes), protein calorie malnutrition, radiation, mercury or copper poisoning, severe epilepsy syndromes such as West syndrome, and low socioeconomic level

These percentages vary greatly depending on the population studied, the methodology of the study, the time when the study was conducted, and the availability of genetic tests.[13]

ID is caused by numerous environmental and genetic factors, but in 55%–60% of cases, the cause remains undefined.[16]

In other studies, the genetic causes of ID were identified in 17%–40% of the cases examined, whereas environmental causes, CNS malformations, and multifactorial conditions accounted for almost 30% of cases (Table 4).[17]

Table 4. [17] Multifatorial factors on Intellectual Disability.

Diagnosis	Prevalence (%)
Chromosomal abnormality	4-28
Recognized syndromes	3-7
Known monogenic conditions	3-9
Structural abnormalities of the CNS	7-17
7–17	2-10
Complications of prematurity	5-13
Environmental/teratogenic causes	3-12
Cultural: family member with MR	1-5
Unique monogenic syndromes	1-5
Metabolic causes	30-50
Unknown	30–50

Source: Curry et al. 1997

The following are a few syndromes that occur concomitantly with ID:

FETAL ALCOHOL SYNDROME OR FETAL ALCOHOL SPECTRUM DISORDERS[18]

This is observed in the offspring of women who consume alcohol during pregnancy. The condition is characterized by ID, microcephaly, pre- and postnatal growth retardation, facial dysmorphisms (epicanthic folds, short nose, small eye opening, flat face), kidney anomalies, cardiopathy, and short stature.

Table 3. Genetic factors on Intellectual Disability[14,15]

Single gene: (>19,000 monogenic diseases)	Chromosome	Multifactorial Polygenic
Dominant (neurofibromatosis type 1 NF1 gene located at 17 q 11.2; tuberous sclerosis with mutation of the TSC2 gene); Noonan and Cornelia de Lange syndrome Recessive: (most innate metabolism errors) X-linked: Fragile X syndrome; Rett syndrome Mitochondrial diseases: MELAS, Alpers syndrome, and Kearns–Sayre	Numerical: Down syndrome, trisomy 18, and trisomy 13 Structural: Deletion of 4p- and 9p-	Doenças complexas: autismo, doenças psiquiátricas

Although fetal alcohol syndrome is seen in children of alcoholic mothers, no amount of alcohol is safe during pregnancy, and consequently pregnant women are advised not to drink throughout pregnancy. Alcohol affects the neuron maturation process during migration and myelination and favors the production of free radicals.

INBORN ERRORS OF METABOLISM[19]

These are genetic diseases with chronic clinical manifestations at any age. The clinical manifestations of inborn errors of metabolism (IEM) are nonspecific and can be confused with more common diseases, a factor that contributes to late diagnosis. Affected patients may have recurrent episodes of metabolic decompensation with alterations in multiple organs, acute or progressive neurological symptoms, and delayed neuropsychomotor development, in addition to behavioral and learning problems. Some of these IEMs, such as phenylketonuria, can be detected by the Guthrie test. Other tests may be performed in the laboratory to detect illnesses such as maple syrup urine disease, galactosemia, and fructosemia.

Numerous studies have linked ID with IEMs. International databases contain more than 7300 studies relating the topics "inborn errors of metabolism" and ID. One disease that requires early diagnosis and immediate treatment is phenylketonuria. From a neurological point of view, the clinical signs and symptoms of a patient with phenylketonuria appear in the first months of life and include irritability and delayed neuropsychomotor development, as well as later symptoms involving learning difficulties and behavioral symptoms such as attention deficit hyperactivity disorder (ADHD). The main neurological manifestation of phenylketonuria is ID. Phenylketonuria was the first IEM in which the relationship between increased levels of a toxic substance and the development of ID was identified. Early diagnosis and immediate implementation of a diet with restricted phenylalanine remains the most effective treatment for patients with phenylketonuria and can prevent neurological damage including ID.

FRAGILE X SYNDROME[15,16,20]

This is the second cause of IDs of genetic origin. It affects 1 in every 4000–6000 newborn males and 1 in every 8000–9000 newborn females.

The molecular finding is a mutation that suppresses the transcription of the *FMR1* gene, which is located in the Xq27.3 region and characterized by the expansion of CGG trinucleotides.

In the normal population, 5–44 CGG repeats in this region are normal. Patients with 50–200 repeats are considered pre-mutation carriers, and those with >200 repeats are considered complete mutation carriers for this syndrome.

Clinically, a male patient with the complete mutation usually has moderate ID, is shy and holds poor eye contact, and is hyperactive and averse to touch. Consequently, many of these patients are on the autism spectrum. They also have large ears, elongated faces, macroorchidism, joint hyperextension, and epileptic seizures.

Male patients with the pre-mutation in adulthood may present with tremor syndrome and ataxia associated with fragile X syndrome (FXS). Females with the complete mutation demonstrate mild ID and timidity and may develop early menopause. Approximately 21% of female patients with pre-mutation reach menopause before age 40, a condition known as early ovarian failure. This syndrome is diagnosed by investigating the mutation of the *FMR1* gene using polymerase chain reaction (PCR) or the Southern blotting technique (gold standard).

The American College of Medical Genetics recommends analysis of the *FMR1* gene for 1) male and female patients with ID or autism spectrum disorder, especially when there are physical and behavioral characteristics of FXS, a family history of FXS, or a relative with ID of unknown cause; 2) individuals who wish to know the risk to their offspring because they have a family history of FXS or ID of unknown cause; 3) women with ovarian failure, especially if there is a family history of early menopause, cases of ID of unknown origin, and cases of FXS; 4) individuals with late manifestation of ataxia/tremor of unknown cause, cases of ID of unknown cause, or family history of FXS.

Inheritance of FXS is linked to the X chromosome and is seen in approximately 2.5% of boys and 1% of girls with ID. Because this syndrome is hereditary, diagnosis of these children is essential to guide parents regarding the risk of FXS also being present in future children. FXS should be considered in children with ID or autism, especially when these are associated with physical and behavioral changes or when there is occurrence of FXS in the mother's family or ID of unknown cause.

Many genetic diseases are responsible for ID, and the description of each disease would be exhaustive, considering that various environmental and genetic factors are responsible for ID and that a large majority of ID cases (50%–60 %) still do not have a defined cause.

DOWN SYNDROME[15]

Down syndrome or trisomy 21 is the most common cause of ID.[1] It is considered the most frequent chromosomal anomaly in humans compared with other trisomies, such as trisomy 18 and 13. Its incidence is estimated at 1:800 live births, affecting all races and social classes. Affected children have an average IQ of 50, and diagnosis is usually suspected from clinical manifestations such as hypotonia, brachycephaly, macroglossia, flattened face, down-slanting palpebral fissures, protruding tongue, single palmar crease,

hallux diverging from the other toes, and malformations of multiple organs and/or systems.

CINICAL PRESENTATION OF INTELLECTUAL DISABILITIES[21-26]

Early diagnosis of ID contributes to an earlier intervention with identification of skills, better acceptance of the child in the community, and parental anxiety reduction. The majority of children present with delayed neuropsychomotor development or dysmorphisms as infants. There are no specific physical alterations in cases of ID, but dysmorphisms found in children may represent the first signs. Newborns show a lack of response to visual and auditory stimuli, and postural changes such as hypotonia or hypertonia and feeding difficulties are present. Severe ID is usually identified by around age 3 years. Mild cases of ID are diagnosed later in the early school years when the child cannot keep up with the academic or social demands typical of that age, and the child's limitations according to academic demands are observed later. In adolescents, mild ID is not easily diagnosed, and many individuals are diagnosed with learning disorders (such as dyslexia) or mask their behavior, causing them to be described as "aggressive" or "incompetent."

In the case of a genetic syndrome like Down syndrome, the classical clinical signs show the etiology of ID, but other indirect signs such as microcephaly or macrocephaly also lead to clinical suspicion. Other conditions usually accompany ID, such as cerebral palsy, epilepsy, hypotonia in infants, and autism. Another cause of ID in girls is Rett syndrome; the first symptoms occur after 6–18 months of normal development, when the child loses the ability to speak and exhibits stereotypical movements of the hands, seizures, and respiratory changes and develops motor abnormalities such as gait impairment. The gene involved in Rett syndrome is *MECP2*.

Children with severe or profound ID usually require earlier attention because they present with clinical impairment, some dysmorphic alterations and psychiatric and behavior disorders, which lead the clinician to consider global cognitive delay.

Patients with mild ID are not quickly diagnosed and are referred for evaluations to various professionals when they start lagging behind in academics. It is not easy to differentiate mild ID from a learning disorder, and the most frequent complaints from parents in the pediatric clinic are speech delay, poor school performance, and changes in behavior.

In learning disorders, specific academic skills are significantly affected, whether it is reading, writing or mathematics. Examples in this category are dyslexia and dyscalculia.

Children with ID usually have other associated clinical conditions, such as visual, hearing, orthopedic, behavioral, and emotional disorders. Some of these disorders are detected at a late stage in children with ID, and if not treated, they may potentially affect the individual's performance, which is sometimes more serious than the ID itself. The most common problems associated with ID are motor impairment, seizures, and behavioral and emotional disorders. The greater the severity of the ID, the greater the number and severity of the associated pathologies.

DIAGNOSIS OF INTELLECTUAL DISABILITY: GENERAL PHYSICAL AND NEUROLOGICAL EXAMINATION AND INVESTIGATION OF DYSMORPHISMS

Anamnesis and physical examination: investigate family history for neurological diseases and ID, history of consanguinity between parents and among family, parental education level, history of pregnancy and childbirth, and family tree. Physical examination: measure skull circumference, inspect the skin, general physical and neurological examination, and investigate congenital anomalies (some are subtle)[14,23].

The examinations most frequently used when investigating ID are neuroimaging examinations such as computed tomography and magnetic resonance imaging (MRI) of the skull; these are mostly applied in cases of microcephaly, macrocephaly, seizures, delayed psychomotor development, and focal neurological signs[27]. Cranial MRI has higher sensitivity than cranial computed tomography, except in suspected congenital infections. The main changes found in cranial MRI were dysplasia of the corpus callosum, persistence of the cavum septum pellucidum and/or vergae, ventriculomegaly, vermian hypoplasia, cortical dysplasias, and enlargement of the subarachnoid space[28,29]. Other tests may be ordered, such as electroencephalography (EEG) and video EEG, according to the clinical condition, because these are more specific examinations and are not ordered as screening tests. Examinations should be ordered according to the clinical suspicion based on the clinical history, physical examination, and assessments by other specialized professionals.

The examinations ordered to investigate ID usually include evaluation of thyroid function, congenital infections (TORCH and Zika virus screening), levels of serum ammonia (in suspected cases of urea cycle disorders), and homocysteine (homocysteine disorders). Screening for hearing and visual disabilities and assessment of neuropsychomotor development are also performed if autism spectrum disorder is suspected[23].

The frequency of chromosomal abnormalities in patients with ID varies from 4% to 34%; therefore, in evaluating a patient with ID, conventional karyotyping or tests with more complex techniques (which will be described later) should be requested[14,23].

Other examinations, which are less frequent but also ordered for ID, include determination of the levels of organic acids and amino acids in the urine, lactate and pyruvate in the blood and cerebrospinal fluid, and serum creatine kinase.

Few metabolic diseases occur alongside ID, with a prevalence reaching 5% according to some studies. IEMs are among the causes of ID, and when these are clinically suspected, examinations should be requested according to the need to clarify the diagnosis.

Chromosomal anomalies and gene mutations can cause ID. These anomalies, which are detected by conventional techniques, generally result in ID-related syndromes because they cause changes in several genes including trisomy 21, which is a common genetic cause of ID. Recently, new techniques have been used when traditional karyotyping does not reveal alterations; these include microarray analysis, which is used to investigate causes of ID. Microdeletions and microduplications are responsible for 15% of the causes of ID. One example of a subtelomeric microdeletion syndrome is 1p36 deletion syndrome[13,14,17,27].

In general, investigation of ID is based on clinical history, laboratory tests, genetic testing such as Giemsa banding, more advanced techniques for microdeletions or microduplications such as comparative genomic hybridization (array CGH), fluorescent in situ hybridization hybridization (FISH), and exome sequencing[14].

The etiologic factors of ID include genetic causes that account for 17%–40% of the cases examined. The conventional cytogenetic examination (karyotype with Giemsa banding) detects chromosomal anomalies. This is a routine technique for diagnosing ID. It is a sensitive and cost-efficient technique, but it does not detect very small anomalous structural segments. Another examination capable of identifying 15%–20% of ID cases is array CGH.

Array CGH is a molecular cytogenetics technique that identifies chromosomal alterations; it allows the simultaneous study of the entire human genome by identifying duplications, deletions of chromosome segments, deletions, and duplications. Array CGH detects changes that are not seen in conventional karyotyping, and this test is officially recommended by the American Academy of Genetics for the diagnosis of children and adults with suspected genetic syndromes, delayed psychomotor development, IDs, and autism spectrum disorder[30].

All changes detected by array CGH can be researched in international databases of variants that catalog the clinical results with the gene location and function; interpretation of results requires trained professionals because many of the changes detected represent variations in the numbers of copies without clinical significance or with unknown clinical significance. Array CGH is a method that permits a refined analysis of the entire genome, and for this reason, it has facilitated the diagnosis and identification of molecular bases of multiple genetic changes such as ID.[30,31]

The advent of FISH has allowed specific regions to be detected. This technique is used to detect submicroscopic chromosomal anomalies, such as those in microdeletion syndromes including Prader–Willi, Angelman, velocardiofacial, Digeorge, and Williams syndromes.

DNA probes are used for specific mutations, with multiplex ligation-dependent probe amplification (MLPA) based on PCR to diagnose Rett syndrome (MECP2)[13,14,17,31].

IDs have genetic causes, but more than half of the cases are still considered idiopathic. The application of classical cytogenetics and molecular techniques has led to accurate diagnosis in some cases. Techniques used to investigate microscopic rearrangements in patients with idiopathic ID include Giemsa banding, FISH, MLPA, and array CGH[33].

Advances in next-generation sequencing have reduced the time and costs involved in sequencing the human genome. This new technology has led to whole exome sequencing and has mainly been applied in clinical practice in cases of suspected monogenic inheritance (a single gene involved in the disease) or significant genetic heterogeneity (several genes responsible for the same condition).[32]

Some publications have suggested that whole exome sequencing should replace microarrays as the first-line test. It should be noted that in spite of the various diagnostic approaches, including microarrays and exome sequencing, the cause of nonspecific ID remains unclear in up to 60% of cases.[34] Rare isolated or *de novo* mutations are not inherited from parents and represent an important cause of ID; exome sequencing is used with a diagnostic strategy for their detection.[34]

In severe cases of ID for which there is a greater chance of finding a genetic causal defect, the diagnostic rate is 42% after complete exome sequencing, which is the most sensitive technique available at the moment as it sequences virtually the entire human genome.[33]

The exome sequencing technique requires a blood sample for DNA extraction. This technique permits the analysis of approximately 20,000 genes and has been used in recent years in research to discover new genes linked to diseases and is also an important diagnostic tool[33]. It is an additional tool for defining the etiology in cases in which conventional karyotyping and microarray CGH do not identify changes[33]. Exome sequencing is an excellent method for diagnosing diseases with significant genetic heterogeneity, such as ID[32,33,36].

Recently, in Brazil, the National Agency of Supplementary Health (NSA) incorporated microarray analysis as a complementary diagnostic method, providing guidelines for use in cases of delayed psychomotor development or IDs; however, this genetic test was not incorporated as a first-line diagnostic examination, and conventional karyotyping and other clinical criteria are still required.[35]

Within the Brazilian Unified Health System, the National Policy of Integrated Care for People with Rare Diseases, which was made official by Decree 199 of January 30, 2014, issued by the Ministry of Health, establishes

the use of microarrays for the etiological investigation of clinical conditions that involve IDs. Both the Brazilian public and private health systems have not yet implemented the systematic use of complete exome sequencing as a diagnostic test. This test is generally paid for by the family and is sometimes obtained through court order.[35]

Exome refers to a set of exons present in the genome of most living beings. The exome is a small portion of the human genome that corresponds to the set of all exons of the genome, i.e., the codifying part of the genome. The exome accounts for <2% of the human genome, but most mutations with pathogenic potential that are responsible for genetically determined illnesses can be found within this small portion of DNA.[35]

Whole exome sequencing has its limitations; because it is designed to evaluate only exons, alterations outside the exons, which may be responsible for the ID, are not analyzed using this technique. Whole exome sequencing analyzes the DNA base pair sequence, which means that changes in the number of copies (microdeletions, microduplications), structural changes of the chromosomes, and epigenetic changes (methylation, acetylation) cannot be confirmed in this analysis and require confirmation through other available techniques such as Giemsa banding, microarray CGH, FISH, and MLPA.

NEUROPSYCHOLOGICAL TESTS[37]

The diagnosis of ID needs to be complemented by neuropsychological tests using individualized intelligence and adaptive behavior tests. The test most commonly used in infants is the Bayley Infant Development Scale, which assesses language, visual problem-solving skills, behavior, and motor skills. The Wechsler scales are used in children aged >3 years; the WPPSI–III is used in children aged 3–7 years and the Wechsler Intelligence Scale for Children-4th Edition (WISC-IV) is used in children with a mental age of >6 years.

The most commonly used test for adaptive behavior is the Vineland Adaptive Behavior Scale, which involves an interview with the parents or caregivers and teachers and assesses adaptive behavior in four areas: communication, activities of daily living, socialization, and motor skills. The results of neuropsychological tests should be carefully interpreted, and some factors must be taken into consideration such as the ethnic and cultural context, educational level, motivation, cooperation, and impairments associated with ID.

DIFFERENTIAL DIAGNOSIS OF INTELLECTUAL DISABILITY[26]

Some disorders can affect cognitive ability and adaptive behavior. These conditions mimic ID, and others are associated with some dysfunctions. These include depression, auditory and visual deficits, learning disorders, and some epileptic syndromes. Other disorders, such as cerebral palsy and autism spectrum disorders, are associated with ID. In cases of cerebral palsy, motor skills are always more affected than cognitive abilities, and in autism spectrum disorders, social skills and adaptive language are most affected.

TREATMENT OF INTELLECTUAL DISABILITY[23,25,27]

ID does not have a specific treatment, but associated impairments may be treated by intervention and pharmacological treatment. The ID may be associated with challenging behavior (aggression, oppositional–defiant disorder) as well as mental illness, such as mood disorders, anxiety, epilepsy, and behavioral disorders. The use of medication depends on the need of the patient; psychostimulants are used for the treatment of ADHD, neuroleptics for self-harming and aggressive behavior, and serotonin reuptake inhibitors for depression and obsessive–compulsive disorder. ID is often associated with aggressive behavior and self-harming, as is observed in FXS and Smith–Magenis, Rett, and Prader–Willi syndromes, and pharmacological intervention may consist of serotonin inhibitors or buspirone.

A child with ID needs medical care with frequent monitoring by the pediatrician, with participation of the family and school. The strategy to manage children with ID covers various aspects such as health, education, leisure and social activities, and treatment of associated diseases and behavioral problems.

ID usually requires the participation of several professionals in addition to the pediatrician. These may include psychologists, physiotherapists, nutritionists, social workers, speech therapists, nurses, and occupational therapists, as well as medical specialists such as neuropediatricians, psychiatrists, and geneticists.

As for education, it is important that the educational programs are relevant to the needs of the child and adapted to the individual abilities.

Leisure activities should be considered for children with ID. Children with ID usually do not encounter problems when playing with normally developing children, but teenagers encounter more difficulties in social interactions and leisure activities.

Participation in sports should be encouraged even if not at a competitive level because sports help with related issues such as weight loss, development of motor coordination and cardiovascular capacity, and self-esteem improvement. Social activities are also important, such as outings and participation in typical events, gatherings, and dances.

Many families adapt to having a child with ID, but others have emotional or social difficulties. The risk of depression in parents and of neglect of these children by parents is frequent when compared with that of healthy children.

Some factors affect how the family accepts and addresses the child's problem; these include a stable parental relationship, fewer siblings, parental self-esteem, higher socioeconomic level, participation of all family members, as well as participating in support programs at school and in the community.

ID of genetic origin presents a risk of transmission to other family members. Therefore, molecular studies are important to calculate the risk of recurrence in future offspring and for family counseling.

PROGNOSIS OF INTELLECTUAL DISABILITIES[11]

In children with severe ID, the prognosis is evident in early childhood. The performance of individuals with ID depends on the underlying cause, degree of cognitive and adaptive impairment, associated pathologies, family resources, and education services in the school and community that are offered to the children and family.

Another way to help these patients is through prevention, by raising awareness in the population that the use of alcohol in pregnancy is extremely harmful to the fetus and leads to irreversible intellectual and physical changes.

CONCLUSION

The essential elements in evaluating ID include extensive investigation of the family, prenatal, perinatal, and postnatal history, complete physical and neurological examination of the patient, as well as laboratory tests that should be selected according to the condition, which may clarify the cause of ID. These range from conventional karyotyping to exome sequencing; however, the latter is costly for the majority of the population and is therefore not routinely used.

The patient must be monitored over time for a diagnosis to be made, with physical and behavioral assessments associated with neuropsychological tests and genetic counseling that is essential for various cases of ID, aiding in treatment and prognosis.

The causes of ID can be genetic or environmental, and despite the availability of modern molecular techniques, almost 60% of the causes of ID have not yet been identified. Two conditions can be specifically treated when identified early: phenylketonuria, which is detected via the Guthrie test, and fetal alcohol syndrome, which can be prevented by advising pregnant women to not consume alcohol at any time during gestation to avoid irreversible damage such as ID.

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