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Artículo de revisión

Clinical approach in neurodevelopmental delay screening tests

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ABSTRACT

Developmental delay is defined as evidence of significant delay in two or more developmental domains. The first 5 years of age constitutes a mayor cerebral plasticity period in neurological development, when relevant changes take place in central nervous system development process. An estimated 5-10% of children have a developmental and/or behavior disorder. Early identification by primary care providers of developmental delays leads to early referral for evaluation and treatment. Selection of a particular screening test is a relevant task and physicians should be encouraged to be experienced in the use of screening tools and developmental surveillance methods to achieve an improved outcome. In this article we overview the most important scales and neurological tests used worldwide to screen developmental delays.

Key words: developmental delays, neurologic scales, brain injury, sensorial deficits.

Enfoque clínico para la detección oportuna de retrasos en el neurodesarollo

RESUMEN

El retraso en el desarrollo se define como evidencia en 2 o más áreas del desarrollo normal. Los primeros 5 años de vida constituyen un periodo de plasticidad cerebral muy importante, en el cual cambios relevantes tienen lugar en el proceso de desarrollo del sistema nervioso central. Un estimado del 5 al 10% de los niños presenta desórdenes en el desarrollo o comportamiento a nivel mundial. La identificación temprana por instituciones de salud de primer nivel lleva a una referencia temprana para evaluación y tratamiento. La selección de un método de tamizaje en particular constituye una tarea relevante para los médicos, a quienes se les debe estimular para familiarizarce con el uso de estos en orden de tener un mejor pronóstico. En este artículo hacemos una revisión de los *test* y escalas neurológicas más utilizadas a nivel mundial para la detección oportuna de retrasos en el neurodesarrollo.

Palabras clave: retraso en el desarrollo, escalas neurológicas, daño cerebral, déficits sensoriales.

Neurodevelopment dysfunctions are a conglomerate of entities regarding different rates of cognitive delays, it is estimated that 5 to 10% of world wide population is affected[1]. Only 30% are identified before school entrance, those detected after school entrance miss out on early intervention services proven to have long term health benefits. Cognitive delays are a neurologic condition resulting from brain injury that occurs before cerebral development is complete and can result from brain injury occurring during the prenatal, perinatal, or postnatal periods. Developmental Disability/Delay (DD) is present when functional aspects of a child's

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development in one or more of the next 5 features: gross/fine motor, speech/language, cognition, social/personal, and activities of daily living[1-4]. In DD this features are significantly delayed compared to the expected level for age, 25% from the expected rate or a discrepancy of 1.5 to 2 standard deviations from the norm.

Early diagnosis is very important because evidence has shown a great deal better results and prognosis when the appropriate therapy is instructed immediately[5,6], therefore an early identification by primary care providers of developmental delays leads to early referral for evaluation and treatment.

The World Health Organization (WHO) has planned as a key Childs health goal, a strategy to identify an effective intervention in both developmental delays and sensorial deficits diagnostic tools before the 5 years of age. However, despite the world wide effort, technological achievements in therapeutic rehabilitation methods now available in most countries primarily countries in development, these strategies had shown to be insufficient to cover the populations needs.

Current statistic data of hospital releases in 2002 Sanitary Services in Mexico regarding the perinatal morbidity rate showed 207.8/100,000 representing 7.9% of all releases during the period[7].

Among the pathologies related to developmental delays Perinatal Asphyxia accounts for the most of development delays reported[8], and represent 3.3% in an overall morbidity rate in public health services in the Hospital General de Mexico[9]. In addition Hypoxic-ischemic encephalopathy leads the most common cause of acute neurologic damage related to developmental delays whit 3 affected per 100,000 new born rates in developed countries[10,11]. Additionally, it is also suggested as the main cause of brain damage in preterm birth cases[12]. Intrauterine and neonatal insults have a high risk of causing substantial long-term neurological morbidity[13].

Diagnostic developmental delays tests based on specific scales are usually performed by a Specialist physician or a Pediatrician when alert signs are revealed during a routine examination[14,15]. Global Developmental Delay (GDD) is a subset of DD defined as significant delay in two or more developmental domains (reserved for children less than 5 years old). Pediatricians are in unique position to provide surveillance and screening due to their routine contact with children and their families. The American Academy of Pediatrics (AAP) recommends all infants and young children have surveillance/screening for developmental delays.

The most effective scale to diagnose developmental delays is still a controversial topic, however, the search for a diagnostic tool with a broad spectrum of application has been for several years a topic of great interest in the medical community, and led to the design and development of various test and scales for delay screening in motor skills, speech/language abilities, and even parental evaluation formats such as the Parents' Evaluation of Developmental Status (PEDS)[2,3,16-18].

Among the scales to determine the newborn overall status, Apgar score has been used since first described in 1954, as a method of assessing the clinical status of the newborn infant and comprises 5 components: heart rate, respiratory effort, muscle tone, reflex irritability, and color, each of which is given a score of 0, 1, or 2. The score is reported at 1and 5 minutes after birth. Despite its great value as a clinical tool, it has been inappropriately used to predict specific neurologic outcome in the term infant and therefore as a predictor of developmental delays.

The Amiel-Tison Neurological Assessment (ATNA) at term age focuses on responses that depend on the corticospinal control system, based on a combination of individual signs and symptoms, identification of the clinical profile, and recognition of prenatal brain damage[18]. The neurological examination can continue in children up to the age of 6 years using the same clinical tool based on a fixed set of observations and maneuvers scored according to the child's age. The complete procedure takes approximately 5 minutes. A simple 0, 1, and 2 scoring system is proposed. The sensitivity of ATNA has proven to be high for detecting disabilities but it also gave a high number of false-positive results,[3] therefore its application may be taken into consideration before hand in cases of known risk factors for development delay.

The Bayley II Infant Neurodevelopmental Screener (BINS) is a scale instrument designed specifically for a high-risk infant population and assesses cognitive, social, language, gross, and fine motor skills[19,20]. It has been developed for children ages 3-24 months and assesses basic neurological functions/intactness, receptive functions, expressive functions, and cognitive processes. Cut scores are used to classify children as high, moderate, or low risk for developmental delays. It is administered by a trained professional in about 10 minutes. The BINS was validated on a high-risk infant population as well as in normal infants, which enables us to perform this test in a mixed risk infant (term and preterm) population. This scale performs a direct examination and scores identify high, moderate, and low risk for Developmental Delay. Nevertheless recent studies had found this scale could understate developmental impairments in premature and low birth weight infants[21,22].

The Peabody Development Motor Scale 2 (PDMS-2) is used to evaluate children from birth trough age 5, the PDMS-2 is composed of six subtest that asses

related motor abilities that develop early in life: Reflexes, stationary (body control and equilibrium), locomotion, object manipulation, grasping and visual-motor integration[23,24]. The PDMS-2 can be used to estimate a child's overall motor competence relative to peer. This test is useful in educational therapy because it assesses both qualitative and quantitative aspects of the child's motor performance. In addition the PDMS-2 can be performed by physicians, physical therapists, psychologists, and others who are interested in examining the motor abilities of young children which makes this test a useful and widely versatile tool to assess developmental delays[25].

The Denver Developmental Screening Test-II (DDST-II) is one of the oldest and best known developmental screening tests performed to determine the presence of developmental problems, speech-language, achievement, and adaptive behavior and has been the traditional tool used for screening cognitive delays[26]. Nevertheless research has found that it is insensitive and lacks specificity despite being used worldwide[27]. Additionally, most of the established DDST-SL norms are different to the latter norms in DDST-II, therefore; developmental screening tests should be used in a specific context and adapted and standardized to the populations in question before utilization[28].

The N-PED test constitutes an automated instrument for neurodevelopmental delays screening. A series of items are computed in a Personal Digital Assistant (PDA) in order to detect deviations from normal neurological development according normal age parameters[29]. This software evaluates speech and language, motor skills and sensorial (visual and auditory) features. N-PED test can be performed by non medical personnel skilled in its use, thus enhancing the population coverage.

CONCLUSIONS

Currently application of neurological status assessment tests in selected children population at public health hospitals accounts for most of the early detection of developmental delays in developed countries, however since this are screening methods, it would be advisable to perform this non invasive test to all children population, narrowing the window of non diagnosed affected children, specially at age 5, when most of the motor and cognitive abilities are susceptible to be treated and therefore aim to better prognosis for each case. As noted by de Committee of Children with disabilities, a main issue in to disregard a successful detection of developmental delays relies in the variability in screening tests. Results derived from screening processes can vary from one locality to another and also may change over time, and information must be updated on a regular basis.

Selection of a particular screening test is a relevant task, some motor and cognitive assessment tests are more suitable than others for specific cases and subjacent pathologies, mainly because of a construct based discrepancy, age limits, patients history and complete background; therefore purpose selection should be advised and information regarding tests specifications should be a continuous concern for pediatric medical services worldwide and pediatricians should be encouraged to be experienced in the use of screening tools and developmental surveillance methods to achieve an improved outcome.

In addition some tests are inconsistent among each other in some level; Bayley Scale of Infant Development II and the Peabody Development motor scale-2 represent a fine example, since recent studies suggest that the standard scores of the BSID II motor scale and the PDMS-2 showed poor agreement and have low concurrent validity leading to disorientation in children further medical requirements. Additionally some test like the DDST-II result poorly beneficial in order to establish neurodevelopmental delays despite current worldwide application.

In developing countries medical services had shown to be insufficient to assess their entire population regarding developmental delays diagnosis and treatment. In Mexico data showed in the 2010 population census an estimate of 5.4% to 15.1% of child deliveries were carried out without proper medical assistance[30], depending on population origin and geographical status, therefore a number of newborns remain undiagnosed for a variable period of time, which represents an additional predicament common in developing countries to address, such as some regions in Latin-American, Sub-Saharan Africa and southeast Asia. In such circumstances selection of a screening method with a wide applicability, and sufficient sensitivity should be a priority assignment. In this subset a test like N-PED, which wide range of applicability could represent and advantage in terms of lack of trained personnel available and the need of wide geographical areas coverage.

Regardless of the screening test used, physicians should be sensitive of the children needs for medical services relying on standard and purpose based scores and scales, and also to be aware of potential differences in results obtained from different screening tests for developmental delays.

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