Original Article

Quality of Developmental screening of 3-12-month infants through comparing with screening by Bayley Infant Neurodevelopmental Screener II

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Objectives: Monitoring development in infancy results in early detection of developmental delay, and early intervention can prevent sever complications of developmental disorders. The purpose of this study was to determine quality of developmental screening of 3- 12 months infants referred to Tehran Health Centers, through comparing with screening by Bayley Infant Neurodevelopmental Screener II (BINS II).

Method: This was a cross- sectional study. 155 infants of 3-12 months old, recourse to Tehran Health Centers, screened developmentally with BINS II and its results was compared with results of routine clinical examination of Tehran Health Centers.

Results: Kappa agreement between results of BINS II and results of routine developmental screening of Tehran Health Centers' clinical examination of 3- 12- month old infants was poor (0.18).

Discussion: Routine clinical examination in Tehran Health Centers, in compare with applying standard screening tools, cannot screen all infants at risk of developmental delay and ignores many of them which should be considered either for follow up or for receiving early intervention services.

. **Key words:** development, screening, BINS, infant

Submitted: 25 Sep. 2013
Accepted: 14 Nov. 2013

Introduction

Development is the process of growing to maturity and creating changes in the human life in order to promote their physical, mental, verbal, and social dimensions (1). Development is comprised of a combination of biological, psychological, and social factors (2). Developmental delays or disabilities are defined as a condition which represents a significant delay in the process of development which child is less developed mentally or physically than normal for their age (1).The most common developmental disabilities include: cerebral palsy, visual impairments, hearing impairments, mental retardation, learning disabilities, attention deficit – hyperactivity disorder, and behavioral problems (2). According to the international statistical reports, prevalence of developmental disorders is estimated313-385 in 1,000 children (3). Medical examination can diagnosed only 30 % of developmental disorders and 50% of mental disorders in children by preschool or school age. Early detection of developmental delays or disabilities is implemented through developmental screening and monitoring (4). More accurate assessment includes the use of standard and formal or non-standard and non- formal tools, information gathering through developmental, social, familial and medical history, and physical examination of the child (4). Development monitoring in infancy results in early detection of developmental delay or any deviation from the normal development (2). Early detection and intervention of developmental disorders is a kind of secondary prevention, aimed to reduce severe complications of developmental disorders (5). In fact, screening is detection of a

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disease or invisible defect through the practical, fast and comprehensive tools (2).

There are many developmental screening tools for infants and young children. Some of them are: Denver Developmental Screening Test II, Child Developmental Review (CDR), Ages and Stages Questionnaires (ASQ), Parents' Evaluation of Developmental Status (PEDS), Battelle Developmental Inventory Screening Test (BDI), Bayley Infant Neurodevelopmental Screener II (BINS II) etc (5). Acceptable screening tools should have a high sensitivity and specificity (2). Denver Developmental Screening Test II and Ages and Stages Questionnaires (ASQ) have been standardized in Iran. Literature reviews show that agreement coefficient among these tools is poor, also doesn't show agreement with the results of the medical examinations. Sensitivity of Denver Developmental Screening Test II was not acceptable and there are too many false negative in its results. Also, ASQ has a high specificity, which leads to increase false positive cases (4). Therefore, it is recommended that Denver Developmental Screening Test II be used with greater caution (4). There is a need to examine other screening tools to find out which may have better predictive utility and is more useful, brief and cost-effective to be applied as a routine screening tool. BINS II is reported as a tool with high sensitivity and positive predictive value in developmental screening in different groups of infant. The BINS is reported to have good internal consistency (0.73–0.85), test–retest reliability (Pearson's r; 0.71–0.84), and inter-rater reliability (Cronbach's α; 0.79–0.96) (6). McCarthy and colleagues evaluated the utility of the BINS II and reported its inter-rater agreement 84.4% and the test - retest for age item sets ranged from 0.80 to 0.93 (Pearson's r). The results of their study indicated that the BINS II is useful and appropriate for Neurodevelopmental screening in South America (7). Guedeset al. investigated BINS psychometric properties in Brazilian preterm infants under risk conditions. Their sample showed to be homogenous characteristics. Reliability indexes were over requested standards. Validity evidences based on external variables were positive moderated. BINS (24 m) and BSID-II (mental) showed high correlation. Validity evidences based on content were attested by expertise. High sensitivity was found. So it seems that, BINS can be considered as an instrument with adequate psychometric properties, able to screen children under risk (8). Gu¨cu¨ examined the utility of the Bayley Infant Neurodevelopmental Screener (BINS) in Neurodevelopmental follow up of high-risk infants. The results of this study represent that BINS II is a quick way of determining infants at risk of developmental delay (9). In 2000, the amount of predictive validity and clinical applications of BINS II was evaluated by Glen P Aylward. In this longitudinal study BINS II was administered for high risk 6, 12, 24- month infants. Also, the McCarthy Scales was performed for them at 3 years of age. The maximum correlations were found between the 24-month BINS and 3-year outcome. The BINS presents an alternative to detailed assessment in high volume clinical applications which has good predictive and concurrent validity (10).

The Bayley Infant Neurodevelopmental Screener (BINS) (10) has been developed for children age 3-24 months and assesses basic neurological functions/intactness, receptive functions, expressive functions, and cognitive processes. It consists of 11–13 items for different age levels, the sum of items failed places the infant in a range of low, moderate and high risk for developmental delay (6).

The literature review did not present any study to investigate the quality of routine developmental examinations, and its adequacy in infants developmental screening, so, this study aimed to determine this issue through comparing its result with developmental screening by BINS II in age 3-12 months in Tehran health centers.

Methods

This research was a cross- sectional study. 155 infants (78 girls and 77 boys) between the age of 3 and 12 months from 3 randomized selected Tehran health centers from different districts were studied.These centers selected by cluster sampling: first, Tehran was divided into three regions (north, south, and center) and one health center was randomly selected from each cluster. Sample size was calculated 52 infants in each cluster. According to the prevalence of risk factors for developmental disorders, each cluster was comprised of 17 infants that affected with one of developmental risk criteria (through convenience and non-probability sampling) and 35 healthy infants without risk criteria (through simple random sampling). Inclusion criteria was: Persian- speaker parents or caregivers, age of infants 3 to 12 months and recoursed to Tehran health centers for routine health monitoring, infants were

not taking any drugs during a week before screening (other than vitamins and minerals supplements recommended by the physician), parent declared their informed consent in oral and written form, the absence of developmental risk criteria in healthy infants and presence of a risk criteria in high risk infants group. The exclusion criteria included: restlessness and crying of infant didn't stop after 5 minutes, the parents tended to draw their infants of the study for any reason and at any time despite their initial satisfaction. At the beginning of study, a BINS training workshop was held by tutor for practice and ensure of examiner's administration and scoring accuracy. In order to increase the validity of the outcomes and to prevent bias, first, BINS II was administered by expert examiner, then, the health workers in those centers checked infants by routine clinical examination while were blind about results of BINS. Finally, all data were recorded and statistical analysis (Kappa coefficient) was performed using the SPSS software (version 17). Amount of Kappa coefficient calculated between the results of screening with BINS II and routine clinical examination in Tehran health centers. The study was approved by the Research Ethics Committee of Iran University of Medical Sciences.

Results

The study included 155 infants of 3-12 month old (77 boys and 78 girls).Comparing the results of BINS II and routine clinical examination in Tehran health centers are shown in table (1).

Table 1. Comparison of BINS II and routine developmental screening in Tehran health centers

			routine developmental screening		Total	**KAPPA coefficient**
			healthy	not healthy		
BINS	low risk	Count	86	14	100	**0.18**
		% within health centers	69.4%	45.2%	64.5%	
	moderate & high	Count	38	17	55	
		% within health centers	30.6%	54.8%	35.5%	
	Total	Count	124	31	155	
		% within health centers	100.0%	100.0%	100.0%	

The comparison of screening developmental indicators of infants by developmental examinations of health centers and BINS II is presented in table (2).

Table 2. Comparison of screening developmental indicators of infants

			BINS		Total	**KAPPA coefficient**
			low	Moderate &.high		
development	has not	Count	100	54	154	**0.02**
		% within BINS	100.0%	98.2%	99.4%	
	has	Count	0	1	1	
		% within BINS	0%	1.8%	.6%	
Total		Count	100	55	155	
		% within BINS	100.0%	100.0%	100.0%	

Tables (1) and (2) show that amount of Kappa coefficient between the results of BINS II and routine clinical examination in Tehran health centers is poor (0.18).The poor kappa coefficient indicates that clinical examination which now is routine in Tehran health centers cannot detect all at risk 3-12-month infants in compare with a standard screening tools such as BINS II.

Discussion

This study investigated the quality of clinical examination of 3-12- month infants through comparing results of BINS II and routine clinical examination in Tehran health centers. Results showed the Kappa coefficient between the two screening methods was poor. It seems that the examinations of health centers in Tehran mainly emphasize on growth indicators of infants and ignore many of the main areas of development such as quality of movement, cognition, emotional - social development, and communication whereas these areas are highly important in developmental screening tools. So, examinations of health centers in Tehran cannot screen developmental delay or impairments in infants.

Gross motor skills are the abilities usually expected to acquire mainly during infancy by approximately age 1 year. Literatures show that there is a relatively wide range age for attaining these skills and other aspects of development during first year of life. It may lead to respite and ignore the existence of any defects or delay in some areas of development in the first year of life, since there is not an exact date to obtain a developmental performance (2, 5). Furthermore, because of the importance of early detection of developmental disorders and starting early appropriate intervention to attain optimum therapeutic results, study all aspects of development in infants is really important. Health monitoring of infants is mainly conducted by health centers in Iran. This system has been very useful and efficient in many cases. Growth monitoring, medical examinations and general vaccinations of Iranian infants and toddlers are done in this system and power of influence of this service is remarkable. But it seems that despite of the efforts have been made by Iran Ministry of Health in this area, these evaluations are not fully integrated and have not being done in all centers. Failure to implement these evaluations can occur because of obstacles such as the lack of a gold standard and acceptable tool to most experts, issues about time and costs, the shortage of trained personnel in these centers, so on (4, 11).

Although various studies have reported high reliability and validity of BINS II and this test investigate different aspects of development very carefully (6-10), according to the results of this study cannot be declared with certainty that screening with this test provides a completely accurate and useful results or can be totally replaced with routine clinical examinations. But, due to being standard and comprehensive, BINS II can be guessed to have probably more accurate results than routine clinical examination. So, it seems that the poor agreement between the results of screening with BINS II and routine clinical examination may be caused by insufficiency of routine clinical examination in Tehran health centers. In order to comparing between these methods, it is suggested to do longitudinal and prospective studies, or use the gold standard tool.

Acknowledgement

This research has been supported by Iran University of Medical Sciences and Health Services grant. This article is based on a thesis written by the first author in partial fulfillment of the requirements for the Master of Science degree in Occupational Therapy from School of Rehabilitation Sciences, Iran University of Medical sciences.

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