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Profile Of Neurobehavioral Strength And Deficit In Children With Intellectual Disability

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***Abstract**: The present study is an attempt to investigate and compare children with intellectual disability (ID) and average intelligence (AI) in terms of various neuropsychological strength and deficit. Two independent samples each consisting of 15 children with age ranging from 8 to 12 years were selected. The statistical analysis of data included on chi square with the main focus on qualitative interpretation. Results indicated that there is a significant difference between children with ID and AI in terms of various neuropsychological strength and deficit.*

***Key words**: Intellectual disability, compare, average intelligence, neuropsychological strength and deficit*

I. INTRODUCTION

Intellectual Disability (Mental Retardation) is one of the commonest diagnoses in children found in psychiatric settings across the world. It is a condition of arrested or incomplete development of the mind which is especially characterized by impairment of skills manifested during the developmental period, which contribute to the overall level of intelligence, i.e., cognitive, language, motor and social abilities. It is generally considered that 2% of the population constitutes persons with mental retardation. Recently it has been estimated that in India there are about 20 million persons who are mildly retarded and about 4 million persons who are moderately or severely retarded.

Although many researchers have worked on ID, particularly genetic studies to determine its causes, there has been a dearth of existing literature that focuses on both specific neuro-psychological strength and deficit. The specific functions that may be assessed in determining the intactness or adequacy of cognition are orientation, the ability to learn necessary skills, solve problems, think abstractly, reason and make judgments, the ability to retain and recall events, mathematical ability and other forms of symbol manipulation, language use and comprehension, attention, perception and praxis.

In children with ID speech is slower to develop, tends to be less articulated, is expressed in shorter than average utterances and is more concrete in quality. Additional difficulties can be superimposed by specific conditions associated with retardation like cerebral palsy and Down syndrome, both of which impair the intelligibility of utterances. Children with ID often have problems in focusing attention, difficulty in shifting attention from one task to another. Research has revealed that children with ID have trouble retaining information in short term memory (Bray et al., 1997). As memory and learning are inter-related, mental retardation always implies difficulties in learning. They have difficulty taking what they learn and generalizing it to new contexts or tasks. One of the most important and challenging areas of contemporary research in special education is the search for strategies and tactics for promoting the generalization and maintenance of learning by individuals with mental retardation. Executive functions are impaired too. Planning involves "if then" thinking, a consideration of what might be rather than what is as well as consideration of multiple outcomes, a kind of thinking which is absent among children with ID.

Thus it is clear that children with ID show certain limitations in neuropsychological functioning. However in order to train or prepare a management plan it is necessary to know both what kind of neuropsychological strength and deficit areas they have so that a training module / management plan can be developed according to their individual needs.

Thus, in the present study an attempt has been made to explore the various neuropsychological strength and deficit in children with ID.

1.1 *Objectives*:

- To assess the strength and deficit in sensory-motor functions in children with intellectual disability and to compare it with children with average intelligence.
- To assess the strength and deficit in perceptual functions in children with intellectual disability and to compare it with children with average intelligence.
- To assess the strength and deficit in cognitive functions in children with intellectual disability and to compare it with children with average intelligence.

- To assess the strength and deficit in skill behaviors in children with intellectual disability and to compare it with children with average intelligence.

II. METHOD

2.1 Participants:

A total of 15 children with diagnosis of mental retardation as per ICD-10 were taken. The sample primarily consisted of children with an IQ ranging from 43 to 70 with an age range between 8-12 years and was subsequently compared with a group of 15 children with AI of similar age range. Purposive sampling technique has been followed for selection of sample.

2.1.1. Inclusion Criteria:

1. Diagnosis of mental retardation as per ICD-10
2. IQ range 43-70 (mild and upper range of moderate
3. Age range between 8-12 years
4. Able to communicate in English, Hindi or Bengali
5. Having basic reading and writing ability
6. Children cooperative for testing

2.1.2. Exclusion Criteria:

1. History suggestive of any comorbid psychiatric conditions
2. Vision and hearing impairment
3. Children having difficulty comprehending instructions
4. Uncooperative patients
5. Children not going to any school

*2.2 Tools Used***:**

The following tools were used for the present study:

2.2.1 *Luria Nebraska Neuropsychological Battery for Children (LNNB-CR)* is a multi-dimensional battery designed to assess a broad range of neuro-psychological functions. It was developed by Golden et al. (1987) based on the theories and diagnostic procedures of the Russian neuropsychologist A.R. Luria. The LNNB-C is a 149 item, individually administered battery designed to measure various types of cognitive deficits in children of 8-12 years of age.

2.2.2 *Seguin Form Board* was developed by Seguin. The Indian Adaptation was done by J. Bharatraj, (Indian Adaptation, 1971). It is the most commonly used performance test for measuring psychomotor and visuo-perceptual abilities. It has been used as a screening tool for the present study to assess the IQ level of the children. Validity of Indian adaptation of this test is within the range from 0.31 to 0.50.

*2.3 Procedure***:**

With the kind permission of hospital and school authorities the children of the study were selected according to the inclusion-exclusion criteria. After individual consents from guardians of all participants were taken, relevant socio-demographic and clinical information was obtained through interview of reliable informants and Seguin Form Board was used as a screening tool. LNNB-CR was administered to assess the neuropsychological strength and deficit of children with ID and AI. Data obtained was scored as per the manual. Lastly, for quantitative interpretation percentage calculation was done and for qualitative interpretation which is the main focus specific item interpretation was done.

III. RESULTS

Table 1 showing function-wise intact areas among children with ID as compared to children with AI

Scale	Item No.	Intact Areas
C1	4-7	Simple movements that requires kinesthetic and tactile feedback (right & left hand)
	8-10	Simple motor movements that requires spatial organization
	19-20	Oral movements
	21-32	Construction Dyspraxia
C3	43-44	Ability to localize a source of tactile stimulation
	51-52	Ability to assess directionality of tactile stimulation
	57-58	Stereognostic perception
C4	59-60	Ability for visual naming
	62	Ability for visuo-spatial analysis
	63	Ability for mirror-image perception

C5	66-67	Understanding of simple phonemes (single sounds)
	72-77	Comprehension of simple words and sentences
	78,80-82	Comprehension of grammatical and inverted grammatical structure
C6	84-85,87	Ability to repeat certain sounds and words by hearing them (single)
	94	Ability to name objects by hearing their description
	95	Ability for automatic speech (1-20 counting)
C7	107	Ability to copy simple alphabets
	108	Ability to write spontaneously
C8	113	Ability to read simple letters

Table 2 showing function-wise impaired areas among children with ID as compared to children with AI

Scale	Item No.	Impaired Areas
C1	1-3	Simple movements of hand(right and left hand)
	11-14	Simple motor movements that requires spatial organization
	15-18	Complex movements of hand
	33-34	Response to speech regulation of motor act
C2	35	Analysis of group tones
	39-40	Evaluation of acoustic signals
C3	45-46	Ability to make sharpness discrimination
	47-48	Ability to discriminate differences in pressure applied to skin
	49-50	Ability to assess two-point stimulation
	53-56	Graphaesthesia
C4	64	Ability for visuo-spatial organization
C5	68-70	Understanding of simple phonemes (double sounds)
	71	Understanding of phonemes at different levels of pitch
	79	Ability for spatial orientation
	83	Ability to understand logical relations
C6	86,88	Ability to repeat certain sounds and words by hearing them
	89-92	Ability to repeat certain sounds and words by reading them
	93	Ability to repeat difficult sentences by hearing them
	96-98	Ability for automatic speech (backward counting and days of week)
	99-104	Ability for spontaneous speech
C7	105-06	Ability for phonetic analysis
	107	Ability to copy
	108	Ability to write spontaneously
	109-111	Ability to write from dictation
C8	112	Ability for phonemic synthesis
	113-118	Ability to read simple letters, sounds, words, phrases and text
C9	119-121	Ability to read and write numbers from dictation
	122-123	Ability to comprehend the categorical structure of numbers
	124-126	Multiplication, addition and subtraction
	127	Serial subtraction
C10	134	Verbal memory
C11	136-139	Comprehension of thematic picture
	140	Interpretation of story
	141	Simple concept formation
	142-143	Abstract thinking
	144-146	Logical relationship and analogy
	147-149	Arithmetic problems

Table 3 Showing Description of Elevation above cut-off point of the Experimental and Control Group

	Experimental Group	Control Group

Scales	Above Critical Level n (%)	Below Critical Level n (%)	Above Critical Level n (%)	Below Critical Level n (%)
Motor Functions(C1)	12 (80%)	3 (20%)	1 (7%)	14 (93%)
Rhythm (C2)	15 (100%)	0 (0%)	7 (47%)	8 (53%)
Tactile Functions (C3)	14 (93%)	1 (7%)	1 (7%)	14 (93%)
Visual Functions (C4)	14 (93%)	1 (7%)	3 (20%)	12 (80%)
Receptive Speech (C5)	15 (100%)	0 (0%)	2 (13%)	13 (87%)
Expressive Speech (C6)	15 (100%)	0 (0%)	4 (27%)	11 (73%)
Writing (C7)	15 (100%)	0 (0%)	2 (13%)	13(87%)
Reading (C8)	15 (100%)	0 (0%)	1 (7%)	14(93%)
Arithmetic (C9)	15 (100%)	0 (0%)	2 (13%)	13 (87%)
Memory (C10)	15 (100%)	0 (0%)	8 (53%)	7 (47%)
Intellectual Processes (C11)	15 (100%)	0 (0%)	1 (7%)	14 (93%)

IV. DISCUSSION

According to quantitative analysis it is seen that children with intellectual disability (ID) on LNNB-CR is severely impaired particularly in scales like rhythm, memory and intellectual processes and they were better able to perform in items of motor, visual and tactile functions.

According to function-wise item interpretation, in oral movements and construction dyspraxia, children with ID had intact performance. In the simple movements of hand and those requiring spatial organization children with ID were unable to perform adequately. A common observation for all the subjects was the right-left disorientation. With regard to speech regulation of motor act it requires keeping in mind the instructions given, interpret them and then respond appropriately. Children with ID were unable to perform all the three tasks together. With regard to tactile functions children with ID had intact performance in ability to localize source of tactile stimulation, directionality of tactile stimulation and stereognostic perception and was unable to discriminate differences in pressure applied, sharpnesss and two-point stimulation. This indicates that they do not understand the concepts of more and less. For visual functions all children with ID had intact performance for visual naming as it included objects they encounter every day. On the other hand, both groups failed to perceive the contrast picture and spatial rotation. This is further supported by Jahan et al. (2000) and Singh et al (2006) where normal children did poor on this item which may be due to high difficulty level and lack of exposure to these type of tasks than merely deficit in visuo-spatial skills.

With regard to speech all children with ID showed intact performance on understanding of simple phonemes of single sounds and comprehension of simple word and sentences and grammatical structure and showed impaired performance in understanding logical relations, spatial orientation and phonemes at different levels of pitch and simple phonemes when presented with double sounds also suggesting poor attention span and difficulty hearing, discriminating and interpreting stimulus which are closely similar to each other. They were able to repeat the sounds and words when presented singularly but not when in series. This was more because of memory problems. They had no difficulty in their ability to name objects by hearing their description or counting forward but all subjects had difficulty with backward counting. This may be because counting is a rote learning thing but when asked to do backward counting it requires planning and processing which is a lack in the subjects of the present study. All children with ID had difficulty with spontaneous speech. This is in accord with the findings of Roberts et al. (2007) who found significant deficits in receptive and expressive vocabulary and speech production in comparison to deficits in non-verbal cognitive skills among Fragile X syndrome and Down syndrome children.

For writing and reading ability children with ID had intact performance in their ability to copy simple alphabets, read simple letters and write their own name spontaneously but had difficulty with the phonetic analysis, ability to read simple sounds, words, phrases and text. This finding along with the speech deficits mentioned above can be corroborated with the findings of Barker et al. (2013) who concluded that phonological awareness has strong relationships with expressive and receptive language and reading skills and naming speed has moderate relationships with these variables, which is also reflected in the present findings.

In the scale assessing rhythm, arithmetic, memory and intellectual performance children with ID had impaired performance. However many children with AI also had difficulty with these scales thereby indicating the difficulty level of these items. This is in accord to findings of Jahan et al. (2000), Kishore et al. (2004) and Singh et al. (2006) where normal subjects performed poorly on items measuring acoustic analysis, ability to analyze group tones and reproduction of rhythm, on serial subtraction, immediate sensory trace recall and verbal memory. According to Carlesimo et al. (1997) Down syndrome subjects were particularly deficient in organizing verbal material according to categorical structure and in selectively retrieving stored information which may be a reason that they could write alphabets in order but not randomly. This can be further substantiated with the findings of Roberts et.al (2005) which revealed that boys with Fragile X syndrome displayed significant deficits in all academic skill areas particularly prewriting skills and visuo-spatial processing abilities and math skills which became more pronounced over time. Further, Daunhauer et al. (2014) and Ornstein et al. (2008) observed significant deficits in working memory and planning in children with ID.

Thus an overall analysis revealed that children showed problems in areas sensitive to attention and concentration and language suggestive of frontal lobe dysfunction. Hence it is evident that inattention is a significant cause affecting ones performance in many other areas. This has also been supported by Roberts et al. (1998) who found that attention deficits are quite prevalent among severe and profound mental retardation. It can also be corroborated by findings of Palmer et.al (2006) who found that children with ID obtained significantly below cut-off scores in neuro-cognitive domains of attention and executive functions. An emphasis on their strength areas is utterly necessary for the behavioral and educational management of children with ID.

V. CONCLUSION

In the present study a thorough analysis of the profile of children with ID suggests that although they have significant deficits in neuropsychological functioning, they have strength areas too which are mainly related to certain motor functions, tactile functions and visual functions. Certain strength areas are also associated with understanding of simple phonemes, comprehension of simple words and sentences and ability to repeat certain single sounds. Deficits were more pronounced for items requiring attention and concentration, vocabulary, academic skills, memory and planning. Thus this study throws light on the neurobehavioral strength and deficit in children with ID with the purpose of highlighting their strength areas which should be focused on while planning a management plan for such special children of our society.

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