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RESEARCH ARTICLE

Criterion Validation of 'Speech Related Items' in INCLEN NDST-Research Form Against Receptive Expressive Emergent Language Scale-4 Among Children with Complaints of Speech Problems

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Abstract

Delay in speech and language is one of the most common neurodevelopmental disorders in early childhood with a prevalence rate of around 6% in children

Objectives:

The primary objective of the study was criterion validation of 'speech related items' in INCLEN NDST-research form against receptive expressive emergent language scale-4 among children with complaints of speech problems as gold standard and to calculate sensitivity, specificity, predictive values, diagnostic accuracy, and likelihood ratios.

Methodology

This descriptive study - diagnostic test evaluation, was carried out from January to August 2022 over a period of 8 months, at NIMS Spectrum-CDRC, Thiruvananthapuram, and a tertiary care centre for children with neurodevelopmental problems. Seventy-five children with complaints of speech problems, coming to NIMS-Spectrum-CDRC, were screened with NDST-research against REELS by an experienced developmental therapist and evaluated with REELS-4 by Developmental nurse counsellor, blind to the results of screening

Result

On doing criterion validation of Speech related items in NDST-research, the psychometric properties were as follows; sensitivity of 97.96%, specificity of 42.31%, positive predictive value

of 76.19 %, negative predictive value of 91.67%, positive likelihood ratio 1.70 and negative likelihood ratio 0.05. Diagnostic accuracy of the test was found to be 78.67%.

Conclusion

Speech related items' in INCLEN NDST-research form against Receptive Expressive Emergent Language Scale-4 (REELS-4) among children is a simple screening test, with good psychometric properties, to screen among children suspected with developmental problems.

Keywords

NDST, Psychometric properties. Speech delay, criterion validation

Introduction

Development of speech helps children not only to get attention from others, to satisfy their needs, to influence the behaviour of others, and to develop social relations, but it also plays an important role in their academic achievements as they grow[1].Language delay or abnormalities in speech and language should be detected during the early stages of life itself, so that early intervention could be instituted. Several tools are available for the purpose of assessing speech and language delay for example; Early Language Milestone Scale (ELM Scale), The Receptive Expressive Emergent Language Scale (REEL), 3-Dimensional language Assessment Tool (3-DLAT), Language Evaluation Scale Trivandrum etc.[2,3]. Speech delay is defined as "when the child's conversational speech is either more delayed than would be expected for age or marked by speech sound error patterns not appropriate for age"[4,5].Delay in speech and language is one of the most common neurodevelopmental disorders in early childhood with a prevalence rate of around 6% in children [6]. Up to 60% of language delays at the age of 2 to 3 year probably resolve spontaneously [7]. However, if serious language delays persist and remain untreated, they can have detrimental effects at older age. Language disorders are strongly related to psychiatric/ behavioural problems [8] and learning problems later at school [9]. These results indicate the need for intensive, early intervention for language impaired youngsters [10].

REELS-4 tool was designed to help identify children (age0-7years) who have language impairments or who have other disabilities that affect language development. The validated tool REELS-4 is too expensive and time consuming for routine clinical use. Hence it was essential to have a screening tool developed and validated locally. In the present study, a feasible approach was to use 'speech related items' in NDST-Research form developed by INCLEN-NDD study team led by Dr N.K Arora, to screen for speech and language problems. After validation againstREELS-4, 'speech related items' in NDST-Research form can also be used to identify a child with speech and language delay early.

Objectives

1. To administer Neurodevelopmental screening tool Research form(NDST-R/F), on consecutive children of 2-7 years with complaints of speech problems, attending NIMS-spectrum CDRC.
2. To administer Receptive Expressive Emergent Language Scale (REEL-4) diagnostic tool on the same children.
3. Criterion validation of 'speech related items' in NDST-R/F as a screening tool against REEL-4 as gold standard using sensitivity, specificity, predictive values, diagnostic accuracy, and likelihood ratios.

Methodology

The present study was a hospital based criterion validation study which was carried out from January to August 2022 over a period of 8months, at Thiruvananthapuram NIMS-Spectrum-Child Development Research Centre (CDRC), Noorul Islam Centre for Higher Education (NICHE), Deemed-to-be University. Institutional Ethical Committee clearance was obtained (Regn. No. ECR/218/Inst/Ker/2013/RR-16 and Approval No. NIMS/IEC/2022/01/03, dtd. 10/01/2022). Seventy five consecutive children of consenting parents, aged 2-7 years with complaints of speech problems, coming to NIMS-Spectrum-CDRC, were included.

Data was collected by interview method. Screening by 'speech related items' in NDST-R/F was done by an experienced Developmental Therapist and then REEL-4was administered by a Developmental Nurse Counsellor, blind to the screening results. The analysis was performed using Statistical package for social science (SPSS version 20).

Results

Out of the study population of 75 children,

- Age: 24-35 months – 26; 36-47 months – 22; 48-59 months - 11; 60-71 months – 12; 72-84 months- 4
- Gender: Male 63 (84%); Female 12 (16%).
- Using NDST-R/F 63 (84%) children had at least one question positive suggestive of Speech related problems.((Table 1)

Table 1: 'Speech related items' in NDST-Research form (n=75)

NDST-Research form Item	**No**	**Sounds only**	**Recognisable words**
Can your child speak?	3	14	58
NDST-Research form Item	**No**	**Somewhat Reduced**	**Yes/lost speech/ Stopped speaking**
After attaining initial speech has your child now stopped speaking or has, he/she stopped learning new words and sentences?	52	15	8
NDST-Research form Items	**No**	**Some-times**	**Most of the time**
Is your child's speech in any way different from other children of his/ her age?	39	10	26
Can your child speak words or sentences which can also be understood by non-family members?	43	24	8
Does your child often repeat the same word or phrase over and over again in the same manner?	59	5	11
Can your child name familiar objects (less than 3years old) or is able to describe an object/ event or an action (if more than 3years old)?	25	16	34
Does your child seem to have difficulty in comprehending what you are saying?	45	21	9
NDST-Research form Impression = No Speech related problems: 12(16%); Speech related problems: 63(84%)			

- Using REEL-4, 49 children (65.3%) had Speech problems. (Table 2)

Table2: Prevalence of Speech problems as per REELS

Interpretation	Number
Normal	26 (34.7%)
Delay	49 (65.3%)
Total	75

Table 3: 'Speech Related items' in NDST-Research form Vs REELS

'Speech related items in NDST-Research form' Impression	REELS Impression		Total
	Delay	Normal	
Delay	**48 (TP)**	15 (FP)	63
Normal	1 (FN)	**11(TN)**	12
Total	49	26	75

On doing criterion validation of Speech related items in Neurodevelopmental screening tool (NDST-Research form) against REELS, the psychometric properties were as follows; sensitivity of 97.96%, specificity of 42.31%, positive predictive value of 76.19 %, negative predictive value of 91.67%, positive likelihood ratio 1.70 and negative likelihood ratio 0.05. Diagnostic accuracy of the test was found to be 78.67%.

Discussion

The COVID-19 pandemic has had long lasting effects on the communication skills of the children especially those who were in their pre-linguistic phase when the pandemic started. Masks are known to degrade the speech signal, serving as a low-pass filter by attenuating high frequencies spoken by the wearer; the decibel level of attenuation ranges from 3 to 4 dB for simple medical masks and close to 12 dB for N95 masks [13]. In children with hearing loss, this seemingly small change may significantly affect speech understanding as compared with their normal-hearing peers. Speech screening tools like Language Evaluation Scale Trivandrum (LEST) have been validated against REELS to be used in the community [sensitivity and specificity of LEST(0-3), was found to be 95.85% and 77.5%, respectively with a negative predictive value of 99.8% and LR (negative) of 0.05] [3]. Another test version tool Screening Test of Early Language Development-Test version (STELD-T) was validated by expert through expert opinion and tested against REELS [14]. However, the NDST being a comprehensive tool evaluating plenty of spheres of development including diseases like epilepsy as well, makes it more community friendly and time saving.

The present study showed that Speech related items in NDST-R/F have good psychometric properties when validated against REELS-4 taken as gold standard. Due to ease of administration and low cost, NDST-R/F is an ideal tool for quick screening of speech problems in the community as well as outpatient setting.

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Conflicts of interest:
There are no conflicts of interest

References

1. Elizabeth B Hurlock. Child development, 6th edition, Tata McGraw Hill Publishers :1942 ;135-495
2. Coplan J, Gleason JR, Ryan R, Burke MG, and Williams ML. Validation of an early language milestone scale in a high-risk population. Pediatrics. 1982 Nov;70(5):677-83. PMID: 7133817.
3. Nair MKC, Mini AO, Bhaskaran D, Harikumaran Nair GS, George B, Leena ML, Russell PS. CDC Kerala 6: Validation of Language Evaluation Scale Trivandrum (0-3 y) against Receptive Expressive Emergent Language Scale in a developmental evaluation clinic population. Indian J Pediatr. 2014 Dec;81 Suppl 2:S99-101. doi: 10.1007/s12098-014-1502-8. Epub 2014 Aug 12. PMID: 25109679.
4. Shriberg LD. Four new speech and prosody-voice measures for genetics research and other studies in developmental phonological disorders. Journal of Speech, Language, and Hearing Research. 1993 Feb;36(1):105-40.
5. Shriberg LD, Austin D, Lewis BA, McSweeny JL, Wilson DL. The Speech Disorders Classification System (SDCS) extensions and lifespan reference data. Journal of Speech, Language, and Hearing Research. 1997 Aug;40(4):723-40.
6. Law J, Garrett Z, Nye C. Speech and language therapy interventions for children with primary speech and language delay or disorder. Cochrane Database Syst Rev. 2003;2003(3):CD004110. doi: 10.1002/14651858.CD004110. PMID: 12918003; PMCID: PMC8407295.
7. Law J, Boyle J, Harris F, Harkness A, Nye C. Screening for speech and language delay: a systematic review of the literature. Health Technol Assess. 1998;2(9):1-184. PMID: 9728296.
8. Sundheim ST, Voeller KK. Psychiatric implications of language disorders and learning disabilities: Risks and management. Journal of Child Neurology. 2004 Oct;19(10):814-26.
9. Johnson CJ, Beitchman JH, Young A, Escobar M, Atkinson L, Wilson B, Brownlie EB, Douglas L, Taback N, Lam I, Wang M. Fourteen-year follow-up of children with and without speech/language impairments: Speech/language stability and outcomes. Journal of Speech, Language, and Hearing Research. 1999 Jun;42(3):744-60.
10. Young AR, Beitchman JH, Johnson C, Douglas L, Atkinson L, Escobar M, Wilson B. Young adult academic outcomes in a longitudinal sample of early identified language impaired and control children. Journal of Child Psychology and Psychiatry. 2002 Jul;43(5):635-45.
11. Bzoch K, League R. Receptive-Expressive Emergent Language Scale. Gainesville, FL: Tree of Life Press.
12. Virginia B, Kenneth B, Richard R. Receptive Expressive Emergent Language Test. 4th ed. Austin,tex;Pro-Ed. 2020
13. Goldin, A.; Weinstein, B.; Shiman, N. How do medical masks degrade speech perception. Hear. Rev. 2020, 27, 8–9.
14. Pathak S, Sovani-Kelkar P. Development of a screening tool to identify babies at risk of language delay in India: A preliminary study. Language Acquisition. 2023 Jan 2;30(1):29-49.