e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(4); 137-142

Original Research Article

Diagnostic Validation of Trivandrum Autism Behavior Checklist (TABC) a Screening Checklist for Autism Spectrum Disorder (ASD) Against Childhood Autism Rating Scale-2-Standard Version (CARS-2-ST)

MKC Nair[1], Shyamal Kumar[2], Riya Lukose[3], Ashwathy LA[4], Avinash Kumar[5]

[1]Director, NIMS-Spectrum-CDRC & Emeritus Professor; Noorul Islam Centre for Higher Education, Deemed-to-be University, Kumarakovil, Kanyakumari District

[2]IAP Fellowship Trainee, NIMS-Spectrum-CDRC; Noorul Islam Centre for Higher Education, Deemed-to-be University, Kumarakovil, Kanyakumari District

[3]IAP Fellowship Trainee, NIMS-Spectrum-CDRC; Noorul Islam Centre for Higher Education, Deemed-to-be University, Kumarakovil, Kanyakumari District

[4]Developmental Nurse Counsellor, NIMS-Spectrum-CDRC; Noorul Islam Centre for Higher Education, Deemed-to-be University, Kumarakovil, Kanyakumari District

[5]HOD Department of Pediatrics, SNMCH, Dhanbad

Received: 17-01-2023 / Revised: 09-03-2023 / Accepted: 28-03-2023
Corresponding author: Dr. Shyamal Kumar
Conflict of interest: Nil

Abstract:

Autism Spectrum Disorder (ASD), a neurodevelopmental disorder is of growing concern because of its progressively increasing prevalence. The current prevalence of 1 in 100 as per WHO data seems largely undermined as a large chunk of population is still not evaluated. There is often a lack of adequate skilled healthcare personnel to evaluate such children in community in LMIC countries. Trivandrum Autism Behavior Checklist (TABC) is a simple tool with ease of administration by Developmental Therapists and Developmental Nurse Counsellors. This study aims at criterion validation of TABC against Childhood Autism Rating Scale – 2 Standard Version (CARS-2ST) a diagnostic tool.

Keywords: ASD, Prevalence, TABC, CARS-2 ST, Evaluation study.

Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by some degree of difficulty with social interaction and communication. Other characteristics are atypical patterns of activities and behaviours, such as difficulty with transition from one activity to another, a focus on details and unusual reactions to sensations. Societal attitudes and the level of support provided by local and national authorities are important factors determining the quality of life of people with ASD[1]. The recent systematic review in India and other South-East Asia population has reported prevalence rate ranging from 0.09% to 1.07% among the children in the age group of 0–17 years with Autism Spectrum Disorder[2]. Early child

care practices at home, specifically breastfeeding duration nil/ <6 months, child does not play with children of same age, do not tell stories/sing songs to the child and no outings for the child are known modifiable risk factors for ASD [3].

Currently, the best evidence-based management of children with ASD is considered to be early diagnosis and early intervention. To achieve the goal of early detection of ASD, an appropriate ASD screening tool which is simple and culturally appropriate may be used. Trivandrum Autism Behavior Checklist (TABC) is one such screening tool for ASD, that has shown in earlier studies, sensitivity: 80%, specificity: 91.1%, positive predictive value:36.4% and high negative predictive value: 98.6% using CARS (original) as gold standard and the same has been published in the in-house journal of CDC, Kerala (Nair MKC, et al. Development of TABC. Teens 2013; 7(1): 4–10). TABC has 20 questions under four major domains (Table 2), which include; (i) social interaction – 5 questions, (ii) communication – 4 questions, (iii) behavioral characteristics – 5 questions), and (iv) sensory integration – 6 questions). Scoring is done as per the response of the parent/guardian into, Never as "1"; Sometimes as "2"; Often as "3"; and Always as "4". As per the total score (minimum 20, maximum 60), children can be grouped into; < 35 means no ASD; 36 – 43 means mild to moderate ASD; 44 and above means severe ASD. Community studies have indicated that with appropriate training, TABC can be effectively used by healthcare workers for early detection of ASD[4]. Now that CARS-2 has been made available, the present study is an attempt at criterion validation of TABC against CARS-2-ST as the gold standard and to calculate sensitivity, specificity, predictive values, diagnostic accuracy, and likelihood ratios.

Material and Method

The gold standard used for this criterion validation study of TABC as a screening checklist for ASD was Childhood Autism Rating Scale-2 Standard Version. The study setting was NIMS-Spectrum-Child Development Research Centre, Thiruvananthapuram a tertiary centre for neurodevelopmental disorders among children. The study duration was for 6 months, and participants were children referred with suspected ASD.

Study type:

This study is a Criterion Validity study aimed at validation of Trivandrum Autism Behavior Checklist (TABC) which is a screening checklist for ASD against Childhood Autism Rating Scale-2 Standard Version

Ethical clearance:

Institutional ethical committee clearance was obtained (Reg. No. ECR/218/Inst./KER/RR16 and Approval No. NIMS/IEC/2021/04/04/ dtd. 12/04/2021) and study was initiated with due consent from each individual parents.

Inclusion criteria:

Suspected children, who were referred were evaluated and screened initially with TABC by an experienced Developmental therapist and then evaluated with CARS-2-ST by a Developmental pediatrician blind to the TABC results.

Exclusion criteria:

Children without a proper guardian or where the guardians failed to give a consent were excluded from the study.

Diagnostic tool used:

The CARS has become one of the most widely used and empirically validated ASD assessment tool. A study done in Kerala have established the diagnostic accuracy of the severity for Childhood Autism Rating Scale (CARS), with the CARS total score for mild, moderate and severe ASD ranging from 30.5 to 35, 35.5-40 and ≥40.5

respectively[5]. The inter-rater reliability (ICC=0.74) and test-retest reliability (ICC=0.81) for CARS were good. Besides the adequate face and content validity, CARS demonstrated good internal consistency (Cronbach's alpha=0.79) and item-total correlation in Indian children[6].

The presently available Childhood Autism Rating Scale– Second Edition (CARS-2) is more promising as a diagnostic measure because of its simplicity, conceptual relevance, high concordance with DSM-V diagnosis of ASD, acceptability, cost effectiveness, utility among different populations and strong psychometric properties[7]. So after screening using TABC, ASD can be confirmed based on the updated diagnostic criteria of CARS-2 which is now one of the recommended diagnostic tools for ASD. The CARS-2 is a 15-item rating scale used to identify children with ASD and distinguishing them from those with developmental disabilities. It is empirically validated and provides concise, objective, and quantifiable ratings based on direct behavioral observation. This second edition of CARS expands the test's clinical value, making it more responsive to individuals on the "high functioning" end of autism spectrum disorders. The clinician rates the individual on each item, using a 4-point rating scale. Ratings are based on frequency of the behavior in question, its intensity, peculiarity, and duration. Physicians, special educators, school psychologists, speech pathologists, and audiologists will all find the CARS-2 easy to administer and score.

Results:

Table 1: Screening of 65 children with TABC and Diagnostic validation using CARS-2-ST.

TABC	CARS-2-ST	
	ASD	**Non-ASD**
ASD	26	7
Non-ASD	1	31

In the present study 65 children with suspected ASD features who were referred to NIMS-Spectrum-Child Development Research Centre (CDRC) were evaluated with Trivandrum Autism Behavior Checklist (TABC) as a screening test and Childhood Autism Rating Scale-2-Standard Version (CARS-2-ST) as a gold standard diagnostic test by two independent observers blind to the results of each other. This study involved 65 children of which 33 (49.2%) were screen positive by TABC, while 26 (40%) children were positive for ASD by both TABC and CARS-2-ST, false positive: 7; and false negative: 1; giving a sensitivity: 96.29%; specificity: 81.57%; positive predictive value: 78.78%; negative predictive value: 96.8%; accuracy: 87.69%; positive likelihood ratio: 5.22; and negative likelihood ratio: 0.045.

Of the total 26 children who were positive both on TABC and CARS-2-ST, 22 children (84.6%) in the age range 2-4 years had ASD features, while 4 children (15.4%) were in the age range 4-6 years. Thus, age of presentation is early in most of the cases and chances of getting diagnosed with ASD is higher among lower age groups.

Table 2: TRIVANDRUM AUTISM BEHAVIOURAL CHECKLIST (TABC)

		Never (1)	Sometimes (2)	Often (3)	Always (4)
Social Interaction (5 items)					
a.	Inability to establish/maintain eye contact				
b.	Child does not respond when called, sometimes appears to be deaf				
c.	Difficulty in mixing and playing with other children of the same age				
d.	Lack of appropriate emotional response				
e.	Can do certain tasks well, but not the tasks involving social understanding				
Communication (4 items)					
a.	Difficulty in comprehension /communication				
b.	May indicate wants by gestures or leading adults by the hand				
c.	Echolalia/using nonsensical words and muttering to self				
d.	Lack of pretend play				
Behavioural Characteristics (5 items)					
a.	Like sameness in everyday routine				
b.	Inappropriate attachments to objects				
c.	Unusual body movements such as flapping hands or rocking and jumping				
d.	Extreme restlessness, hyperactivity/over passivity or prefers to be alone all the time				
e.	Not responsive to normal teaching methods				
Sensory Integration (6 items)					
a.	Doesn't like to be hugged or touch/apparent insensitivity to pain				
b.	Intolerance/ Addiction to certain sounds, tastes, odours, visuals				
c.	No understanding of fear of real dangers/Excessive fear of heights, change in position				
d.	Enjoys spinning or rotating objects				
e.	Inappropriate laughing and giggling/Crying spells with extreme distress for no apparent reasons				

f.	Difficulty in fine motor skills. A tendency to fall/ clumsiness/ resistance to new motor movement activities.				

Ref : Nair MKC , et al. Development of TABC. TEENS 2013; 7(1): 4 – 10. Published by CDC Kerala

SCORING: 20 – 35: Non Autistic; 36 – 43: Mild – Moderately Autistic; 44 and Above: Severely Autistic

Discussion

The present study demonstrates good psychometric properties of TABC as a screening checklist for Autism Spectrum Disorder. With a Negative predictive value of 96.8% it can be used as a tool to evaluate and rule out ASD. Previous studies have reported that mean age at diagnosis for all ASDs ranged from 38 months to 120 months and the factors associated with earlier diagnosis included (i) greater symptom severity, (ii) high socioeconomic status, and (iii) greater parental concern about initial symptoms[8]. A systematic review and meta-analysis for studies (2012 to 2019) evaluating age at ASD diagnosis that included 56 studies from 40 countries and involving 120,540 individuals with ASD, showed that the mean age at diagnosis was 74.7 months for studies that only included children aged ⩽10 years[9]. Of the 26 children who were positive both on TABC and CARS-2-ST, 23 were males (88.5%), while 3 were females (11.5%). Thus, clearly there was a higher prevalence of ASD among male as compared to females in this study. Here, it may be noted that among children aged 8 years, the most recent estimates of ASD prevalence in USA was given as 23/1,000 or one in 44, and that ASD was 4.2 times as prevalent among boys as among girls[10]. The Spectrum-CDRC being a referral centre, the high 40% prevalence of ASD in this study is on expected lines and this also could have influenced the diagnostic test results.

Conclusion

With ever growing prevalence of ASD in society, there is an inherent need to have a tool for easy screening. Also, there is this need for the screening tool to be culturally apt. TABC is one such simple easily administered screening checklist, with Negative predictive value of 96.8%, that can be administered by any health worker. TABC is an excellent screening tool with high sensitivity, negative predictive value, positive likelihood ratio and accuracy. Thus, this tool can be easily used at community level for screening for Autism Spectrum Disorder.

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