Al-Azhar Med. J. *Vol. 46(1), January, 2017, 71-78*
DOI: 10.12816/0035536

EARLY DETECTION OF AUTISTIC SPECTRUM DISORDER (ASD) BY MODIFIED CHECKLIST FOR AUTISM IN TODDLERS, REVISED (M-CHAT-R) IN CHILDREN WITH SOCIAL AND VERBAL DELAY

By

Mahmoud Taher El Mougy, Hassan Ali Hassan, Mohammed Abd Elftah Elmahdy and Mohammad Hassaan Nasr Ahmed

Departments of Pediatrics and Psychiatry, Al-Azhar Faculty of Medicine

ABSTRACT

BACKGROUND: There is a great interest in developing screening instruments for autistic spectrum disorder (ASD). Although many ASD-specific screens exist, the modified checklist for autism in Toddlers revised (M-CHAT-R) is among the most accessible.

OBJECTIVES: To detect the early signs and symptoms of ASD by M-CHAT-R in children with verbal delay.

PATIENTS AND METHODS: The study included 100 children with social or verbal delay between 16 and 30 months. All patients included in this study were subjected to careful history taking, thorough clinical examination, and M-CHAT-R assessment.

RESULTS: Sixty patients failed to pass M-CHAT-R questionnaire, while 24 patients failed to pass CARS questionnaire. However, there was a statistically significant correlations between CARS and M-CHAT-R. In addition, there was a statistically significant agreement between M-CHAT-R and CARS regarding ASD diagnosis. M-CHAT-R had a good diagnostic reliability for diagnosis of ASD in the studied population with a sensitivity of 100% and specificity of 53 %.

CONCLUSION: The modified checklist for autism in Toddlers revised (M-CHAT-R) was among the most accessible screening instruments for ASD. In addition, a statistically significant agreement between M-CHAT-R and CARS regarding ASD diagnosis. M-CHAT-R had a good diagnostic reliability for diagnosis of ASD.

Key words: Autism, Toddlers, Social and verbal delay.

INTRODUCTION

Autistic spectrum disorder (ASD) is a complex neuro-developmental disorder that results in social and communication impairments, as well as repetitive and stereotyped patterns. Genetically, ASD has been described as a multifactorial genetic disorder **(*Adi et al., 2015)*.** Structural language anomalies or impair-ments in autistic spectrum disorder (ASD) are theoretically and practically important ***(Boucher, 2012).*** There has been

consi-derable concern that the incidence of autism is alarmingly on the rise, especially in Western nations, and environmental factors are increasingly suspected to play a role **(*Seneff et al., 2012).***

Although the etiology of autistic-spectrum disorder (ASD) remains unclear, great advances have been made to clarify the underlying neuroanatomical abnorma-lities and brain-behavior relationships in autism. Additionally,some specific brain regions are particularly implicated including the frontal, limbic, basal ganglia and cerebellar regions. There is also an evidence of volume abnormalities in both grey and white matter ***(Bryńska, 2012).***

The definitive diagnosis of ASD is usually made by pediatricians, psycho-logists, or psychiatrists who institute a process of analysis which involves a developmental and clinical history, tests for cognitive function, and assessment of receptive and expressive language skills ***(Berman, 2010).*** Screening and early identification of children with ASD is of paramount importance because early intervention is crucial in the appropriate management of the disease **(*Dumont-Mathieu and Fein, 2005).***

Modified Checklist for Autism in Toddlers Revised (M-CHAT-R) proved to be a useful tool with good sensitivity and specificity and is a preferable develop-mental surveillance screening instrument for detection of ASD ***(Sunita and Bilszta, 2013).***

The present work aimed to detect the early sign and symptoms of ASD by M-CHAT-R in children with verbal delay.

PATIENTS AND METHODS

The present study was conducted at Al-Alzhar University Hospitals during the period from October, 2015 to June 2016 after obtaining informed consents from parents of the study participants. The study included 100 children with social or verbal delay between 16 and 30 months.

All patients included in the study were subjected to careful history taking, thorough clinical examination and M-CHAT assessment to maximize sensitivity **(Robins et al., 2001).**

Child Autistic Rating Scale (CARS), evaluated the severity of autistic behaviors in 14 functional areas by assigning a score from 1 to 4. An overall score was calculated by adding all the grades to stratify patients into three levels: severely autistic (score between 37 and 60), mildly to moderately autistic (score between 30 and 36.5), and absence of ASD (score less than 30). The time for administering this questionnaire was around 20-30 min **(Schopler et al., 1980).**

Statistical analysis: Data obtained

from the present study were computed using SPSS versions 17 under the platform of Microsoft Windows XP, professional edition. Continuous data were expressed in the form of mean ± SD, while categorical data were expressed in the form of count and percent. Correlation between variables was achieved using Pearson's correlation coefficient. Kappa test of agreement was used to detect tests agreement. P value less than 0.05 was considered statistically significant.

RESULTS

The studied patients had parental consanguinity in 41 cases. Maternal abortions were reported in 32 cases: 36 patients were delivered vaginally, while 64 were delivered by CS. Family history of developmental delay was reported in 32 patients and 21 patients were previously isolated in NICU. Sixty patients failed to pass M-CHAT questionnaire, while 24 patients failed to pass CARS question-naire (Table 1).

Table (1): Reported history, clinical data and prevalence of ASD according to M-CHAT-R and CARS in the studied patients (n=100).

Parameters \ Count			No	%
Consanguinity			41	41.0
Abortions			32	32.0
Delivery	**Vaginal**		36	36.0
	CS		64	64.0
NICU			21	21.0
Family history			32	32.0
Developmental delay			100	100.0
Behavioral delay (Hyperactive)			1	1.0
Head circumference	Macrocephaly		7	7.0
	Microcephaly		18	18.0
Neuromuscular	• **Convulsions**	Tonic	1	1.0
		Myoclonic	1	1.0
	• **Tone** (Hypotonia)		9	9.0
	• **Reflexes** (Hyper-reflexia)		10	10.0
	• **Muscles** (Wasting)		1	1.0
Prevalence of ASD according to M-CHAT-R	**Passed**		40	40.0
	Failed		60	60.0
Prevalence of ASD according to CARS	**Passed**		76	76.0
	Failed		24	24.0

The studied patients comprised 72 males and 28 females. They have an age of 25.4 ± 4.0 months , IQ of 79.3 ± 9.9 , CARS of 26.2 ± 5.8 , and M-CHAT of 3.5 ± 2.6 (Table 2).

Table(2): Demographic data and reported psychiatric scales of the studied patients (n=100).

Sex	**Males**	72
	Females	28
	Range	**Mean ± SD**
Age (months**)**	15 – 30	25.4 ± 4.0
IQ	57 - 96	79.3 ± 9.9
CARS	15 - 42	26.2 ± 5.8
M-CHAT	0 – 11	3.5 ± 2.6

There was a statistically significant correlation between CARS and M-CHAT and a good diagnostic reliability of M-CHAT for diagnosis of ASD in the studied population, with a sensitivity of 100 % and specificity of 53 % (Table 3).

Table(3): Correlations between M-CHAT and CARS and diagnostic reliability of M-CHAT.

CARS		**r**		**p**	
M-CHAT		0.91		0.0001*	
				Kappa	
		Passed	**Failed**	Value	P
M-CHAT	**Passed**	40	-	0.35	**0.0001***
	Failed	36	24		
Diagnostic reliability of M-CHAT					
Sensitivity				100.0 %	
Specificity				53.0 %	
Positive predictive value				40.0 %	
Negative predictive value				100.0 %	

DISCUSSION

The present study assessed early detection of autism by M-CHAT in children with social and verbal delay. The study comprised 100 infants. They were subjected to careful history taking and thorough clinical examination. In addition, they were investigated for

autistic manifestations using the Childhood Autism Rating Scale (CARS) and M-CHAT.

Children included in the present study have an age of 25.4 ± 4.0 months. They comprised 72 males and 28 females. The predominance of males was also reported by **Meguid et al. (2014)** who noted that among 100 autistic children, 71 were males and 29 females. Because girls tend to be more socially driven than boys, some mildly affected girls may go unrecognized. Those girls who are detected may be considered more severely impaired than boys owing to the cultural bias toward higher social expectations for girls, which may in turn influence behavioral ratings **(Baron-Cohen et al., 2005).**

In the studied patients, there were parental consanguinity in 41 cases. Maternal abortions were reported in 32 cases. Thirty six patients were delivered vaginally while 64 were delivered by CS. Family history of developmental delay was reported in 32 patients,and 21 patients were previously isolated in neonatal intensive care unit (NICU).

Consanguinity was documented as a risk factor for developmental delay in the study of **(Karimzadeh et al., 2016)** who investigated the clinical and paraclinical manifestations in patients who presented by neurodevelopmental delay. In their study, 71.4% of parent's patients had consanguinity of marriages. Also, the study of **(Torabi et al., 2012)** noted, maternal abortions as a significant predictor of developmental delay. In addition, it was found that positive family history was associated with higher rate of developmental delay in children **(Kim et al., 2014).**

Regarding the clinical data, notable findings included microcephaly, macro-cephaly and hyperreflexia. The significant association between microcephaly and developmental delay was reported by the study of **Aggarwal et al. (2013),** while **Schwab et al. (2009)** reported the link between macrocephaly and developmental delay.

In the present study, 60 patients failed to pass M-CHAT questionnaire, while 24 patients failed to pass CARS question-naire. However, there was a statistically significant correlation between CARS and M-CHAT. In addition, a statistically significant agreement between M-CHAT and CARS regarding ASD diagnosis. M-CHAT had a good diagnostic reliability for diagnosis of ASD in the studied population with a sensitivity of 100.0 % and specificity of 53.0 %. This was in agreement with the study of **Kleinman et al. (2008)** who found that the M-CHAT continues to be a promising instrument for the early detection of ASD.

Another study was conducted in nine Arabic speaking countries to evaluate M-CHAT for screening of young children with autism. The final analysis included 228 children (122 screened positive for ASD). The sensitivity was 0.86, the specificity was 0.80 and positive predictive value was 0.88 **(Seif Eldin et al., 2008).** Also, **Canal-Bedia et al. (2011)** used M-CHAT for autism screening in Toddlers. The results obtained were similar to those yielded by the original M-CHAT studies.

Furthermore, **Chlebowski et al. (2013)** provided empirical support for the utility of population screening

for ASD with the use of the M-CHAT in a primary care setting. Results suggest that the M-CHAT continues to be an effective screening instrument for ASD. In another study conducted in Japan, M-CHAT screening successfully detected Toddlers with ASD with and without developmental delay and is a promising screening tool to complement existing community surveillance **(Kamio et al., 2014).**

In Korea, **Seung et al. (2015)** examined the clinical utility and psychometric properties of the Korean Modified Checklist of Autism in Toddlers (K-M-CHAT)-2. A sample of 2300 parents of 16- to 36-month-old children was recruited across South Korea. Authors concluded that K-M-CHAT-2 is a useful ASD screening test when implemented with a follow-up.

In UK, **Charman et al. (2016)** tested the accuracy of two screening instruments in UK Community health services: Modified Checklist for Autism in Toddlers (M-CHAT) and Social Communication Questionnaire (SCQ) for autism spectrum disorder (ASD). The sensitivity and specificity were 64% (95% confidence intervals; range 51-80%) and 75% (63-85%) for the SCQ, and 82% (72-92%) and 50% (33-64%) for M-CHAT.

Finally, **Srisinghasongkram et al. (2016)** validated the use of two-step Modified Checklist for Autism in Toddlers (M-CHAT) screening adapted for a Thai population. Their participants included both high-risk children with language delay and low-risk children with typical development. Compared with the critical scoring criteria, the total scoring method (failing ≥3 items) yielded the highest sensitivity of 90.7 %; specificity was 99.7 %, positive predictive value 96.1 %, and negative predictive value 99.4 %.

On the other hand, **Samadi and McConkey (2015)** evaluated two tools: M-CHAT which is widely used internationally and one developed in Iran called Hiva. A population sample was recruited of nearly 3000 preschoolers in one Iranian city. Parents self-completed the two tools and children who screened positive were invited for a follow-up interview followed by a diagnostic assessment. The Hiva scale proved to be more efficacious in identifying children with ASD and the resulting prevalence rate was higher than that previously reported for Iranian 5 year olds. The study confirmed the need to attune screening tools to the cultural contexts in which they are used.

CONCLUSION

There were a statistically significant correlation between CARS and M-CHAT, and a statistically significant agreement between M-CHAT-R and CARS regar-ding ASD diagnosis. M-CHAT-R had a good diagnostic reliability for diagnosis of ASD in the studied population with a sensitivity of 100.0 % and specificity of 53.0 %.

REFERENCES

1. **Adi A, Tawil B, Aldosari M, Shinwari J, Nester M, Aldhalaan H, Alshamrani H, Ghannam M, Meyer B and Al Tassan N (2015):** Homozygosity analysis in subjects with autistic spectrum disorder. Mol Med Rep., 2: 2307-12.
2. **Aggarwal A, Mittal H, Patil R, Debnath S and Rai A (2013):** Clinical profile of children with

developmental delay and microcephaly. J Neurosci Rural Pract., 3: 288-91.

3. **Baron-Cohen, S., Knickmeyer, R.C. and Belmonte. M.K (2005):** Sex differences in the brain: Implications for explaining autism. Science, 310:819–823.

4. **Berman MH (2010):** Autistic spectrum disorder: the challenge for dentists. Dent Today,10: 96-8.

5. **Boucher J (2012):** Research review: structural language in autistic spectrum disorder - characteristics and causes. J Child Psychol Psychiatry, 3: 219-33.

6. **Bryńska A (2012):** Seeking the etiology of autistic spectrum disorder. Part 1: Structural neuroimaging. Psychiatr Pol., 6 :1053-60.

7. **Canal-Bedia R, Garcʔa-Primo P, Martʔn-Cilleros MV, Santos-Borbujo J, Guisuraga-Fernʔndez Z, Herrʔez-Garcʔa L, Herrʔez-Garcʔa Mdel M, Boada-Muʔoz L, Fuentes-Biggi J and Posada-de la Paz M (2011):** Modified checklist for autism in toddlers: cross-cultural adaptation and validation in Spain. J Autism Dev Disord., 10:1342-51.

8. **Charman T, Baird G, Simonoff E, Chandler S, Davison-Jenkins A, Sharma A, O'Sullivan T and Pickles A (2016):** Testing two screening instruments for autism spectrum disorder in UK community child health services. Dev Med Child Neurol., 4:369-75.

9. **Chlebowski C, Robins DL, Barton ML and Fein D (2013):** Large-scale use of the modified checklist for autism in low-risk toddlers. Pediatrics, 4:1121-7.

10. **Dumont-Mathieu T and Fein D (2005):** Screening for autism in young children: The Modified Checklist for Autism in Toddlers (M-CHAT) and other measures. Ment Retard Dev Disabil Res Rev., 3:253-62.

11. **Kamio Y, Inada N, Koyama T, Inokuchi E, Tsuchiya K and Kuroda M (2014):** Effectiveness of using the Modified Checklist for Autism in Toddlers in two-stage screening of autism spectrum disorder at the 18-month health check-up in Japan. J Autism Dev Disord., 1:194-203.

12. **Karimzadeh P, Jafari N, Nejad Biglari H, Jabbehdari S, Khayat Zadeh S, Ahmad Abadi F and Lotfi A (2016):** Neurometabolic Diagnosis in Children who referred as Neuro-developmental Delay (A Practical Criteria, in Iranian Pediatric Patients). Iran J Child Neurol., 3 :73-81.

13. **Kim SW, Jeon HR, Park EJ, Chung HJ and Song JE (2014)**: The differences in clinical aspect between specific language impairment and global developmental delay. Ann Rehabil Med., 6:752-8.

14. **Kleinman, J. M., Robins, D. E., Ventola, P. E., Pandey, J., Boorstein, H. C., Esser, E. E and Fein, D (2008):** The Modified Checklist for Autism in Toddlers: A follow-up study investigating the early detection of Autism Spectrum Disorders. Journal of Autism and Developmental Disorders, 38:827-839.

15. **Meguid NA, Kandeel WA, Wakeel KE and El-Nofely AA (2014):** Anthropometric assess-ment of a Middle Eastern group of autistic children. World J Pediatr., 4: 318-23.

16. **Robins, D and Dumont-Mathieu, T (2006):** Early screening for autism spectrum disorders: Update on the modified checklist for autism in toddlers and other measures. Journal of Developmental and Behavioral Pediatrics, 27 (Supplement 2):SI 11-S119.

17. Robins, D. L., Fein, D., Barton, M. L and Green, J. A (2001): The modified checklist for autism in toddlers: An initial study investigating the early detection of autism and pervasive developmental disorders. Journal of Autism and Developmental Disorders, 3 1:131-144.

18. Samadi SA and McConkey R (2015): Screening for Autism in Iranian Preschoolers: Contrasting M-CHAT and a Scale Developed in Iran. J Autism Dev Disord., 9: 2908-16.

19. Schopler E, Reichler RJ, DeVellis RF and Daly K (1980): Toward objective classification of childhood autism: Childhood Autism RatingScale (CARS). J Autism Dev Disord., 10:91-103.

20. Schwab JG, Pena L, Waggoner D and Pytel P (2009): Two Children with macrocephaly, developmental delay, and PTEN mutation. Clin Pediatr (Phila)., 1:89-92.

21. Seif Eldin A, Habib D, Noufal A, Farrag S, Bazaid K, Al-Sharbati M, Badr H, Moussa S, Essali A and Gaddour N (2008): Use of M-CHAT for a multinational screening of young children with autism in the Arab countries. Int Rev Psychiatry, 3:281-9.

22. Seneff S, Davidson R and Mascitelli L (2012): Might cholesterol sulfate deficiency contribute to the development of autistic spectrum disorder? Med Hypotheses, 2: 213-7.

23. Seung H, Ji J, Kim SJ, Sung I, Youn YA, Hong G, Lee H, Lee YH, Lee H and Youm HK (2015): Examination of the Korean Modified Checklist of Autism in Toddlers: Item Response Theory. J Autism Dev Disord., 9:2744-57.

24. Srisinghasongkram P, Pruksananonda C and Chonchaiya W (2016): Two-Step Screening of the Modified Checklist for Autism in Toddlers in Thai Children with Language Delay and Typically Developing Children. J Autism Dev Disord., 11:301-12.

25. Sunita MA and Bilszta JL (2013): Early identification of autism: a comparison of the Checklist for Autism in Toddlers and the Modified Checklist for Autism in Toddlers. J Paediatr Child Health, 6:438-44.

26. Torabi F, Akbari SA, Amiri S, Soleimani F and Majd HA (2012): Correlation between high-risk pregnancy and developmental delay in children aged 4-60 months. Libyan J Med.,7:18811.

الكشف المبكر لمرض الذاتوية في الأطفال الذين يعانون من تأخر في النطق والتطور الإجتماعي بواسطة النسخة المنقحة من القائمة المُعدلة لإستبيان التوحد عند الأطفال

محمود طاهر الموجى - حسن على حسن - محمد عبد الفتاح المهدى- محمد حسان نصر أحمد

قسمى طب الأطفال والطب النفسى - كلية طب الأزهر

خلفية البحث: يوجد إهتمام بالغ بتطوير أدوات للكشف عن مرض التوحد ، و بالرغم من وجود العديد منها تبقى النسخة المنقحة من القائمة المعدلة للتوحد عند الأطفال من أيسرها و أكثرها إستخداما.

الهدف من البحث: الكشف عن العلامات والأعراض المبكرة لمرض التوحد عند الأطفال الذين يعانون من تأخر فى النطق بواسطة النسخة المنقحة من القائمة المعدلة للتوحد عند الأطفال .

المرضى وطرق البحث: تتضمن الدراسة ١٠٠ طفلا يعانون من تأخر اجتماعي و لفظى من عمر ١٦ الى ٣٠ شهر. وقد خضع جميع المرضى فى هذه الدراسة إلى أخذ تاريخ مرضى دقيق،والفحص السريري الدقيق، وتقييم النسخة المنقحة من القائمة المعدلة للتوحد عند الأطفال.

النتائج: كشفت الدراسة عن فشل ٦٠ طفلا في إجتياز القائمة المعدلة ، بينما فشل ٢٤ في إجتياز مقياس التوحد عن الأطفال ، إلا أنه وجدت درجة كبيرة من التوافق بين الإختبارين و قد ثبت أن للقائمة المعدلة قدرة تشخيصية جيدة بحساسية بلغت % ١٠٠ ، ودقة بلغت ٥٣%.

الإستنتاج: تبقى النسخة المنقحة من القائمة المعدلة للتوحد عند الأطفال من ايسر أدوات الكشف عن مرض التوحد، بالإضافة إلى وجود درجة توافق كبيرة بين القائمة المعدلة و مقياس التوحد عند الأطفال ، و قد ثبت أن للقائمة المعدلة قدرة تشخيصية جيدة لتشخيص مرض التوحد.