

Social cognition profile in amnestic MCI

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Abstract

Background: For years, disturbance of social cognition was considered as an early feature of schizophrenia and autism. Recently, it has been studied in many neurodegenerative diseases, and included as one of the six key domains of cognitive function defined by DSM- V. Mild cognitive impairment (MCI) is a transitional state between normal cognitive aging and dementia, mainly of AD type. Few reports have addressed theory of mind (ToM) capacity in patients with MCI

Aim: To detect ToM impairment among amnestic MCI patients and to characterize the neuropsychological and functional profiles of MCI cases according to their ToM capacity.

Methods: 40 elderly diabetic patients with amnestic MCI were recruited. Each patient underwent cognitive, and functional assessment. The second order false belief (John and Merry story) test was used to assess social cognition.

Results: There was no significant difference between cases with and without impaired social cognition regarding age, ADL, or IADL, while MMSE scores were significantly lower among cases with impaired second order belief. Stick design tests, and digit span tests were significantly affected in the cases with impaired social cognition.

Conclusions: Social cognition was impaired in about 17.5% of patients with MCI, which was not reflected upon functional status. MCI patients with impaired social cognition, performed worse in the stick design test and the digit span forward test.

Keywords: Theory of mind, social cognition, second order false belief

Background:

Social Cognition was defined by Fiske, 1993¹ as the means by which we make sense of ourselves in relation to others and the environment in which we live. Decades later, Forbes & Grafman, 2010² demonstrated that social cognition includes any cognitive process that is utilized to understand or interpret the self in relation to others.

For years, disturbance of social cognition was considered as an early feature of schizophrenia and autism. Recently, it has been studied in many neurodegenerative diseases, and included as one of the six key domains of cognitive function defined by DSM-V³.

According to DSM-V³, social cognition has 3 subdomains which include recognition of emotions,

theory of mind, and insight. Theory of Mind (ToM) is the main subdomain of social cognition. It is the ability we attribute mental states (beliefs, intentions, or knowledge) to ourselves and others⁴.

ToM capacity can be assessed by different tests including the first- and second-order false belief tasks, the Faux Pas Recognition (FPR) test, the Reading the Mind in the Eyes (RME) test and Ekman's Facial Emotion Recognition Test.⁵

ToM impairment in patients with dementia was largely observed in early cases of frontotemporal lobe degeneration.^{6,7} In Alzheimer's disease (AD), the high levels of ToM i.e. second-order belief tasks were impaired, even in the early course of the disease.^{6,8,9}

However, other studies reported the affection of more basic levels of ToM in early AD i.e. gaze detection or first-order false belief tasks.^{10,11}

Mild cognitive impairment (MCI) is a transitional state between normal cognitive aging and dementia, mainly of AD type. Few reports have assessed ToM capacity in patients with MCI.^{4,12,13}

The aim of the current study was to detect ToM impairment among amnesic MCI patients and to characterize the neuropsychological and functional profiles of MCI cases according to their ToM capacity.

Methods

Study population

A cross sectional study was conducted on 40 elderly diabetic patients with amnesic MCI attending the outpatient clinics in Ain Shams University Hospital, Cairo, Egypt.

The subjects who refused or could not complete the interview were excluded from the study. Any subject with a history of head trauma, CNS pathology, depression, dementia, or delirium, or using anticholinergic drugs were excluded from the study.

Ethical consideration:

The study methodology was reviewed and approved by the Research Review Board of the Geriatrics and Gerontology Department, Faculty of Medicine, Ain Shams University. Informed consent was taken from every subject participating in this study.

All participants underwent comprehensive geriatric assessment that included detailed personal and medical histories, physical examination, cognitive and functional, and mood assessment tests.

Cognitive assessment:

Using the Arabic version of mini-mental state examination (MMSE)¹⁴ and the second order false belief (John and Merry story) test to assess ToM as a subdomain of social cognition.

Functional assessment:

Functional assessment was performed using Activities of daily living (ADL),¹⁵ and Instrumental activities of daily living (IADL).¹⁶

Statistical Analysis

The collected data were coded, tabulated, revised and statistical analyzed using SPSS program (version 16). Quantitative variables were presented in the form of means and standard deviation.

Qualitative variables were presented in form of frequency tables (number and percent). Comparison

was made by the Student t-test. The qualitative variables were compared by using the chi-square test. P value is considered significant if equal to or less than 0.05 frequency tables (number and percent).

Results

Forty elderly were enrolled in this study, 27(67.5%) of them were males, 28(70.0%) were illiterate, 28(70.00%) were functionally disabled in ADL (score <6), and 27(67.5%) were functionally disabled in IADL (score <8).

The mean age of the participants was 64.97±3.39 years.

Seven (17.5%) of the participants had impaired social cognition as assessed by second order belief (John and Merry story) test.

Table 1: comparison between the cases with and without impaired social cognition

	impairment according to John Merry story		P-value
	Intact 33(82.5%)	impaired 7(17.5%)	
Age mean (SD)	64.93(3.53)	65.14(2.85)	0.888
Body mass index mean (SD)	28.58(5.7)	28.67(7.03)	0.972
MMSE mean (SD)	23.87 (1.83)	22.14(0.889)	0.02*
ADL total score mean (SD)	4.69(1.26)	4.28(0.95)	0.42
IADL total score mean (SD)	6.24(1.95)	5.85 (1.36)	0.62
Education n (%)			0.05*
	Illiterate	21(63.3%)	7(100%)
	Can read and write	12(36.7%)	0(0.0%)

.There was no significant difference between cases with and without impaired social cognition regarding age, ADL, or IADL, while MMSE scores were significantly lower among cases with impaired second order belief. [Table 1]

There were statistical significant differences between the cases with and without impaired social cognition as regards items of dressing, food preparation, reading and writing in ADL, IADL, and MMSE. [Table 2]

Executive function and complex attention were significantly affected in the cases with impaired social cognition. [Table 3]

Table 2: Descriptive ADL, IADL, and MMSE profiles in cases according to TOM

Items affected	Impaired ToM	Intact ToM	P value	Items affected	Impaired ToM	Intact ToM	P value
ADL				MMSE			
Feeding	0	0		Medication management	5(71.42%)	18(54.5%)	0.41
Continance	6(85.71%)	22(66.7%)	0.65	Food preparation	6(85.71%)	14(42.42%)	0.03*
Toileting	0 (0%)	3(9.09%)	0.40	Time orientation	5(71.42%)	18(54.5%)	0.41
Dressing	5(71.42%)	11(33.33%)	0.05*	Place orientation	5(71.42%)	18(54.5%)	0.41
Bathing	0(0%)	4(12.12%)	0.33	Registration	2(28.57%)	7(21.21%)	0.67
Transfer	1(14.28%)	6(18.18%)	0.85	Calculation	7(100%)	32(96.7%)	0.64
IADL				Recall	7(100%)	29(87.8%)	0.33
Telephone use	0(0%)	1(3.03%)	0.64	Language	2(28.57%)	3(9.09%)	0.15
Handling finance	1(14.28%)	4(12.12%)	0.87	3 order command	0	1(3.03%)	0.64
Laundry	0(0%)	4(12.12%)	0.33	Reading	7(100%)	21(63.4%)	0.05*
Shopping	1(14.28%)	4(12.12%)	0.87	Writing	7(100%)	21(63.4%)	0.05*
Transportation	0(0%)	4(12.12%)	0.33	Copy design	6(85.71%)	22(66.7%)	0.31
House keeping	2(28.57%)	9(27.27%)	0.94				

*Statistical significance

Table 3: the affected cognitive domains among cases according to ToM performance

Impaired cognitive domain	impairment according to John Merry story		P-value
	Intact 33(82.5%)	impaired 7(17.5%)	
stick design test	6(18.18%)	4(57.14%)	0.031*
Animal fluency teat	11(33.3%)	5(71.42%)	0.06
digit span tests	Forward 13 (39.39%)	6(85.71%)	0.026*
	backward 26(78.78%)	7(100%)	0.18
go-no-go test	8(24.24%)	3(42.85%)	0.31
logical memory test	Immediate recall 32(96.7%)	7(100%)	0.64
	Delayed recall 6(85.71%)	6(85.71%)	0.87

*statistical significance

Discussion

In the recent years, interest increased in social cognition in neurodegenerative diseases. Insufficient social cognitive function in frontotemporal dementia possibly account for the early social inappropriateness among these patients.¹⁷

In AD and its prodromal stage (MCI), the deficits in TOM were suggested to be secondary to their primary memory impairment.¹⁷

The impaired cognitive component of ToM is well documented in AD; however, controversial data exist

regarding the affective component of ToM which is mainly a function of medial portions of the prefrontal cortex.¹³

To date, few studies have reported occurrence of TOM in MCI.^{4,12,13} The main goal of the current study was to detect ToM impairment among amnesic MCI patients and to characterize the neuropsychological and functional profiles of cases according to the ToM capacity.

In this study, 7(17.5%) of the participants had impaired ToM assessed by second order false belief test. This result proves that impaired social cognition may occur prior to dementia development, which agrees with previous studies.^{12,13}

Although MMSE is not a sensitive test for detecting MCI in elderly¹⁸, the MMSE score in cases with and without impaired ToM was 23.82 ± 1.91 , this agrees with another study in Nigeria¹⁹, due to low educational level of the participants in both studies. Those with and without impaired ToM differ significantly in the degree of cognitive decline measured by MMSE scores.

This finding did not agree with previous studies.^{4,13} They reported that the risk for ToM impairment was not related to the severity of general cognitive decline. This difference can be attributed to the significant difference in the educational level between the two groups..

The current study reported that 28(70.00%) of the patients were functionally disabled in ADL (score <6), and 27(67.5%) were functionally disabled in IADL (score <8). Although, the defect in performing different items of ADL is not included as a criterion for diagnosis of MCI⁽³⁾, this study as well as, the study performed by Roberts *et al.* 2008²⁰ found that self-care items in ADL were affected in patient with MCI.

The current study found that dressing was the most affected item in ADL among cases with and without impaired social cognition. This could be due to the presence of other precipitating factors as early loss in dressing is against the loss of functional hierarchy²¹. Yet the performance of different ADL items was not affected by impaired ToM.

Impairment in IADL typically precedes the impairment in basic activities of daily living in the settings of cognitive decline.²² There was no significant difference between cases with and without impaired social cognition regarding IADL except for dependency in food preparation. This may indicate executive dysfunction that was also observed by significant difference in performing stick design test, attributed to the reflection of stick design test to the executive function.²³

Contradictory observations exist regarding the relationship between ToM and executive function. Aboulafia-Brakha *et al.*²⁴ in their meta- analysis showed a congruent association between ToM and executive function in 64 % of studies and incongruent associations in 29 % of studies.

Digit span tests are indicators of complex attention affection;²⁵ there was significant difference in performing digit span tests between cases with and without impaired social cognition. The observation regarding the association between attention and socioemotional difficulties possibly caused by deficits in TOM was previously noted in children with attention deficit/hyperactivity disorder.²⁶ Similar associations were not examined among elderly with neurodegenerative diseases; this can be a target for future research.

Conclusion:

Impaired social cognition in neurodegenerative diseases is now well documented in MCI. Functional profiles of amnesic MCI cases with impaired ToM did not differ from those with intact ToM except for food preparation and dressing. MCI patients with impaired social cognition, performed worse in the stick design test and the digit span forward test suggesting that executive control may interfere with automatic stereotyping.

Our study had several limitations; firstly, due to the small sample size, its statistical power might be insufficient. Secondly, we did not examine the social impact of ToM impairments. Thirdly, we did not examine different tests to assess affective and cognitive ToM. Larger studies are needed to determine the ToM capacity in MCI cases compared to healthy elderly. ToM should be assessed in all cases with amnesic MCI.

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