

The Relationship Between Suicidal Behavior, Neurocognitive Functions, and Insight in Patients with Schizophrenia

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ABSTRACT

Background: In schizophrenia, the relationship between suicide and cognition is unclear. We aimed to assess cognitive functions and insight in schizophrenia patients with and without suicide attempts.

Methods: In our study consisting of 77 patients, 36 of the patients had attempted suicide at least once in their lives and the remaining 41 had never attempted suicide. Sociodemographic data scale, Beck Cognitive Insight Scale, and Cambridge Neurophysiological Assessment Battery were applied.

Results: In this study, patients with schizophrenia who attempted suicide had higher Beck Cognitive Insight Scale self-reflectiveness scores ($P=.004$), lower Beck Cognitive Insight Scale self-certainty scores ($P=.040$), and higher Beck Cognitive Insight Scale total score ($P=.004$). Delay aversion ($P=.003$) and risk-taking scores ($P=.044$) of Cambridge Neurophysiological Assessment Battery Cambridge gambling task were higher in patients who attempted suicide. In logistic regression analysis, as independent factors, the number of hospitalizations increased the risk of suicide 1.5 times per hospitalization ($P=.021$), Cambridge gambling task delay aversion increased the risk of suicide 8.4 times per score ($P=.044$), and the Beck Cognitive Insight Scale self-certainty score was shown as the factor that decreased the risk of suicide by 0.78 times ($P=.024$).

Conclusion: The causes of suicide attempts in schizophrenia still preserve its uncertainty. Our results proposed a statistically significant relationship between cognitive insight and increased suicide attempts. This study also sustains that cognitive impulsivity is associated with suicidal behavior in patients with schizophrenia.

ARTICLE HISTORY

Received: November 10, 2022

Accepted: April 23, 2023

Publication Date: June 16, 2023

INTRODUCTION

Schizophrenia, a psychotic disorder, is an important mental disorder affecting 1% of people. The main symptoms are delusions and hallucinations, thought, speech and behavior disorders, emotional and affective disturbances, and cognitive losses.¹ In addition to these symptoms, there is an increased risk of suicide in psychotic disorders, and suicide-related deaths are among the leading causes of death in patients with schizophrenia.² The literature indicates that the risk of suicide is higher in patients with a single psychotic attack compared to the general population, and the frequency of suicidal ideation in these patients varies between 21% and 50%.³⁻⁵

It has been suggested that several factors may influence the relationship between schizophrenia and suicidal behavior. In 1 review, previous suicide attempts, history of depression, substance abuse, agitation, intellectual disability, non-adherence to treatment, and recent bereavement were associated with suicidal behavior.⁶

Based on these findings, other risk factors for suicide were being younger, single, gender, age of onset, insight, and having sleep disorders.⁷

It is suggested that various factors may affect the relationship between schizophrenia and suicidal behavior. One such factor is that insight can influence suicidal behavior. Lack of insight, as per studies, reduces adherence and treatment response in schizophrenia and, as a consequence, increases the likelihood of suicide.⁸⁻¹⁰ Additionally, several studies have discovered a link between a greater risk of suicide and increased insight.¹¹ Many studies found a relationship between suicidal behavior and cognitive functioning.^{9,12,13} In comparison to schizophrenia patients who had not attempted suicide, 1 study revealed higher smoking rates, fewer negative symptoms, and better focus in those who had attempted suicide.¹⁴ It has also been determined that there is a deterioration in cognitive functioning with suicidal behavior.^{9,12} Executive functions,

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Cite this article as: Calli SY, Fidan Sever Y, Bestepe EE, Izci F. The relationship between suicidal behavior, neurocognitive functions, and insight in patients with schizophrenia. *Psychiatry Clin Psychopharmacol.* 2023;33(2):126-133.



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attention, perceptual/motor activity, vigilance, verbal learning, memory, verbal and spatial working memory, and verbal fluency are the most frequently affected areas in schizophrenia.^{15,16}

The relationship between cognitive function and suicide attempts in individuals with schizophrenia has been the subject of numerous studies. Some reports suggest that higher levels of verbal fluency, attention, and cognitive flexibility may elevate the risk of suicide in patients with schizophrenia.^{17,18} Conversely, other studies have failed to establish a correlation between cognition and suicidal behavior.¹⁹⁻²¹ Furthermore, research has also indicated that individuals who attempt suicide without a psychiatric diagnosis display cognitive impairment.²² A systematic review revealed that various factors, including poor general neuropsychological functioning (excluding working memory) and poor social cognition risk factors, may impact suicide attempts in patients with first-episode psychosis.²³

Despite this information, the literature on the relationship between schizophrenia and suicide is still limited.^{24,25} Due to the ongoing uncertainty in the studies and the paucity of studies in the Turkish population, it was intended to investigate the relationship between suicidal behavior in patients with schizophrenia and cognitive functions (executive functions, decision-making, cognitive flexibility, and impulsivity) and insight that may affect this behavior. It is crucial to identify the risk factors for suicide and thus predict suicide in schizophrenia.

This study aims to examine the relationship between suicidal behavior in patients with schizophrenia and cognitive functions (executive functions, decision-making, cognitive flexibility, and impulsivity) and insight, which may affect this behavior.

MATERIALS AND METHODS

Study Setting

This case-control study aimed to examine the relationship between suicidal behavior and cognitive functions and insight in patients with schizophrenia and was conducted between March 2018 and November 2018, in accordance with the principles of the Declaration of Helsinki. Research and publication ethics were complied with in our study. The study was approved by Erenköy Mental and Nervous Diseases Training and Research Hospital ethics committee

(12.03.2018/2). Written informed consent was obtained from the patients.

Study Design and Participants

The study included 91 patients between 18 and 65, who received outpatient or inpatient treatment within the specified date range, and agreed to be included in the study. The patients were diagnosed with schizophrenia according to the Diagnostic and Statistical Manual of Mental Disorders-5,²⁶ in remission for at least 3 months, and without any other concurrent psychiatric disorder (43 patients with suicide attempts and 48 patients without suicide attempts). Among the participants, 3 patients were found to have mental retardation and cognitive impairment; 3 patients suffered alcohol/substance abuse disorder in the last year; 7 patients had previous head trauma and neurological and medical diseases that may impair cognition and motor functions (amnesic conditions, MS, rheumatological diseases, HIV, etc.); and 1 patient had received ECT treatment in the last 6 months were excluded from the study. The final analysis was conducted with 36 patients with schizophrenia who had attempted suicide at least once in their lifetime and 41 patients with schizophrenia who had never attempted suicide. Power analysis was performed according to the self-certainty item in the Beck Cognitive Insight Scale (BCIS). With a total of 77 participants, 5% type-I error, and a 1.6% effect size, the power of the research was calculated to be over 90%.

Assessment Instruments

The research data were obtained from the patients' sociodemographic and clinical data forms, the 60-minute The Cambridge Neuropsychological Test Automated Battery (CANTAB) tests, and the BCIS. Between the tests, the participants were given enough time to rest and were accompanied during the tests. Sociodemographic and clinical data form was performed by the researcher. CANTAB, a computer-based test, and Beck Cognitive Insight Scale were administered to the patient in a quiet room, and the patient was accompanied by a practitioner during the test and informed in accordance with predetermined instructions.

Age, gender, marital status, education level, income level, smoking, family history of psychiatric disorder, duration of schizophrenia, and the number of hospitalizations were recorded.

Beck Cognitive Insight Scale is a 4-point Likert-type scale consisting of 15 items developed by Beck in 2004.²⁷ It measures the patient's awareness of the disease. Turkish validity and reliability of the scale were done by Aslan et al in 2006.²⁸ In this scale, the participants are asked to rate the relevant items between 0 (strongly disagree) and 3 (strongly agree). The scale has 2 main dimensions: self-reflectiveness consisting of 9 questions and self-certainty consisting of 6 questions. The composite index is calculated by subtracting

MAIN POINTS

- Self-certainty reduces the risk of suicide while self-reflectiveness increases the risk of suicide patients with schizophrenia.
- Cognitive impulsivity increases the risk of suicide in patients with schizophrenia.
- The number of hospitalizations increases the risk of suicide by 1.5 times per hospitalization.

the self-certainty score from the self-reflectiveness score. In the internal consistency measurements of the scale, 2 sub-dimensions for self-reflectiveness and self-certainty were found to be Cronbach's alpha (0.56) and (0.50).²⁸ In the current study, the Cronbach's alpha coefficient scale score was 0.70 for the self-reflectiveness subscale and 0.64 for the self-certainty subscale.

The CANTAB is an observational test that measures executive functions, attention and psychomotor speed, memory, and emotional processes. Language-independent tests and touch screen technology were chosen because of the rapid and non-invasive provision of cognitive assessment, easy application, and sensitivity in detecting cognitive disorders in psychiatric disorders. The test was administered to each patient for approximately 40 minutes. In the evaluation of cognitive functions, 5 areas were examined: stop signal task (SST), emotional recognition task (ERT), Cambridge gambling task (CGT), intra/extradimensional set shifting (IED), and spatial working memory (SWM). Stop signal task is a classic stop

signal response time test that measures the response inhibition ability. Cambridge gambling task assesses decision-making and risk-taking behavior outside of the learning context. The IED is the equivalent of the Wisconsin Card Sorting Test (WCST), a test that includes rulemaking, reverse learning, and alternating attention spans, which is simplified to administer than the WCST. Spatial working memory is a test that measures executive functions and functions of the frontal lobe.²⁹ Test-retest reliabilities were high for CGT and SST ($r > 0.8$) for some measures of visual learning and visual and for SWM (total errors $r=0.7$) and the IED attentional set-shifting task (extradimensional shift errors $r=0.7$).³⁰ Although CANTAB is a test used worldwide, its validity and reliability have not been established in the Turkish population.

The patients were compared by forming patient groups with and without suicide attempts, using sociodemographic and clinical data, cognitive functions assessed with the CANTAB, and self-reflectiveness, self-certainty, and composite index results evaluated with the BCIS.

Table 1. Association Between Suicide Attempt and Sociodemographic Factors

Variables	Suicide Attempt (SA)				P
	Patients with SA		Patients Without SA		
	n	(%)	n	(%)	
Gender					.593 ^a
Women	18	43.90	23	56.10	
Men	18	50.00	18	50.00	
Marital status					.966 ^b
Married	13	46.43	15	53.57	
Single	23	46.94	26	53.06	
Education status					.899 ^a
Middle school	4	40.00	6	60.00	
High school	19	47.50	21	52.50	
University	13	48.15	14	51.85	
Income level					0.295 ^a
Low	7	38.89	11	61.11	
Middle	21	44.68	26	55.32	
High	8	66.67	4	33.33	
Smoking					1.000 ^b
Smoker	34	47.22	38	52.78	
Nonsmoker/past-smoker	2	40.00	3	60.00	
Presence of psychiatric disorder in family history					.215 ^a
First-degree relative	12	44.44	15	55.56	
Second-degree relative	16	59.26	11	40.74	
No history	8	34.78	15	65.22	
	Median (25-75 percentile)		Median (25-75 percentile)		P
Age (years)	34 (29-43)		38 (29-44)		.481 ^c
Number of hospitalizations	2 (1-4)		1 (1-1.5)		.009 ^c
Duration of disorder (years)	10 (6-18)		10 (4-20)		.763 ^c

^aChi-square test; ^bFisher's exact test; ^cMann-Whitney U-test.

Statistical Analysis

Descriptive statistics were presented as median (25-75th percentile) and *n* (%). Kolmogorov-Smirnov tests were used to evaluate the distribution of variables. Mann-Whitney *U*-test was used for non-normally distributed continuous variables, and the chi-square test or Fisher's exact test was used for categorical variables. The factors associated with suicide attempts were determined by logistic regression analysis. The model fit was evaluated with Nagelkerke *R*² and Hosmer-Lemeshow tests. Statistical analyses were performed using the Statistical Package of Social Sciences version 28.0. (IBM SPSS Corp.; Armonk, NY, USA).³¹ The type-I error rate was accepted as 0.05.

RESULTS

The median age of 77 people participating in the study was 36 (29-43), 41 (53.24%) of the participants were female, and 28 (36.36%) were married. When the education level was examined, 10 participants (12.98%) completed middle school, 40 (51.94%) completed high school, and 27 (35.06%) completed university education. Eighteen (23.38%) of the participants had low income; 47 (61.04%) had medium income; 12 (15.58%) had high income; and 72 (93.51%) stated that they smoked. In the family history of the patients, 27 participants (35.06%) had a history

of psychiatric disorder in their first-degree relatives, 27 (35.06%) in their second-degree relatives, and 23 (29.88%) did not have a story of psychiatric disorder in their family. When inpatient treatment was evaluated, the median number of hospitalizations was 1 (1-2). Regarding suicidal behavior, 36 (46.75%) of the participants had attempted suicide at least once. The median number of hospitalizations was higher in the group with suicide attempt 2 (1-4) than in the group without suicide attempt 1 (1-1.5) (*P* = .009). In terms of sociodemographic data of the 2 groups, no statistically significant difference was found in terms of age (*P* = .481), gender (*P* = .593), marital status (*P* = .966), educational status (*P* = .899), income level (*P* = .295), smoking (*P* = 1.000), presence of psychiatric disorder in family history (*P* = .215), and duration of disorder (*P* = .763) (Table 1).

When the relationship between suicidal behavior and insight in patients with schizophrenia was assessed, the median value of BCIS self-reflectiveness (*P* = .004) and the total score (*P* = .004) was higher in the group with suicide attempts; and BCIS self-certainty scale was lower in the group with suicide attempts (*P* = .040). When the cognitive levels of the participants were examined, the median values of CGT delay aversion (*P* = .003) and CGT risk taking (descending) (*P* = .044) were higher in those who attempted suicide (Table 2).

Table 2. Evaluation of Cognitive Behavior and BCIS Results with Suicide Attempt

Variables	Suicide Attempt (SA)		<i>P</i>
	Patients with SA	Patients without SA	
	Median (25-75 percentile)	Median (25-75 percentile)	
BCIS self-reflectiveness	9.0 (6.3-12.0)	6.0 (4.0-9.0)	.004
BCIS self-certainty	6.0 (4.0-8.0)	7.0 (5.0-10.0)	.040
BCIS total score	4.5 (-2.0-7.0)	0.0 (-5.0-4.0)	.004
SWM between errors	60.0 (49.3-72.0)	61.0 (37.0-73.0)	.980
SWM total errors	60.5 (49.3-74.0)	61.0 (38.0-74.5)	.996
SWM Strategy	38.0 (34.3-41.8)	39.0 (35.5-40.5)	.967
IED out-of-front-size errors	6.0 (5.0-15.3)	7.0 (5.0-17.0)	.528
IED stage errors	15.5 (4.0-25.0)	8.0 (4.0-24.5)	.536
IED-adjusted total errors	41.5 (21.3-57.0)	48.0 (16.5-61.5)	.834
IED stages completed	8.5 (7.0-9.0)	9.0 (7.0-9.0)	.745
SST direction errors on stop-and-go trials	5.0 (2.0-8.0)	4.0 (1.0-7.0)	.454
SST rate of successful stops	0.5 (0.4-0.6)	0.5 (0.4-0.5)	.383
Reaction time of SST attempts	508.5 (438.0-681.5)	511.0 (438.5-654.0)	.988
SST stop signal delay	200.3 (71.2-478.0)	274.2 (101.3-385.4)	.855
CGT delay aversion	0.8 (0.5-0.9)	0.4 (0.0-0.8)	.003
CGT overall odds (descending)	0.9 (0.8-1.0)	0.9 (0.8-1.0)	.826
CGT quality of decision-making (descending)	0.7 (0.5-1.0)	0.6 (0.5-1.0)	.643
CGT risk adjustment (descending)	0.0 (0.0-0.4)	0.0 (-0.2-0.9)	.844
CGT risk taking (descending)	1.0 (0.8-1.0)	0.9 (0.6-1.0)	.044

BCIS, Beck Cognitive Insight Scale; CGT, Cambridge gambling task; IED, intra/extradimensional set shifting; SST, stop signal task; SWM, spatial working memory.

*Mann-Whitney *U*-test.

Table 3. Logistic Regression Analysis of Association Between Suicide Attempt and Potential Risk Factors

Variables	B	SE	OR	95% CI	P
Age	0.014	0.031	0.986	0.954-1.078	.661
Gender (female)	0.307	0.627	0.735	0.398-4.652	.624
Family history of psychiatric disorder (reference: first)					
Second-degree relative	0.265	0.756	0.767	0.296-5.739	.726
Positive family history	-0.729	0.772	2.074	0.106-2.191	.345
Number of hospitalizations	-0.428	0.185	1.524	0.454-0.937	.021
BCIS—self-certainty	0.247	0.109	0.781	1.033-1.586	.024
CGT delay aversion	-2.132	1.060	8.431	0.015-0.947	.044
CGT risk taking (descending)	-1.454	2.039	4.279	0.004-12.715	.476

$R^2=0.332$ (Cox-Snell), $R^2=0.444$ (Nagelkerke), Model: $\chi^2=29.088$, $P<.001$.

Hosmer-Lemeshow test: $\chi^2=5.479$, $P=.705$.

BCIS, Beck Cognitive Insight Scale; CGT, Cambridge gambling task; OR, odds ratio; SE, standard error.

Logistic regression analysis was performed to identify suicide attempt risk factors. This analysis included age, gender, family history of psychiatric disorder (first/second-degree relatives and non/have), number of hospitalizations, CGT delay aversion, CGT risk taking (descending), and BCIS self-certainty. The results of the analysis showed that predictors predicted significantly as a set (Nagelkerke $R^2=0.444$; Hosmer-Lemeshow test $P=.705$). According to this regression analysis; the risk of suicide increases as the number of hospitalizations increases [odds ratio (OR)=1.524, 95% CI 0.454 vs. 0.937, $P=.021$], and the risk of suicide is higher among those with higher CGT delay aversion (OR=8.431, 95% CI 0.015 vs. 0.947, $P=.044$); simultaneously, while the BCIS self-certainty score increases (OR=0.781, 95% CI 1.033 vs. 1.586, $P=.024$), the risk of suicide decreases (Table 3).

DISCUSSION

Suicide-related deaths are one of the leading causes of death in patients with schizophrenia, a common and important psychotic disorder.² Although it is known that insight and cognitive functions are affected by schizophrenia,^{8-10,12} the literature on the relationship between these factors and suicidal behavior in patients with schizophrenia is not clear. In this case-control study evaluating the cognitive functions (executive functions, decision-making, cognitive flexibility, impulsivity, facial recognition) and insight of patients with schizophrenia—with and without suicide attempts—patients with suicide attempts had a higher hospitalization rate and higher self-reflectiveness scores (assessed with BCIS) and lower self-certainty scores. Also, delay aversion scores, a surrogate marker of impulsivity assessed by the CGT, were higher. In logistic regression analysis, as independent factors, the number of hospitalizations has been shown to increase the risk of suicide by 1.5 times per hospitalization, CGT delay aversion has been shown to increase the risk of suicide by 8.4 times per score, and the BCIS self-certainty score has been shown to decrease the risk of suicide 0.78.

Demographic and clinical factors of patients with and without suicidal attempts may be related to suicidal attempts. Although suicidal attempts have been described in every stage of schizophrenia, the risk is higher in the prodromal period and when it is newly diagnosed.²⁵ The risk of suicidal attempts also increases during hospitalization or post-hospitalization, treatment non-compliance, or relapse.³² Our study showed that the only clinical factor that showed a significant difference between schizophrenia patients with and without suicidal attempts was the number of hospitalizations. The probability of suicidal attempts increased as hospitalizations increased (OR=1.524). This finding can be explained by the fact that patients who need frequent hospitalization have more severe disease, and the severity of the disease is a factor that increases the risk of suicide.^{32,33}

Insight defines a broad spectrum, including many domains, and it has been shown that decreased insight in patients with schizophrenia is associated with poor clinical outcomes and an increased risk of suicide. However, it has also been shown that attempts to increase insight in patients with schizophrenia, especially increased awareness of the disease, decrease the quality of life. This phenomenon has been called the “insight paradox.”^{34,35} Although some studies have shown that good insight has a protective effect against suicide,^{36,37} a plethora of evidence indicates that increased disease insight is associated with hopelessness, demoralization, depression, and suicide.^{37,38} Our study demonstrated that schizophrenia patients with suicidal attempts had higher self-reflectiveness scores and lower self-certainty scores as assessed by the BCIS. As patients’ awareness of the disease increased, this situation possibly drove them to despair. As a subcategory (component) of good insight, increased self-certainty is associated with a decrease in the risk of suicide, and interventions in this regard may reduce the risk of suicide among patients with schizophrenia.

Working or short-term memory has been identified as one of the main components of cognitive impairment in

schizophrenia. There is a strong correlation between the areas of attention, planning, memory, and intelligence that are impaired in schizophrenia and working memory.³⁹ In the literature, there are studies among schizophrenia patients indicating that patients with suicidal behavior have less impairment in working memory⁴⁰ and those that show similar working memories.⁹ In our study, SWM was used to measure working memory, and no difference was found between patients with and without suicidal attempts.

One of the main cognitive disorders in schizophrenia is executive function disorder. Executive function activities are often evaluated with cognitive flexibility. It is observed that individuals who do not show cognitive flexibility insist on performing according to the old rule despite receiving feedback that their reactions are no longer valid.⁴¹ It is expected that individuals with cognitive flexibility will exhibit effective coping skills, and the probability of suicide will decrease. Current literature is conflicted regarding the relationship between suicidal behavior and executive functions; several studies state a relationship between suicidal behavior and executive functions,³⁸ whereas others failed to show a relationship.²⁰ In our study, cognitive flexibility was evaluated with the IED test, and no relationship was found between suicidal behavior and executive functions in patients with schizophrenia.

Impulsivity encompasses inappropriate or overly risky behaviors, and it is one of the symptoms of many psychiatric disorders. Impulsive behaviors can be evaluated in 2 main categories: impulsive action (motor impulsivity) or impulsive decision-making (cognitive impulsivity). In our study, CGT (cognitive impulsivity) and SST (motor impulsivity) tests were used to measure impulsive behavior.

Motor impulsivity is a tendency to act spontaneously and can be measured with the SST on the CANTAB. In the SST test, a slowdown in reaction time was observed in many psychiatric disorders, such as schizophrenia/schizoaffective disorder and Attention Deficit Hyperactivity Disorder.⁴²⁻⁴⁴ In our study, no significant difference was found in SST subtests between the patients with and without suicide attempts.

Impulsive decision-making or cognitive impulsivity is defined as initiating actions without adequate consideration of other possible options or consequences. Studies have frequently shown that there are impairments in the decision-making process in patients with impulse control disorders and schizophrenia.⁴⁵ The relationship between suicidal behavior and impaired decision-making has also been studied widely.⁴⁶ In our study, in line with the literature, an increase in risk-taking behavior—which is 1 of the CGT subtests—was observed in those with suicide attempts, and it was found that these patients took more risks. In addition, 1 of the tests used to measure impulsive choice is “delay aversion.” Delay aversion was also found to be higher in those who attempted suicide. Findings from

both tests (CGT risk taking and CGT delay aversion) are consistent with the literature, showing that patients are more impulsive in decision-making.⁴⁴

Our study has many limitations. The main limitations are the small sample size, the lack of any sampling method, and, therefore, the low representation ability; the lack of assessment of the medications used by the patients during the study and their potential relationship with cognitive functions; and the absence of a healthy control group. Despite these limitations, the main strength of this study is the homogeneous and detailed neurocognitive testing performed in patients with schizophrenia who were in remission, with and without suicide attempts.

To conclude, the current study shows schizophrenic patients with suicide attempts had higher hospitalization rates, higher self-reflectiveness, lower self-certainty, and higher impulsivity. Understanding modifiable clinical and psychobehavioral risk factors within these patients would help reduce the risk for suicidal behavior. In order to validate these risk factors, it is imperative to conduct further studies encompassing a range of patient populations.

Ethics Committee Approval: This study was approved by the ethics committee of University of Health Sciences, Erenköy Mental and Nervous Diseases Training and Research Hospital (Approval no: 2, Date: March 12, 2018).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - S.C.; Design - S.C.; Supervision - E.B.; Resources - Y.F.; Materials - S.C.; Data Collection and/or Processing - S.C., Y.F.; Analysis and/or Interpretation - F.I.; Literature Search - S.C.; Writing - S.C., Y.F.; Critical Review - S.C., F.I.

Declaration of Interests: The authors have no conflict of interest to declare.

Funding: The authors declared that this study has received no financial support.

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