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Cognitive Performance in Suicidal Depressed Elderly: Preliminary Report

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Abstract

Objective—Deficits in executive functions may play an important role in late-life suicide; however the association is understudied. This study examined cognitive function in general and executive functioning specifically in depressed elderly with and without suicidal ideation and attempts.

Design—Case-control study.

Setting—University-affiliated psychiatric hospital.

Participants—We compared 32 suicidal depressed participants aged 60 and older with 32 non-suicidal depressed participants equated for age, education, and gender.

Measurements—We assessed global cognitive function and executive function with the Dementia Rating Scale (DRS) and the Executive Interview (EXIT25), respectively.

Results—Suicidal and non-suicidal depressed groups were comparable in terms of severity of depression and burden of physical illness. Suicidal participants performed worse on the EXIT25, and on the DRS total scale, as well as on Memory and Attention subscales. The differences were not explained by the presence of dementia, substance use, medication exposure, or brain injury from suicide attempts.

Conclusions—Poor performance on tests of executive function, attention, and memory is associated with suicidal behavior in late-life depression.

Keywords

Suicide; attempted; cognition; adaptation; psychological; frontal lobe; prefrontal cortex; depressive disorder; aged

Globally¹ and in the United States,² suicide rates are higher in the elderly than in any other age group. Suicide attempts in the elderly are marked by high intent and lethality.³ Depression, substance use, bereavement, and physical illness are associated with suicide attempts and completed suicide in late life, but beyond this our knowledge of risk factors is rudimentary.⁴ In younger adults with suicidal behavior, there is accumulating evidence that cognitive deficits—and executive dysfunction in particular—may act as a risk factor for suicide attempts. Some areas of cognitive function decline in normal aging, which may undermine the older person's

ability to flexibly adapt and problem solve. Suicidal behavior may arise as a dysfunctional solution to coping with loss^{5,6} or physical health difficulties^{7,8} that seem impossible to resolve. Failures of effective problem-solving were noted previously in younger depressed suicidal people.^{9–11} Suicidal behavior may also be associated with poor cognitive flexibility (the cognitive rigidity hypothesis), giving rise to a failure to generate alternative solutions^{12,13} to life's problems.

Neuropsychological evidence of executive¹⁴ and decision-making¹⁵ impairments in young adult suicide attempters appears to indicate neuropathology in ventral prefrontal cortex.^{16,17} The only neuropsychological study performed in suicidal older adults (50+ years) to date suggested an accelerated decline with age in executive function in suicide attempters, on the Trails Making Test Part B (measuring cognitive flexibility), but found no group differences between 18 attempters and 29 nonattempters.¹⁸ Although some neuropathological data¹⁹ support a link between suicidality and dementia in the elderly, data from psychological autopsy studies do not,^{8,18} perhaps due to the difficulty in documenting cognitive impairment among the deceased. Among patients with probable Alzheimer disease, suicidal ideation is more prevalent in moderate/severe cases than in mild stages.²⁰ Thus, the role of cognitive impairment as a risk factor for suicidal ideation or attempts remains unclear. This is an important gap because specific interventions may be developed to target cognitive impairment in the prevention of late-life suicide, as has been shown for late-life depression.²¹

The aim of the present study was to examine cognitive performance in suicidal depressed elderly, using a test of executive function and a global measure of cognitive function that yields several separate domain scores. We used baseline data from a federally funded longitudinal study of late-life suicide. We hypothesized that suicidal participants would suffer from greater executive dysfunction, compared to nonsuicidal depressed comparison participants.

METHODS

All participants provided written informed consent. The University of Pittsburgh Institutional Review Board approved the studies.

Suicidal Depressed Participants

Between January of 2003 and January of 2005, we recruited 32 inpatients aged 60 and older diagnosed with major depression with (N=5) and without (N= 21) psychotic features, adjustment disorder with depressed mood (N = 1), depression secondary to medical condition (N=2), and depressive disorder not otherwise specified (N=3) by Structured Clinical Interview (SCID) for the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* Axis I Disorders (SCID/*DSM-IV*).^{22,23} Participants were required to have a suicide attempt within 3 months of the assessment or suicidal ideation with specific plan, serious enough to precipitate an inpatient admission, and a score of 18 or greater on the Mini-Mental State Exam (MMSE; actual range: 18–30).²⁴

Nonsuicidal Depressed Participants

A total of 32 age-, gender-, and education-equated comparison patients with major depression were recruited through two federally funded treatment trials in late-life depression described in detail elsewhere.^{25,26} They were required to have a SCID/*DSM-IV* diagnosis of major depression, a score of 15 or higher on the 17-item Hamilton Rating Scale for Depression (HRSD)-17,²⁷ and a score of at least 15 on the MMSE (actual range: 23–30). Patients were judged to be nonsuicidal if they had not ever reported suicidality or a feeling that life is empty or not worth living as reflected by a score of 0 on the HRSD suicide item in 12 weekly assessments before and during depression treatment. In our previous study,²⁸ there was a 97%

agreement between a score of 0 on the HRSD suicide item and a score of 0 on the Scale for Suicidal Ideation. Fifteen (47%) of the 32 depressed comparison subjects were assessed as inpatients; most of them were admitted for treatment-resistant depression or depression with comorbid anxiety disorders and serious physical illness, or because of a lack of social supports, or of nonadherence to outpatient care.

Among both suicidal and nonsuicidal participants, we excluded patients with bipolar disorder, schizophrenia, schizoaffective disorder, and sensory disorders that precluded cognitive testing. Although neurologic disorders such as stroke, epilepsy, brain tumor were exclusion criteria, prior history of brain injury was not. Patients receiving electroconvulsive therapy in the previous six months were excluded.

Assessments

We assessed executive functioning with the Executive Interview (EXIT25)²⁹ (possible range: 0–50). The 25 items comprising this test are administered in rapid succession with minimal instructions and elicit automatic behaviors and disinhibition and also include modifications of well-known “frontal lobe” tests (number/letter sequencing, Stroop, fluency tests, go/no-go tests, and Luria’s hand sequencing). EXIT25 scores have been associated with left frontal cortical pathology as measured with magnetic resonance imaging.³⁰ We also used the Mattis Dementia Rating Scale (DRS)³¹ to assess global cognition. A participant can receive a total of 144 points on the DRS. The DRS comprises subscales assessing Initiation/Perseveration (37 points), Attention (37 points), Construction (6 points), Conceptualization (39 points), and Memory (25 points). Depression severity was measured with the 17-item Hamilton Rating Scale for Depression.²⁷ Burden of physical illness was assessed with the Cumulative Illness Rating Scale adapted for Geriatrics.³² Intraclass correlation coefficients measuring interrater reliability among our assessors were 0.95 for HRSD, 0.97 for CIRS-G, 0.94 for the EXIT25, and 0.99 for the DRS.

Procedures

Our study of late-life suicide was conducted on a psychogeriatric inpatient unit of a university-affiliated hospital. Participants were assessed within two weeks of inpatient admission or at the beginning of treatment as outpatients. Patients continued to receive psychotropic medications as clinically indicated. Neuropsychological testing took place in one to two sessions over one to three days. Assessors were blind to clinical history and ratings.

Statistical Analysis

We compared groups on demographic and clinical characteristics using *t*-tests and χ^2 tests. We used analysis of covariance (ANCOVA) to compare EX-IT25 and DRS total scores between groups, using age as a covariate. For DRS subscales, we performed Mann-Whitney U tests, due to the limited range of observed values; we report the exact *p* value. We used two-tailed tests ($\alpha=0.05$) for all analyses.

RESULTS

Group Characteristics

There were no significant differences between groups in demographic characteristics, burden of physical illness, or severity of depressive symptoms (Table 1). Psychotropic exposure was similar across groups. Of 32 suicidal patients, 27 received any psychotropic drugs, with 5 patients on anticholinergics, 7 on sedatives/hypnotics, 3 on opioids, and 25 on other psychotropics including antidepressants, antipsychotics, and anticonvulsants. Of 32

nonsuicidal patients, 24 received any psychotropics, 3 received anticholinergics, 11 received sedatives, 5 received opioids, and 20 received other psychotropics (Table 2).

The suicidal group included 10 participants with lifetime substance use disorders, compared to only one in the nonsuicidal group. There were also two participants with dementia and four with cognitive disorder not otherwise specified in the suicidal group, compared to one participant with dementia and one with cognitive disorder not otherwise specified (minimal cognitive impairment, amnesic type) in the nonsuicidal group.

Mean current suicidal ideation score on the Beck Scale for Suicidal Ideation³³ was high at 23.3 (6.3). For the 20 participants who had made a suicide attempt mean medical lethality of the most recent attempt on the Beck Medical Lethality Scale³⁴ was 2.80 (2.17); respective mean suicide intent on the Beck Intent Scale³⁴ was 18.05 (4.03), indicating both high lethality and intent.

Cognitive Function

Suicidal participants performed worse than non-suicidal depressed participants on the DRS Total (ANCOVA, covarying for age: $F(1,61) = 6.88$, $p = 0.011$) and the Memory and Attention subscales, but not on the Initiation/Perseveration, Construction, or Conceptualization subscales. Suicidal participants also performed worse on the EXIT25 ($F(1,61) = 14.96$, $p = 0.0003$). Using the empirically validated cutoff of 15 of 50 or above on the EXIT25, correlated with significant functional impairment,^{35–39} we identified 10 of 32 suicidal participants and only 3 of 32 non-suicidal participants as impaired (Fig. 1).

Effects of Comorbid Conditions

The significant group difference in EXIT25 total scores remained after we excluded 11 participants with substance use disorders ($F(1,50) = 11.89$, $p = 0.0012$), five with psychotic depression ($F(1,56) = 13.75$, $p = 0.0005$), or seven with dementia and other cognitive disorders ($F(1,54) = 8.60$, $p = 0.0049$). As cognitive performance could be affected by anoxic or other brain damage following suicide attempts, we compared EXIT25 scores between suicide attempters with a medical lethality score of 4 or higher (indicating periods of unconsciousness, cardiovascular instability, or need for resuscitation) and all other suicidal patients and found no significant differences (Mann-Whitney U test: exact $p = 0.46$).

DISCUSSION

To our knowledge, this is the first study to show that elderly depressed patients with suicide attempts and severe suicidal ideation demonstrate poorer cognitive and, particularly, executive performance compared to nonsuicidal depressed elderly. These differences are not explained by the burden of physical illness, severity of depression, presence of clinical dementia or other cognitive disorders, effects of substance use, or psychotropic medication exposure. In agreement with the findings of Keilp and colleagues in younger adults,¹⁴ the deficits did not appear to reflect brain injury from suicide attempts.

Although the study was conducted at a tertiary care center, the inclusion of patients with comorbid substance use and cognitive disorders adds to the generalizability and clinical relevance of our findings. Other strengths of our study include comprehensive medical and psychiatric clinical characterization, and a detailed assessment of suicidal attempts and ideation.

The case-control design represents the main limitation of our study and precludes strong causal inferences. For example, an alternative hypothesis regarding the relationship between cognitive function and suicide has been articulated in the schizophrenia literature⁴⁰ and states that

persons lacking the ability to plan are less capable of a suicide attempt. Although this does not seem to be the case in patients with depression,^{14,15,18} only a prospective study can conclusively rule out such a possibility. It is also conceivable that people who commit suicide (and thus cannot be assessed neuropsychologically) plan their attempts better. Additionally, while the suicidal and nonsuicidal groups were equated on factors known to affect cognitive ability, the nonsuicidal comparison patients may have differed from our suicidal patients on other unknown but important characteristics. For example, since all of the suicidal patients and only half of our nonsuicidal patients were assessed as inpatients, the unfamiliar environment and other factors associated with hospitalization may have influenced cognitive performance. Ceiling effects on the DRS and its sub-scales represent yet another limitation: designed for assessing dementia, this test may be relatively easy and therefore not sensitive for most nondemented depressed patients. Thus, although we observed marked differences in executive functioning on the EXIT25 and the Memory and Attention subscales of the DRS, differences in other cognitive domains may be underestimated. Also, we cannot say how specific the executive function deficits are in the absence of a test of premor-bid intelligence or sensitive comparative measures such as a verbal learning task.

Our finding of poorer executive performance in suicidal depressed participants is similar to the observations of King and coauthors,¹⁸ who found that suicide attempters aged 50 and older performed more poorly on the Trail Making Test—Part B with increasing age than depressed comparison patients. Conceivably, such deficits may predispose a depressed patient facing physical illness^{8,41} or interpersonal loss^{5,6} toward a suicidal crisis through impaired problem-solving and perspective-taking. Indeed, persons with poorer executive functioning demonstrate difficulties in coping with physical illness as shown by noncompliance with human immunodeficiency virus treatment,³⁶ diminished capacity to give informed consent,³⁷ and trouble learning to use inhalers.³⁹ Similar findings have been reported for self-care³⁵ and financial competency,³⁸ which is also noteworthy because financial stressors have been implicated in late-life suicide,^{42,43} and our patients often name them as a precipitant of their suicidal crisis. These factors may be particularly suicido-genic when they are not mitigated by social support.⁴⁴ Although these and previous^{14,18} findings seem to support the role of executive dysfunction, it is still unclear how exactly they lead to suicidal ideation and attempts. Future studies will need to examine this association by focusing on specific cognitive areas that are important for real-life functioning, including problem-solving, decision-making, forward planning, and affective processing. Finally, although it seems plausible that these cognitive abilities moderate the impact of life and health stresses on suicidal behavior in the elderly, longitudinal studies are needed⁴⁵ to explore this relationship.

CASE VIGNETTE

Depression, Physical Illness, Losses, Executive Dysfunction, and Suicidality*

Mr. F., a 71-year-old white man, was transferred to the psychogeriatric unit with depression and thoughts about suicide by jumping off a bridge after being treated for pulmonary embolism. He suffered from chronic obstructive pulmonary disease, anemia, and congestive heart failure. Mr. F. felt overwhelmed with his medical illness; he was adamant that he could not live with such physical limitations and refused to use portable oxygen.

Mr. F. had three prior psychiatric admissions for depression and thoughts of suicide. After his wife of 17 years divorced him 12 years ago, he tried to kill himself by running his car in the garage, became unconscious, but was found by a neighbor. He has no children and is not close

*The authors changed some of this patient's characteristics to maintain confidentiality.

to any of his three brothers. He was forced to retire from his clerical job two years ago due to cardiac problems.

On admission, Mr. F. was severely depressed with a HAM-D-17 score of 27. Neuropsychological assessment detected no global cognitive impairment with scores of 30 on the MMSE and 139 on the DRS. However, his executive performance was limited, with an EXIT25 score of 14.

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FIGURE 1. Overall Cognition and Executive Functioning in Suicidal and Non-Suicidal Depressed Elderly

Suicidal participants performed significantly worse than nonsuicidal depressed participants on the DRS total score (ANCOVA, covarying for age: $F(1,61)=6.88$, $p=0.011$) and the EXIT25 ($F(1,61)=14.96$, $p=0.0003$). *EXIT scores of 15/50 or higher have been correlated with significant functional impairment^{35–39}

DRS: Dementia Rating Scale;

EXIT: Executive Interview.

TABLE 1
Demographic and Clinical Characteristics of Suicidal and Nonsuicidal Depressed Elderly Participants

	Suicidal	Nonsuicidal	t or χ^2	df	p Value
N	32	32			
Age, years (SD)	70.2 (9.0)	71.5 (7.1)	0.63	62	0.53
Men (%)	47	38	0.58	1	0.45
White (%)	84	75	0.89	1	0.35
Education, years (SD)	12.1 (2.9)	12.7 (2.5)	0.79	62	0.43
Cumulative Illness Rating Scale adapted for Geriatrics (SD)	9.0 (3.8)	9.5 (3.4)	0.55	62	0.58
17-item Hamilton Depression Rating Scale excluding item 3 (SD)	19.5 (5.6)	20.3 (3.4)	0.76	62	0.45
Recurrent depression (%)	57	59	0.25	1	0.61
Mini-Mental Status Examination	26.0 (3.4)	27.3 (2.1)	NA	NA	0.16 ^d

^aMann-Whitney U test, exact p value.

TABLE 2
Cognition in Suicidal and Nonsuicidal Depressed Elderly

	Suicidal	Nonsuicidal	p Value
N	32	32	
Executive			
Interview (EXIT25)	13.3 (5.9)	8.9 (4.2)	0.0003^a
Dementia Rating			
Scale (DRS), total score	128.0 (11.5)	133.2 (9.3)	0.011^b
DRS			
Initiation/Perseveration	33.2 (4.6)	34.3 (4.0)	0.063 ^c
DRS Attention	34.4 (2.2)	35.5 (1.3)	0.046^c
DRS Construction	5.6 (0.7)	5.7 (0.7)	0.50 ^c
DRS Conceptualization	34.6 (4.3)	35.5 (3.0)	0.53 ^c
DRS Memory	20.3 (3.9)	22.2 (3.2)	0.021^c

Notes: Data are means (SD).

^a Analysis of covariance with age included as covariate, $F[1,61] = 14.96$.

^b Analysis of covariance with age included as covariate, $F[1,61] = 6.88$.

^c Mann-Whitney U tests, exact p values reported.