Impulsive Choice and Psychological Pain in Acutely Suicidal Depressed Patients

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Objective: Despite identification of several risk factors, suicide prediction and prevention is still a clinical challenge. Suicide can be seen as a consequence of poor decision making triggered by overwhelming psychological pain. We examined the relationship of choice impulsivity and psychological pain in depressed patients with acute suicidality. **Methods:** Impulsive choice (delay discounting), psychological pain, and clinical characteristics were assessed in four groups of adults ($N = 20$–22): a) depressed patients within 72 hours after a suicide attempt, b) depressed patients with active suicidal ideation, c) nonsuicidal depressed patients, and d) healthy controls. **Results:** Impulsive choice was higher in the suicide attempt (0.114 [0.027]) and ideation (0.099 [0.020]) groups compared with nonsuicidal depressed (0.079 [0.020]) and healthy (0.066 [0.019]) individuals ($F(3,79) = 3.06$, $p = .042$). Psychological pain data showed a similar profile ($F(3,78) = 43.48$, $p < .001$), with 43.4 (2.9) rating of psychological pain for the suicide attempt, 54.3 (2.2) for suicide ideation, 37.0 (3.2) for nonsuicidal depressed, and 13.7 (0.5) for healthy groups. Within the suicide attempt group, persisting suicidal ideation was associated with more severe depression (36.6 [2.9] versus 21.5 [3.1], $p = .007$) and choice impulsivity (0.134 [0.03] versus 0.078 [0.04], $p = .015$). Both measures normalized within a week: depression (29.9 [2.6] versus 14.4 [3.0], $p = .006$) and choice impulsivity (0.114 [0.026] versus 0.066 [0.032], $p = .019$). **Conclusions:** Transient impulsive choice abnormalities are found in a subset of those who attempt suicide. Both, suicidal ideation and behavior were associated with choice impulsivity and intense psychological pain. **Key words:** suicide, suicidal ideation, depression, cognition, pain, delay discounting.

BAI = Beck Anxiety Inventory; **BDI-II** = Beck Depression Inventory; **BHS** = Beck Hopelessness Scale; **C-SSRS** = Columbia Suicide Severity Rating Scale; **FDR** = false discovery rate; **GLM** = general linear model; **MCQ** = Monetary Choice Questionnaire.

INTRODUCTION

Worldwide, approximately one million people die by suicide yearly (1). In the United States, suicide was ranked 10th among causes of death in 2010, claiming more than 38,000 lives (2), and in subsequent years, the suicide rate has continued to rise. Deaths by suicide are more numerous than deaths related to septicemia, human immunodeficiency virus infection, chronic liver disease, Parkinson disease, or homicide. These statistics are believed to be underestimates because a considerable number of suicides are underreported or misclassified (e.g., single-person auto accidents, accidental poisonings, etc). Moreover, more than 13% of the general population experience suicidal ideation at some point in their lives, and approximately 4% attempt suicide (3). Suicidal ideation is known to predict risk for suicide, particularly within the first year after its onset (4).

A variety of factors (i.e., impulsivity, anhedonia, hopelessness, and psychological pain) are associated with suicide (5,6). Suicidality is associated with cognitive rigidity, impaired executive function, poor problem-solving skills including an excessively passive approach (7,8), and deficits in the ability to delay gratification (9). Neurobiological findings associated with suicide include reduced serotonergic neurotransmission, increased hypothalamic-pituitary-adrenal axis activity, and abnormal prefrontal cortical function (for review, see Ref. (10)). However, precisely predicting individual risk for suicide continues to be the most challenging task in clinical practice.

Although virtually all psychiatric disorders increase the risk of suicide (4,11), major depression is associated with more than one-half of all suicides (12). Decisions made during depressed states are tainted by a pessimistic outlook and distorted negative cognitions (13), especially of a negative self-referential nature (14). Depression is associated with impaired reward processing and alterations in the brain reward system (15,16). However, suicide is associated with cognitive abnormalities independent of depression (17).

Suicide has been described as "a permanent solution to a temporary problem" (18), a comment reflecting the view that suicide is the result of flawed impulse control. Moreover, in accordance with the Shneidman (19) view of suicide as the result of overwhelming angst of the individual (psychache, psychological pain, or mental pain), suicide could be seen as an impulsive decision that aims to eliminate this psychological pain by discounting the rest of the individual life span (20). Thus, in this report, our focus is the relationship of choice impulsivity and psychological pain with acute suicidal behavior in adult depressed patients. (See Box 1 for a description of concepts used in this study.) We hypothesized that depressed patients after a recent suicide attempt (within 72 hours) will show both exaggerated impulsive choice and intense psychological pain. Our second hypothesis was that the increase in both impulsive choice and psychological pain will decrease after the suicidal crisis is resolved.

METHODS
Participants

We recruited four groups of adults aged 18 to 65 years of both sexes from November 2011 to November 2012:

Group 1: depressed patients after a recent (within the previous 72 hours) suicide attempt that was assessed to be moderate-high in intent and lethality as defined by a score of 2 or higher in the actual lethality/medical damage

a) depressed patients after a recent suicide attempt will show both exaggerated impulsive choice and intense psychological pain, and b) the increase in both impulsive choice and psychological pain will decrease after the suicidal crisis is resolved.

-Impulsive choice: abnormal aversion for delay of reward
-Delay discounting: ability to delay gratification, which was quantified in this study with the Monetary Choice Questionnaire (MCQ)
-Discounting rate: constant that represents the ability to delay gratification for each individual; it is calculated from administration of the MCQ.
-Psychological pain: state of intense inner tension or angst, also known as mental pain or psychache, which, in severe and overwhelming cases, can be associated with suicidal ideation and behavior
-Suicide attempt group: depressed patients with at least moderate intent and lethality self-harm within the last 72 hours
-Suicidal ideation group: depressed patients with current suicidal ideation and no suicide attempt in the last year

subscale (0, no physical damage or very minor physical damage; 1, minor physical damage; 2, moderate physical damage, medical attention needed; 3, moderately severe physical damage; medical hospitalization and likely intensive care required; 4, severe physical damage; medical hospitalization with intensive care required; 5, death) and a score of 1 or higher in the potential lethality subscale (0, behavior not likely to result in injury; 1, behavior likely to result in injury but not likely to cause death; 2, behavior likely to result in death despite available medical care) of the Columbia Suicide Severity Rating Scale (C-SSRS), a clinician-rated measure of current and past suicidal ideation and behavior (21) ($n = 20$);
Group 2: depressed patients with current suicidal ideation ($n = 22$);
Group 3: nonsuicidal depressed patients ($n = 20$); and
Group 4: healthy controls ($n = 20$).

These volunteers were recruited from the psychiatric inpatient units and medical-surgical inpatient units who consulted psychiatry (Groups 1, 2, and 3) or psychiatric outpatient clinics (Groups 2 and 3) at the University of Miami and Jackson Memorial Hospitals, and the community (Groups 3 and 4). All participants in Groups 1, 2, and 3 fulfilled the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition criteria for major depressive disorder. To avoid confounding effects of recent suicide attempts, depressed patients (Groups 2 and 3) with suicide attempts in the last year were excluded. To avoid confounding effects of electroconvulsive therapy on cognitive measures, patients receiving electroconvulsive therapy currently or within the last month were excluded. All procedures were approved by the University of Miami and Jackson Memorial Hospital institutional review boards.

Consecutive patients admitted to the inpatient and outpatient research locations were approached for participation in this study. Twenty consecutively depressed patients hospitalized after a recent suicide attempt were approached and agreed to participate. Twenty-seven patients hospitalized for suicidal ideation were approached, 22 were enrolled, and 5 did not agree to participate in the study. Twenty outpatients were invited and agreed to participate in the study. The healthy controls were recruited through flyers posted in the community.

Procedure

After written informed consent, participants' demographics and psychiatric and medical history were obtained. The C-SSRS and Beck Depression Inventory (BDI-II) (22) were used to quantify suicidal ideation and behavior, as well as depression severity. Known risk factors associated with suicide were characterized with the Beck Anxiety Inventory (BAI) (23), Beck Hopelessness Scale (BHS) (24), Barratt Impulsiveness Scale (25), Childhood Trauma Questionnaire (26), and the Psychache Scale were administered (27). The Psychache Scale is

self-reported and consists of 13 items. It focuses on changes in the self and its functions and accompanying negative feelings. Next, the Trail Making Tests, Parts A and B, were administered to assess attention and switching components of executive functioning, respectively (28). Choice impulsivity was evaluated with the Monetary Choice Questionnaire (MCQ). The MCQ takes 5 to 10 minutes to complete and presents repetitive choices between immediate smaller rewards and delayed larger ones. The scale features 27 choices of varying sizes and delays, with each choice contributing to the estimate of the participants' discount rate (k) for the hyperbolic-decay model, $V_d = V/(1 + kd)$ as described previously (29), where V_d represents the value of the sooner amount (reported as a proportion of the delayed amount) and d is the delay. Patients from the suicide attempt group were readministered the BDI-II, BAI, BHS, Psychache Scale, and the MCQ 5 to 10 days after the initial evaluation, but before hospital discharge. Participants were remunerated for their participation.

Data Analysis

Analysis of variance was used to compare demographic measures (age, sex, race, education years, functioning level). A general linear model with correction for age, sex, race, marital status, education years, and functioning level was performed to compare clinical measures (C-SSRS, BDI-II, BAI, BHS, Barratt Impulsiveness Scale, and Psychache Scale), executive function (Trail Making Tests A and B), and choice impulsivity (MCQ) scores between the four groups. Significant results were followed by Dunnett test using the nonsuicidal depressed group as reference. Independent Student's t test was used to compare clinical characteristics within the suicide attempt group (i.e., those with and without current suicidal ideation) and between depressed women and men. Paired Student's t test was used to compare clinical characteristics of patients in the suicide attempt group between initial and follow-up visits. Linear regression analysis using suicidal ideation and behavior as dependent variables was used. Binary logistic regression analysis was used to build hierarchical models to predict differences between groups. Significance level was set at $p = .05$. We performed multiple comparison corrections using the false discovery rate (FDR) method. We used PROC MULTTEST of SAS 9.2 to correct for multiple comparisons correction. PROC MULTTEST approaches the multiple testing problem by adjusting the p values from a family of hypothesis tests. An adjusted p value is defined as the smallest significance level for which the given hypothesis would be rejected, when the entire family of tests is considered. We used FDR-controlling p value adjustments. FDR requests adjusted p values by using the linear step-up method of Benjamini and Hochberg (30). We reported adjusted p values.

RESULTS

The most common method of suicide attempt was drug overdose, followed by wrist cutting and jumping into traffic, onto train tracks, or off a bridge. Table 1 shows the demographic characteristics of our sample. There were no significant differences in age, race, sex, or years of education between the groups. The healthy control group was entirely composed of individuals who were either working or attending school, whereas the proportion of such individuals in the other groups ranged between 27% and 50%. Interestingly, the suicide attempt group had a higher proportion of functionally active individuals (working or studying versus unemployed or disabled) than the suicidal ideation or nonsuicidal depressed groups ($\chi^2 = 23.7$, $df = 3$, $p < .001$).

Depression severity in the nonsuicidal depressed group was lower than that in the suicidal ideation group and lower than that in the healthy control group ($F(3,79) = 39.38$, $p < .001$). However, this may be an effect of the limited sample size. A similar picture was observed regarding hopelessness ($F(3,79) = 19.84$, $p < .001$) and psychological pain ($F(3,79) = 6.50$, $p < .001$). There was no significant difference in the severity of past

TABLE 1. Clinical Characteristics of Depressed Patients After a Recent Suicide Attempt, Depressed Patients With Suicidal Ideation, Nonsuicidal Depressed Patients, and Healthy Participants

	Suicide Attempt	Suicide Ideation	Depressed Controls	Healthy Controls	Unadjusted p	Adjusted p
n	20	22	20	20		
Age, y	36.4 (3.8)	43.1 (2.7)	46.2 (2.5)	39.3 (4.5)	.10	
Sex (male)	8	11	7	10	.25	
Race					.96	
White	10	8	8	10		
Black	5	6	6	5		
Hispanic	5	8	6	5		
Education, y	13.0 (0.5)	12.4 (0.7)	13.9 (0.5)	14.9 (0.5)	.091	
Functioning level						
Student or working/unemployed, disabled, or retired	10/10	6/16	9/11	20/0	<.001[a]	
Clinical characteristics						
Depression (BDI)	29.1 (2.6)	36.2 (2.6)[b]	25.5 (2.4)	2.2 (2.6)[b]	<.001	<.001
Anxiety (BAI)	22.7 (3.4)	25.0 (2.8)	22.3 (3.2)	3.6 (1.1)[b]	<.001	<.001
Hopelessness (BHS)	10.1 (1.5)	13.7 (1.2)[b]	8.4 (1.4)	1.0 (0.3)[b]	<.001	<.001
Psychache	43.4 (2.9)	54.3 (2.2)[b]	37.0 (3.2)	13.7 (0.5)[b]	<.001	<.001
Physical pain	14.8 (1.7)	11.8 (2.2)	14.2 (2.3)	4.7 (1.6)[b]	<.002	.096
Suicidality						
Suicidal severity	1.9 (0.5)[b]	2.5 (0.4)[b]	0.1 (0.0)	0 (0)[b]	<.001	<.001
Frequency	2.8 (0.4)	3.2 (0.4)[b]	0.5 (0.2)	0 (0)[b]	<.001	<.001
Duration	3.0 (0.4)[b]	2.5 (0.4)[b]	0.4 (0.2)	0 (0)	<.001	<.001
Controllability	3.1 (0.4)[b]	3.1 (0.4)[b]	0.6 (0.3)	0 (0)	<.001	<.001
Deterrents	2.2 (0.4)[b]	1.7 (0.3)[b]	0.2 (0.1)	0 (0)	.001	.004
Reasons for ideation	4.5 (0.3)[b]	4.0 (0.3)[b]	0.9 (0.4)	0 (0)	<.001	<.001
Past suicide attempts	20	15	10	0		<.001[a]
No. suicide attempts	2.6 (0.8)[b]	2.5 (0.8)	1.7 (0.8)	0.0 (0.0)[b]	.013	.46
Past highest lethality	2.6 (0.4)	2.2 (0.5)	1.5 (0.4)	0.0 (0.0)	<.001	.23[c]
Trauma history						
Childhood trauma	58.3 (4.9)[b]	57.3 (4.7)[b]	43.7 (2.9)	28.9 (1.4)[b]	<.001	<.001
Recent social cultural stress	22.9 (1.8)	21.8 (1.5)	18.9 (0.9)	13.3 (0.5)[b]	<.001	.005
Recent social acceptability stress	12.2 (0.9)	13.6 (0.9)	11.6 (0.8)	6.5 (0.4)[b]	<.001	.001
Recent social victimization	10.2 (0.7)[b]	9.2 (0.8)	7.4 (0.5)	5.6 (0.4)	<.001	.001
Recent work-related stress	13.8 (1.1)	14.6 (1.2)	13.1 (1.0)	10.2 (0.7)	.026	.063
Recent finance-related stress	13.5 (1.2)	15.3 (0.9)	12.9 (1.0)	8.7 (0.6)[b]	<.001	.023

BDI = Beck Depression Inventory; BAI = Beck Anxiety Inventory; BHS = Beck Hopelessness Scale; GLM = general linear model.

Values are presented as mean (standard deviation). Analysis of variance was performed for all demographic variables. GLM with correction for age, sex, race, marital status, and education years was performed to compare all clinical variables between the four groups, except for Yates χ^2.

[a] Yates χ^2.

[b] Compared with the depressed control group.

[c] GLM performed only with Groups 1 to 3.

previous suicide attempts between the three depressed groups ($F(2,60) = 1.52$, $p = .23$).

Childhood trauma ($F(3,78) = 12.58$, $p < .001$) was higher in both the suicide attempt and suicidal ideation groups than in the nonsuicidal depression group. Regarding recent experiences, the suicide attempt group showed significantly higher social victimization than the nonsuicidal depressed group ($F(3,78) = 8.28$, $p < .001$). Steeper delay discounting, evidenced by discount rates (operational measure of delay discounting in the MCQ; $F(3,79) = 3.06$, $p = .042$), was found in the suicide attempt and suicidal ideation groups than in the nonsuicidal

depressed group. Logistic regression analysis showed that psychological pain predicted the presence of suicidal ideation in the overall sample ($r^2 = 0.29$, $p < .001$, odds ratio [OR] = 1.08, confidence interval [CI] = 1.04–1.12) and differentiated between the suicide attempt and suicidal ideation groups ($r^2 = 0.15$, $p = .044$, OR = 1.06, CI = 1.00–1.13).

Within the suicide attempt group, those with continuing suicidal ideation at entry into the study (10) exhibited more severe depression ($t = 3.08$, $p = .007$), hopelessness ($t = 2.31$, $p = .034$), and increased delay discounting ($t = 2.79$, $p = .015$) than did those without current suicidal ideation (Fig. 1). Logistic regression
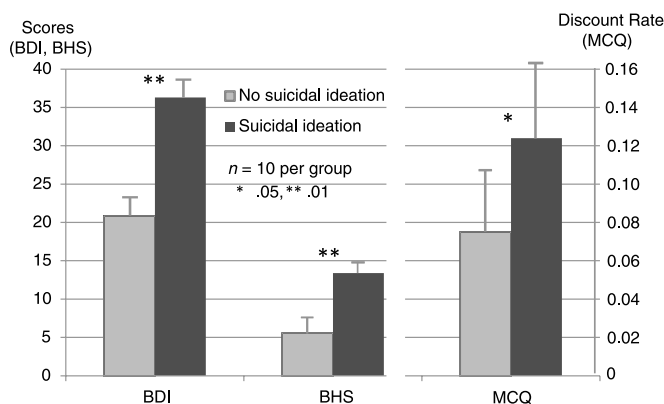
Figure 1. Comparison of depressed patients after a recent suicide attempt with and without persisting suicidal ideation. BDI-II = Beck Depression Inventory score; BHS = Beck Hopelessness Scale score; MCQ = Monetary Choice Questionnaire.

identified depression severity as a predictor of continuing suicidal ideation ($r^2 = 0.37$, $p = .038$, OR = 1.19, CI = 1.01–1.41).

On a second assessment 5 to 10 days after the initial interview and before hospital discharge, the suicide attempt group showed reductions in severity of depression ($t = 3.94$, $p = .006$), hopelessness ($t = 3.04$, $p = .019$), psychological pain ($t = 4.27$, $p = 0.004$), and suicidal ideation intensity scores ($t = 4.21$, $p = .003$), as well as in delay-discounting rates ($t = 3.43$, $p = .019$; Fig. 2).

Overall, depressed women showed higher anxiety ($t = -3.25$, $p = .002$), history of sexual abuse ($t = -2.15$, $df = 79$, $p = .035$), and lethality of past suicide attempts ($t = -2.04$, $p = .045$) than did depressed men. Among the suicide attempt group, 78% of patients were receiving antidepressants before the attempt and 94% were doing so by the time of our first assessment (Table 2).

DISCUSSION

The major findings from this study support our hypothesis that both exaggerated choice impulsivity and intense psychological pain were found associated with a recent suicide attempt (within 72 hours). With respect to these two measures, however, there were no significant differences between the suicide attempt and and suicidal ideation groups. Continuing suicidal ideation after a recent suicide attempt was associated with more severe depression, hopelessness, and exaggerated delay discounting. Within 1 week after a suicide attempt, there were significant reductions in depression, hopelessness, suicidal ideation, psychological pain, and delay-discounting deficits.

Cognitive and Decision-Making Deficits in Suicidal Behavior

One of our major findings was the lack of difference in depression level, severity and intensity of suicidal ideation, psychological pain, and choice impulsivity between the suicide attempt and suicidal ideation groups. The lack of differences in choice impulsivity between the suicide attempt and suicidal ideation groups may be explained in at least two ways.

First, a subset of the suicide attempt group reported a subjective improvement accompanied by a decrease in depression severity and the absence of suicidal ideation. This improvement may reflect an inherent limitation of a post–suicide attempt assessment. Thus, even with assessing patients as early as 72 hours after an attempt, our study may have failed to capture the exact frame of mind of patients during the time of the suicide attempt. Because of the difficulty of recreating the true state of mind (not only recall of emotions or thoughts, but also performance in the MCQ and Trail Making Tests), our assessment was directed at the state of mind at the time of the interview. In contrast, at the time of testing, all of the patients in the suicidal ideation group were expressing current ideation (usually accompanied by more severe depression, psychological pain, and cognitive impairments).

A second explanation may lie in the heterogeneity of the suicide attempt group, who used varied lethality methods that may dilute and mask clinical severity and choice impulsivity abnormalities. Suicidal ideation is known to be a critical precondition for suicide (31). In agreement with our results, executive function impairments (i.e., shift setting and cognitive rigidity) (32) and negative cognitive biases (33) have been found in depressed patients with suicidal ideation compared with those without it. In addition, decision-making deficits have been described in depressed patients after a suicide attempt with persistent suicidal ideation within 3 months after their last attempt (34). On the other hand, previous reports had shown that depressed patients after a suicide attempt display impaired cognition and deficits in executive function (i.e., impaired visuospatial conceptualization, inhibition, visual attention, and working memory) (17,35) and social problem solving (7; however, patients after a high-lethality suicide attempt displayed increased ability to delay gratification compared with those who used low-lethality methods (9). Furthermore, participants with a history of high-lethality suicide attempts exhibited deficits in executive function and intellectual functioning independent of depressive symptoms (8). Poor inhibition was found in patients with various psychiatric diagnoses
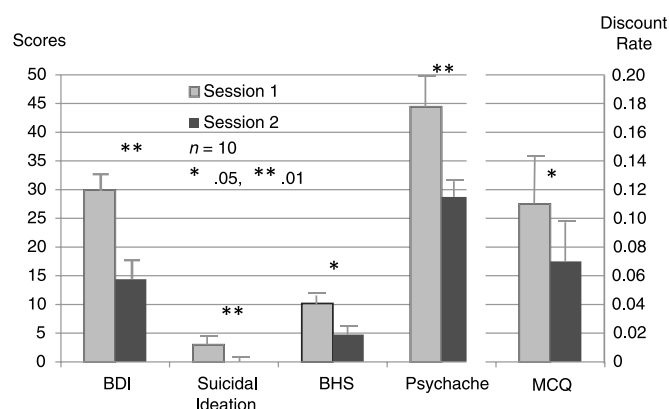

Figure 2. Evolution of depression (BDI-II), suicidal ideation, hopelessness (BHS), psychological pain (Psychache Scale), and delay-discounting rate (K) from the MCQ in depressed patients within 1 week after a suicide attempt. BDI-II = Beck Depression Inventory score; BHS = Beck Hopelessness Scale score; MCQ = Monetary Choice Questionnaire.

TABLE 2. Executive Function, Decision Making, and Impulsivity in Depressed Patients After a Recent Suicide Attempt, Depressed Patients With Suicidal Ideation, Nonsuicidal Depressed Patients, and Healthy Participants

	Suicide Attempt	Suicide Ideation	Depressed Controls	Healthy Controls	Unadjusted p	Adjusted p
n	20	22	20	20		
Delay discounting (discount rate)	0.114 (0.027)[a]	0.099 (0.020)[a]	0.079 (0.02)	0.066 (0.0192)	.013	.042
No. impulsive choices	19.3 (1.2)	21.0 (0.9)	17.9 (1.4)	15.2 (1.2)	.021	.057
Attention (Trail Making Test A), s	34.2 (2.5)	40.5 (5.0)	36.0 (2.8)	19.4 (1.4)[a]	<.001	.19
Cognitive processing speed (Trail Making Test B), s	99.8 (12.9)	104.4 (13.9)	86.3 (8.4)	62.4 (9.8)	.056	.56
Impulsivity (BIS-11)						
Attentional	19.8 (1.8)	19.3 (1.0)	17.5 (1.0)	14.7 (1.0)	.023	.13
Motor	25.5 (1.4)	26.5 (1.2)[a]	22.4 (1.1)	20.3 (1.3)	.003	.17
Nonplanning	26.9 (1.4)	30.7 (1.5)	26.5 (1.2)	20.4 (1.4)	.002	.035

BIS-11 = Barratt Impulsiveness Scale; GLM = general linear model.
Values are presented as mean (standard deviation). GLM with correction for age, sex, race, marital status, and education years performed in all variables.
[a] Compared with the depressed control group.

who had attempted suicide compared with patients with only suicidal ideation (36). Impaired decision making, reflected in poor performance in the Iowa Gambling Task (designed to mimic complex and uncertain decision making), is found in individuals who used violent methods compared with those who employed nonviolent ones (37). It is possible that cognitive deficits may be more specific to suicidal behavior than to any given psychiatric diagnosis because these observations hold true for suicidal patients with depression, bipolar disorder, schizophrenia, and even temporal lobe epilepsy (8,35,38,39). In summary, suicidal behavior has been associated with a wide array of executive function and decision-making deficits. However, it is important to remember that most of these studies were conducted in euthymic patients months or years after a suicide attempt. The distance in time between the suicide attempt and the post–suicide assessment in the studies stands in a sharp contrast with our study's evaluation of the patients within 72 hours after a suicide attempt.

Impairments in decision making and executive function are thought to lead susceptible individuals to be more likely to get involved in difficult interpersonal situations and then to manage them poorly. Such factors also contribute to the development of depression and suicidal ideation (40). The ventromedial prefrontal cortex plays a key role in decision making in the presence of complex choices and uncertain situations. Several lines of evidence support the view that serotonergic input to the ventromedial prefrontal cortex and its connections with the amygdala and insula are important mediators of the processes leading to suicide (41). At least some of the poor decision making associated with suicide implies an abnormal ability to delay gratification (delay discounting), in agreement with our findings, in the form of sacrificing the remaining lifetime to relieve an overwhelming negative emotion (psychological pain) (20,42).

Three Days Afterward: Soon Enough?

A strength of the present study was its emphasis on examining patients within a short period (72 hours) after the attempt. However, it is possible that our 3-day window may be too long

to capture the state of mind that led these individuals to attempt suicide, including symptom severity, hopelessness, psychological pain, executive function, and decision-making processes. Often, surviving a suicide attempt is followed by an intense and dramatic improvement in depression and resolution of suicidality. Thus, it has been reported that immediately after jumping off a bridge in a suicide attempt, patients realized that they actually wanted to live (43). This phenomenon has been linked to a number of factors, including the subjective experience of divine intervention, a renewed sense of purpose (43,44), and resolution of the precipitant interpersonal conflicts. In our sample, dramatic improvements in depression, hopelessness, suicidality, and psychological pain were observed within the week after the attempt and, in parallel with these, were improvements in choice impulsivity abnormalities. Our results suggest that this clinical improvement may be related to an improvement in depression, with further amelioration in symptoms possibly related to the existential impact of a life-changing experience, the structured inpatient environment, or the initiation of a new antidepressant agent. This is consistent with previous reports of improvement of depression, anxiety, and general functioning within 1 week after a suicide attempt (45–47). In addition, suicidal ideation and hopelessness occurred as a function of depression severity (48,49). Suicidal ideation in particular correlates with mood symptoms and self-punitive thinking (36,50,51). Further follow-up studies are necessary to clarify the relationship between depression severity, suicide, and decision-making impairments.

State or Trait?

The normalization within 1 week of exaggerated delay discounting in persistently suicidal patients after a suicide attempt, with parallel improvements in suicidality and depression, supports the view that both increased choice impulsivity and psychological pain are associated with severe suicidal ideation (see Fig. 2). Our data prevent us from establishing a causal relationship, which will need to be explored in further longitudinal studies. Our results are in contrast to previous findings

from studies of euthymic patients months or years after their last suicide attempt that suggest that decision-making and cognitive deficits represent a trait associated with suicidal behavior (17,34,35,37). Regardless of whether cognitive and decision-making impairments associated with suicide represent a state or trait phenomenon, there is a growing evidence that suggests that these variables are valuable targets in suicide prevention. Currently available tools to target cognition and decision making in individuals at high risk for suicide include cognitive remediation (52) and problem solving–oriented psychotherapies (53,54).

LIMITATIONS

An intrinsic limitation of trying to understand what leads to a suicide attempt is that surviving a suicide attempt could be a dramatic transforming experience for the individual. With respect to our study, its relatively small sample is a limitation. In addition, the window of 72 hours after suicide attempt may be too long a period to capture the state of mind of an individual immediately before an actual suicide attempt. It is important to note that, among our study participants, history of suicide attempts was present not only in the recent suicide attempt group but also in the suicidal ideation group (15/22) and the nonsuicidal depressed group (10/20). We used self-reported measures of depression and anxiety (BDI-II and BAI), which have been associated with bias in capturing mood in contrast to somatic or cognitive symptoms (55). It is possible that we missed those suicide attempts with very high lethality, which landed patients in intensive care units not stable enough for psychiatry to be consulted (i.e., comatose, altered mental status, or nonverbal because of recovery from a lifesaving surgical intervention). No conclusions can be drawn on any potential role of antidepressant medications in the development of suicidal ideation or behavior because a high percentage of patients had been treated with antidepressants for variable periods before the attempt and practically all patients who attempted suicide were receiving active antidepressant treatment. Lastly, Axis II pathology was not systematically obtained in our study.

CONCLUSIONS

Although a number of suicide risk factors have previously been identified, this study highlights the role of increased choice impulsivity and psychological pain in suicide. Both choice impulsivity and severe psychological pain are associated not only with suicidal behavior but also with suicidal ideation. Given the limited sample, we cannot determine whether this is merely an effect of depression severity. Demonstrable but transient decision-making abnormalities were found in a subset of depressed patients shortly after a recent suicide attempt. Further studies are warranted to determine the contribution of depression severity to the development of decision-making deficits and emotion processing associated with suicidal ideation. Potentially, cognitive and decision-making deficits during acute suicidality are targets for clinical intervention such as cognitive remediation and problem solving–focused cognitive behavioral therapy.

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