A Prospective Study of the Paradoxical Relationship Between Impulsivity and Lethality of Suicide Attempts

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Background: Biological studies suggest that lower serotonergic activity is associated with both greater suicide lethality and impulsive personality traits. These results may lead to the conclusion that impulsivity in the attempt should be associated with greater lethality. However, Klerman's review of epidemiologic suicide studies suggests an inverse relationship between impulsivity and lethality. This seemingly paradoxical relationship between impulsivity and lethality has not been explored in large representative clinical samples of suicide attempts.

Method: During 1996 to 1998, 478 individuals who attempted suicide were studied in a general hospital in Madrid, Spain. Impulsivity was measured as described in the literature by combining 2 items of Beck's Suicidal Intent Scale (active preparation for attempt and degree of premeditation). Lethality of the attempt was assigned 1 of 4 levels according to the need for medical and/or psychiatric treatment.

Results: More than half of the attempts were impulsive (55%; 95% confidence interval [CI], 51% to 59%), approximately one fourth of the attempts had an intermediate level of impulsivity (28%; 95% CI, 24% to 32%), and approximately one sixth of the attempts were not impulsive (17%, 95% CI, 13% to 21%). There was an inverse association between the impulsivity and lethality of the suicide attempt ($\chi^2 = 62.639$, df = 6, $p < .0001$). The most impulsive attempts tended to result in less morbidity, while the less impulsive attempts tended to be more lethal.

Conclusion: If the inverse relationship between impulsivity and lethality is replicated in other large and representative samples, new studies will be needed to clarify the complex interactions between the clinical dimensions (lethality, impulsivity as a state, and impulsivity as a personality trait) and the biological correlates (particularly serotonergic function) of suicidal behavior.

(J Clin Psychiatry 2001;62:560–564)

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Supported in part by a Young Investigator Award from the National Alliance for Research on Schizophrenia and Depression, Great Neck, N.Y. (Dr. Baca-García).

Presented as a poster at the 54th annual meeting of the Society of Biological Psychiatry, May 13–15, 1999, Washington, D.C.

The authors thank Debra Browne, B.S., for editorial assistance.

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Suicide is a major cause of mortality and use of health resources. It is also a tragic and serious preventable public health problem all over the world.[1] Each year in the United States, 30,000 people die due to suicide (eighth leading cause of death), and in the world, 1 million people complete suicide (1.8% of total world mortality).[2] In the United States, suicide causes more deaths than homicide or acquired immunodeficiency syndrome (AIDS). There are no reliable statistics about the number of suicide attempts made in the United States; however, it is estimated that 775,000 suicide attempts occur each year, accounting for 500,000 visits to emergency departments.[3,4] One clinical study[5] identified suicidal behavior in 38% of psychiatric emergencies (95% confidence interval [CI], 33% to 43%).

The assessment of acute suicide risk is one of the most difficult and demanding tasks performed in the emergency department.[6] Recently, impulsivity has been recognized as a major risk factor in suicidal behavior,[7–9] especially in repetitive suicidal behavior.[10] In fact, a recent report by the U.S. Surgeon General identified impulsive tendencies as a risk factor for suicidal behavior.[4]

Biological studies suggest that low serotonergic activity is associated with impulsive personality traits and suicidal behavior.[7,8,11] Moreover, low levels of the main serotonin metabolite, 5-hydroxyindoleacetic acid (5-HIAA), in cerebrospinal fluid (CSF) are considered a stable marker of risk for suicidal behavior independent of psychiatric diagnosis. In addition, lower serotonergic activity

(measured by low CSF 5-HIAA levels, blunting of prolactin response to fenfluramine, or platelet 5-HT_{2A} receptor up-regulation) is associated with lethality in suicide attempts.[7,12] Additionally, low serotonergic function is also associated with impulsive personality traits.[13]

When linking these previous findings, one might conclude that impulsivity should be positively associated with lethality in suicide attempts. However, after reviewing epidemiologic studies of suicide, Klerman[14] paradoxically suggested that impulsivity may be a feature of less serious suicidal attempts. In the National Comorbidity Survey, Kessler et al.[15] did not find a significant relation between lethality of intent and the presence of a plan or the speed of attempt after onset of ideation. Published clinical studies, which include nonrepresentative samples of suicide attempts, show varying results including no association between lethality and impulsivity,[16] a positive relationship between lethality and impulsivity (more impulsivity associated with more lethality),[9,17] and a negative relationship between lethality and impulsivity (more impulsivity associated with less lethality).[18–20]

The seemingly paradoxical relationship between high impulsivity and low lethality may be real or may result from the differences in settings, sampling methods, and defining criteria of the published studies.[20] Unfortunately, there are no published clinical studies relating impulsivity and the lethality of the attempt in representative samples of suicide attempts. There are studies of impulsivity in the general population[13,21,22]; however, there are few studies of impulsivity in suicide attempts. These studies are limited to (1) studies of suicide attempt histories in the context of a specific psychiatric disorder[8,23–29] and (2) studies of impulsivity in relatively small samples ($N < 200$) of patients hospitalized after a suicide attempt.[10,17,18,20,30,31] This is the first large study that assesses impulsivity of the suicide attempts in a sample of diagnostically heterogeneous suicide-attempt patients presenting to an emergency department. The availability of this sample offers an opportunity to estimate the prevalence of impulsive attempts and to examine the relationship between impulsivity and lethality of suicide attempts.

METHOD

This sample, collected from 1996 to 1998, included 478 patients who were brought to the Hospital Ramon y Cajal (Madrid, Spain) after a suicide attempt. This general hospital provides triage for all emergencies in a catchment area of 500,000 persons in Madrid and is part of the National Health Service that provides free medical coverage to the Spanish population, which only includes whites.

A suicide attempt was defined using O'Carroll and colleagues'[32] definition, which can be summarized as an attempt with some evidence that the person intended to kill himself/herself.

The definitions of impulsive suicide attempts found in the literature are varied. Some authors define impulsive attempts as those with a short period of premeditation (from no premeditation to less than 5 minutes).[17,18,33] As some other researchers[20,30] have done, for this study we used a more complete index that combines 2 items of the Suicidal Intent Scale (SIS).[34] These 2 items are (1) active preparation for attempt and (2) degree of premeditation. Each item was scored from 0 to 2 (for active preparation for attempt, 0 = none, 1 = minimal to moderate, and 2 = extensive; for degree of premeditation, 0 = none, 1 = suicide contemplated for 3 hours or less, and 2 = suicide contemplated for more than 3 hours). Scores for these items were added and coded into 3 levels: impulsive (sum of scores = 0), intermediate (sum of scores, 1–2), or nonimpulsive (sum of scores, 3–4).

In this study, the lethality of the suicide attempt was scored from 1 to 4 according to the medical/psychiatric treatment elected by the clinicians to resolve the episode: 1 = discharge from the emergency department without psychiatric treatment, 2 = psychiatric treatment recommended after discharge from emergency department, 3 = psychiatric admission, and 4 = medical admission, including admission to the intensive care unit. The on-call internists decided whether hospitalization was required in the medical units before any psychiatric assessment took place. The on-call psychiatrists determined the need for psychiatric hospitalization or outpatient treatment using their clinical judgment. They also interviewed the patients using the SIS. After complete description of the study to the subjects, informed consent was obtained.

The SIS item expectation of fatality was used to measure the lethality expected by the patient (0 = unlikely, 1 = possible, 2 = probable or certain). The National Comorbidity Survey[15] defines lethality reported by the patient in a similar way.

The frequency of different levels of impulsivity and 95% CIs were calculated. The associations between impulsivity and lethality and between impulsivity and expectation of fatality were assessed using a chi-square test.

RESULTS

The sample mean ± SD age was 36.2 ± 14.3 years (95% CI, 35 to 38 years). Gender, DSM-IV primary diagnosis, method of attempt, psychiatric history, history of suicidal behavior, and alcohol use (according to the corresponding SIS item) of the patients studied are summarized in Table 1. This sample is clinically similar to other samples studied in emergency departments.[5,9,16,35]

Using the combination of the 2 items from the SIS scale (see Method), more than half of the attempts were impulsive (55%; 95% CI = 51% to 59%), approximately one fourth of the attempts had an intermediate level of impulsivity (28%; 95% CI = 24% to 32%), and one sixth of

Table 1. Description of the Sample (N = 478)

Variable	N	%
Gender		
Male	171	36
Female	307	64
DSM-IV diagnosis		
Main Axis I diagnosis		
Mood disorder	197	41
Substance use disorder	120	25
Schizophrenia	36	8
Anxiety disorders	22	4
Other	36	8
No major Axis I diagnosis	67	14
Axis II diagnosis		
Personality disorder	145	30
Suicide method[a]		
Poisoning	386	81
Cutting self	62	13
Other[b]	27	6
Psychiatric history		
Prior psychiatric treatment	356	74
Prior psychiatric admission	172	36
Suicide history		
Suicide attempts during lifetime	277	58
Suicide attempts during last year	159	33
Alcohol intake immediately prior to attempt	117	24
Not related/did not influence attempt	48	41
Impaired judgment	30	26
Was intended to facilitate attempt	39	33

[a]The suicide method was not recorded in 3 subjects.
[b]Other suicide methods included hanging, jumping from heights, and shooting.

the attempts were not impulsive (17%; 95% CI = 13% to 21%). There was no significant association between impulsivity of the attempt and gender ($\chi^2 = 3.2$, df = 2, $p < .21$) or age ($\chi^2 = 0.1$, df = 2, $p < .97$).

An inverse association was found between the impulsivity and the lethality of the suicide attempt ($\chi^2 = 62.6$, df = 6, $p < .001$). The most impulsive attempts tended to result in less morbidity, while the least impulsive attempts tended to be more lethal (Table 2). There was also an inverse association between impulsivity and the patient's expectation of fatality ($\chi^2 = 87.9$, df = 4, $p < .0001$). Patients whose attempts were more impulsive tended to expect less chance of fatality, and those with less impulsive attempts considered fatality to be more likely (Table 3).

Two variables, anxiety and alcohol intake, need particular attention. Anxiety as a symptom has been associated with acute suicide risk and impulsive suicidal behavior.[6,9,36–38] Anxiety is a frequent symptom in many psychiatric disorders, including mood disorders. However, the diagnosis of an anxiety disorder seems relatively rare in patients who attempt suicide. Five percent of the patients in our study had a diagnosed anxiety disorder compared with 1% to 7% in prior studies of patients in emergency departments.[9,35] It must be remembered that since our study and prior studies tend to reflect the primary diagnosis, the possibility that a patient may have a secondary anxiety disorder cannot be excluded. Future studies should include measurements of anxiety as a symptom to assess its influence on the impulsivity of the suicide attempt.

Alcohol consumption immediately prior to the attempt was measured by the SIS relationship between alcohol intake and attempt item and was related to the impulsivity of the attempt ($\chi^2 = 21.5$, df = 4, $p < .0001$). Among the attempts made by patients who consumed alcohol but denied its relationship with the attempt, 69% (33/48) were impulsive. A similar proportion of impulsive attempts, 67% (20/30), was identified among patients who acknowledged impaired judgment secondary to alcohol use at the time of the attempt. However, impulsive attempts were most frequently made by patients who used alcohol to facilitate their attempt (77% [30/39]). Alcohol consumption immediately prior to the attempt was also related to the expectation of fatality ($\chi^2 = 14.8$, df = 4, $p = .005$). Sixty-one percent of patients who used alcohol to facilitate the implementation of the suicide attempt (24/39) were certain that they would die. This percentage of patients expecting death was higher than the percentages found in patients using enough alcohol to impair judgment (20%, 6/30) and in patients with prior alcohol intake that was not related to the attempt (33%, 16/48). These data support the idea that alcohol consumption may be related to impulsive suicides[9,20] and that alcohol abuse may be related to an increased expectation of death.[39]

DISCUSSION

More than half of all suicide attempts studied were impulsive. This result agrees with the recent literature in several countries, which reports rates of impulsive suicide attempts between 40% and 80%.[9,17,20,33] The characteristic of this sample is very similar to other recent studies performed in emergency departments.[5,9,35]

Klerman's[14] review suggests that impulsive suicide attempts tend to be less serious and lethal or serious suicide attempts are more frequent among the least impulsive attempts. Biological studies of suicide suggest that low serotonergic function is associated with higher lethality. Biological studies of personality traits also suggest that low serotonergic function is associated with impulsivity. The results of our study support Klerman's view that impulsive suicide attempts tend to be less lethal than nonimpulsive attempts. A possible reason for the apparent contradiction between these biological studies could be that the different sampling methods used resulted in different study populations. Most studies in suicide are performed in the context of postmortem studies of completed suicides or retrospective studies of series of psychiatric patients with a history of suicidal behavior. These 2 approaches are associated with an evident selection bias produced by sources of information and inclusion criteria.[40]

Another limitation of this study was that the assessment of impulsivity was based on a measurement

Table 2. Lethality (measured by level of treatment needed) and Impulsivity of Suicide Attempts[a]

	Impulsivity of Attempt											
	Impulsive (N = 261)			Intermediate (N = 134)			Nonimpulsive (N = 83)			Total (N = 478)		
Level of Treatment Needed	N	%	CI	N	%	CI	N	%	CI	N	%	CI
Discharge	74	28	23 to 34	16	12	8 to 19	7	8	4 to 16	97	20	17 to 24
Discharge and psychiatric referral	106	41	35 to 47	50	37	29 to 45	13	16	10 to 25	169	35	31 to 39
Psychiatric admission	70	27	22 to 33	62	46	38 to 54	53	64	53 to 73	185	39	35 to 43
Medical admission	11	4	2 to 7	6	5	2 to 10	10	12	7 to 21	27	6	4 to 9

[a] $\chi^2 = 62.6$, df = 6, $p < .0001$. CI = 95% confidence intervals of percentages.

Table 3. Subjects' Expectations of Fatality and Impulsivity of Suicide Attempts[a]

	Impulsivity of Attempt											
	Impulsive (N = 260)			Intermediate (N = 133)			Nonimpulsive (N = 82)			Total (N = 475)		
Expectation of Fatality	N	%	CI	N	%	CI	N	%	CI	N	%	CI
Unlikely	83	32	27 to 38	12	9	5 to 15	2	2	0 to 8	97	20	17 to 24
Possible	118	45	39 to 51	61	46	38 to 54	21	26	18 to 36	200	42	38 to 46
Probable or certain	59	23	18 to 28	60	45	38 to 54	59	72	61 to 81	178	38	34 to 42

[a] $\chi^2 = 87.9$, df = 4, $p < .0001$. Three of the 478 subjects did not complete the item for expectation of fatality. CI = 95% confidence intervals of percentages.

obtained from 2 items of the SIS scale. This measure, previously used in the literature, may not fully reflect impulsivity of the suicide attempt; however, these items reflect the essence of impulsiveness: to act immediately without thinking.[41] Impulsive behavior may occur in the absence of impulsivity traits,[20] which may explain why our findings differ from biological studies focused on specific groups of patients. In this sense, this study attempted to measure impulsiveness as a state, rather than as a personality trait. Serotonergic hypofunction has been related to impulsive personality traits.[8,13] Unfortunately, this study did not include any measure of impulsive personality traits. Measures of aggressiveness or hostility might also have helped to determine these dimensions related to impulsivity.

This study used 2 measures of the severity of the suicide attempt: (1) a clinical variable, lethality, based on clinical decisions made by the treating physician, and (2) an experiential variable, the expectation of fatality, reported by the patient. The main outcome variable was the first, the lethality according to the judgment of the clinicians working at the hospital. As with any clinical judgment, this may be relatively arbitrary. However, there are some differences between the Spanish and U.S. health care systems that suggest that these clinical judgments were not influenced by economic issues, pressure from managed companies, or fear of lawsuits. This hospital provides free coverage to all Spanish people living in the catchment area; all admissions were paid for by the Spanish government through taxes. The decision to admit a patient is made purely by clinicians; no approval is needed from any organization or managed care company. In recent years there has been some pressure from hospital administrations in Spain to increase efficiency in bed occupancy, but the administrations have never tried to implement specific guidelines on how to do it. The number of malpractice lawsuits filed against physicians in Spain is very small, so the decision to keep a patient in the hospital is mainly based on the patient's characteristics and the clinical experience of the psychiatrist, not on legal liabilities. Patients are released to their families, who are encouraged to monitor the patients.

The admission to a medical unit was done without psychiatric input in our hospital and therefore could not have been influenced by any psychiatric judgment. It is unlikely that the decisions that were made by the psychiatrists were influenced by the impulsivity item of the SIS, since the published literature tends to suggest the opposite of the study findings and this analysis was not planned when the study was started. Undeniably, the clinical selection of treatment by the on-call psychiatrists probably reflects some arbitrariness similar to that found in clinical decisions for treatment of suicide attempts in other hospitals all over the world. In any case, the mortality and the reattempt rates observed in our hospital are similar to those in other published studies. Therefore, it is likely that clinical management of these patients in this hospital may be relatively similar to other hospitals and a relatively good index of the seriousness of the suicidal behavior.

This study generates more questions than it answers. The inverse relationship between impulsivity and lethality needs to be replicated in other representative samples of suicide attempts. Two types of studies need to be performed: (1) biological studies restricted to smaller samples of patients willing to participate in such studies and (2) large clinical studies reflecting all types of patients.

New biological studies during the acute phase following suicide attempts will need to focus on the complex interactions between the clinical dimensions (lethality, impulsivity as a state, and impulsivity as a personality trait) and the biological correlates (particularly serotonergic function) of suicidal behavior. New clinical studies trying to resolve the paradox will need to examine the complex relationship between impulsivity as a trait and impulsivity as a state and learn how each is impacted by psychopathology, substance intoxication, and other environmental influences. The difference between impulsivity as a trait and impulsivity as a state may prove to be at the heart of the perceived paradox.

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