Self-Report vs. Computerized Measures of Impulsivity as a Correlate of Suicidal Behavior

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Summary: Objectives: To compare the use of a self-report form of impulsivity versus a computerized test of impulsivity in the assessment of suicidal adolescent psychiatric inpatients. Methods: Sixty consecutive admissions to an adolescent inpatient unit were examined. The severity of suicidal behavior was measured with the Childhood Suicide Potential Scale (CSPS), and impulsiveness was measured with the self report Plutchik Impulse Control Scale (ICS) and with the Test of Variables of Attention (TOVA), a continuous performance test (CPT). The TOVA is used to diagnose adolescents with attention deficit disorder. Results: There was a significant but low correlation between the two measures of impulsivity. Only the TOVA commission and omission errors differentiated between adolescent suicide attempters and nonattempters. Conclusions: Computerized measures of impulsivity may be a useful way to measure impulsivity in adolescent suicide attempters. Impulsivity appears to play a small role only in nondepressed suicidal adolescents, especially boys.

Keywords: Impulsivity, suicide, computerized measures, adolescent, hospital.

Suicidal behavior among adolescents has become a central issue in public health. Not only has there been a significant rise in deaths from suicide among this age group, but also there has been a concomitant rise in nonfatal suicidal behaviors among young people. About 40% of teenagers who kill themselves had made a previous nonfatal attempt, so that attempted suicide is a definite risk factor for later suicide (Schaffer & Fisher, 1981).

Adolescent psychiatric inpatients represent an important group of individuals for research in suicidology. First, the prevalence of suicidal behavior in this group is high (Motto, 1984; Robbins & Alessi, 1985). Moreover, many studies have suggested that the vast majority of young people (up to 90%) who complete suicide and those who make serious suicide attempts have at least one diagnosable mental disorder at the time of their suicide attempt (Beautrais et al., 1998; Brent et al., 1993; Shaffer et al., 1996). Second, adolescent patients usually have a history of repeated suicide attempts (Barter et al., 1968). Third, up to 10% of these patients go on to commit suicide (Motto, 1984; Pfeffer et al., 1988; Welner et al., 1979).

The underlying causes of suicidal behavior are complex and multifactorial. One major area of interest in this regard has been that of impulsivity and lack of impulse control (Apter, Brown, Korn, & van Praag, 1991a). The relationship between impulsivity, aggression, and suicide has studied by psychoanalysts (Menninger, 1933), biologists (van Praag et al., 1987), and psychometricians (Plutchik & van Praag, 1989; Horesh et al., 1999). Impulsivity has frequently been described as a risk factor for suicide and a personality characteristic of adolescent suicide attempters. Lack of impulse control has been found to distinguish adolescent suicide attempters from adolescents with an acute illness (Slap et al., 1988). However, impulsivity does not seem to characterize all suicide attempters, since group comparisons have found no differences between suicidal patients and controls on measures of cognitive impulsivity (Spirito et al., 1989). Instead, impulsivity may be important in identifying high-risk subgroups. A 1-year follow-up of suicide attempters showed repeaters to be more impulsive than nonrepeaters. Furthermore, it has been suggested that impulsive suicide attempters come from families where action supersedes verbal mediation, and that male attempters may be more impulsive than females (Marks & Haller, 1977). Finally, impulsive suicide attempters have been found to be less depressed and less hopeless than nonimpulsive attempters (Williams et al., 1988). It is surprising how few studies have been conducted on the relationship between impulsivity and teenage suicide given the frequent reference to teenage suicide attempts as impulsive. In those
studies that do exist, the distinction between impulsive cognitive style and impulsive attempts must be considered. Another problem is that the measures of impulsivity used in these studies often reflect angry and aggressive behavior as much as behavior suggesting a lack of reflection or planning. There now seems to be little doubt that impulsivity is an important variable to study in relationship to suicidal behavior (Apter et al., 1993).

Impulse control is defined as “the ability to resist an impulse, drive or temptation to perform an action.” A major deficit of studies up to now in this field have been the almost total reliance of self-report forms in the measure of impulsivity in studies on suicidality. Intuitively, it would seem problematic to rely on an adolescent to report subjectively his or her own tendency to self-restraint. In the field of childhood attention deficit hyperactivity disorder (ADHD), this difficulty has been addressed by the introduction of computerized continuous performance tests (CPT) such as the TOVA. The main purpose of these measures are to assess attention, although they also can be used to score impulsivity. Thus, subjects’ impulse control is measured by their ability to control their impulse to click on a trigger in a simple computer game over a period of time. The correlation between impulsivity on TOVA and classroom observation is controversial (Greenberg & Waldman, 1993).

The present study studied TOVA as a measure of impulsivity in the assessment of suicidal behavior among suicidal hospitalized adolescents. The hope was that this “objective” measure would show more significant correlations with suicidal behavior than self-report forms in this vulnerable population.

Methods

Population

Sixty consecutive admissions to a university-affiliated adolescent psychiatric inpatient unit over a 1-year period were evaluated. Forty were boys and 20 were girls; 37 were admitted because of a suicide attempt and 23 for other reasons. Mean age was 15.83 with an SD of 1.66. Assessment was done 2 to 3 weeks after admission. Twelve patients had schizophrenia (7 suicidal, 5 nonsuicidal), 20 had conduct disorder (12 suicidal, 8 nonsuicidal), 16 had an affective disorder (11 suicidal, 5 nonsuicidal), 8 had eating disorders (5 suicidal, 3 nonsuicidal) and four, various other disorders (2 subjects in each group). There were no significant differences in the diagnostic distribution between the suicidal and nonsuicidal groups. Four of the conduct disorder subjects had been diagnosed with ADD (two in the suicide group and two in the nonsuicide group). None of the subjects was diagnosed as having ADHD, although this is a very difficult diagnosis to make in an adolescent inpatient with a serious axis I diagnosis. Diagnoses were based on a structured psychiatric interview “Hebrew Version of the Childhood Schedule for Affective Disorders and Schizophrenia” (K-SADS) (Apter et al., 1989). Extensive ward observation was also performed. DSM III-R criteria were used for diagnoses, and only one primary diagnosis was considered.

Assessments

The Child Suicide Potential Scale—CSPS (Pfeffer et al., 1979)

The CSPS is a semistructured interview intended to evaluate different aspects of suicidal behavior in children and adolescents. It consists of nine scales, of which we used only the spectrum of suicidal behavior to measure the severity of suicidal behaviors occurring in the last 6 months. This scale classifies suicidal behavior on a 5-point spectrum of severity ranging from nonsuicidal behavior (rated 1) through suicidal ideas (2), suicidal threats (3), mild suicidal attempts (4) to serious suicidal attempts (5). Each subject’s score is determined by the highest degree of documented suicidal tendency. Examples of questions: “Have you ever thought of hurting yourself?” (Pfeffer, 1986; Pfeffer et al., 1979, 1984, 1988).

Psychometric Properties. Cronbach’s α for the scales ranged from .57 to .98, indicating good to high level of internal reliability (Pfeffer et al., 1979, 1980, 1983, 1987). Evaluation of interrater reliability for the spectrum of suicidal behavior showed 94% of agreement of two clinicians. The interrater reliability was r = .93 among Israeli adolescent inpatients (Ofek et al., 1997). Discriminate validity has been established in several studies (Pfeffer et al., 1982).

In this study the suicidal group had a mean score of 3.7 and a standard deviation (SD) of 1.4 and the control group a mean score of 1.3 and SD 0.6.

The Impulse Control Scale (ICS)

The ICS is a scale developed by Plutchik and Van Praag (1989). This self-report scale has 15 items each measured on a four-point range. The original version has been shown to be psychometrically sound (Plutchik & Van Praag, 1989; Apter et al., 1991b). The ICS has also shown high internal reliability (0.76) and external validity in adolescents (Grosz, 1991). A Hebrew version tested on adolescents has shown high internal consistency and reliability with young males (Wagner, 1989).

Test of Variable of Attention (TOVA)

This instrument is a continuous performance measure (CPT) designed to diagnose children, adolescents and adults with ADHD. The subject is asked to watch for a target perceptual stimulus as it appears on a computer
When it does, the subject should click on the trigger. When a nontarget perceptual stimulus appears, the subject should not click the trigger. The interval between the appearance of the visual stimuli is 0.8 s. The computer automatically notes the following errors:

1. **Errors of omission**: These occur when the subject does not respond to the designated target, i.e., the subject omits pressing the button although a target is present. The omission score is the result of the subject’s errors of omission and is measured as a ratio of the subject’s correct responses to targets to the actual number of targets presented, minus the number of anticipatory responses toward targets. Omission scores are considered to be measures of inattention.

2. **Errors of commission**: These occur when the subject fails to inhibit responding and incorrectly responds to a nontarget, i.e., the subject clicks although a nontarget stimulus appeared. The commission score is the result of the subject’s errors of commission. It is measured by the ratio of the subjects incorrect responses to nontargets to the actual number of nontargets presented minus the number of anticipatory responses to nontargets. Commission errors are regarded as measures of impulsivity or disinhibition by the developers of the TOVA (Greenberg & Waldman, 1993).

3. **Reaction time** to stimuli.

4. **Repeated clicking** on one stimulus (a measure of central nervous system “immaturity”)

### The Beck Depression Inventory (Beck & Steer, 1987)

This is a 21-item self-report questionnaire widely used to measure depression in adolescents and adults. Each item consists of four statements regarding depressive symptoms or attitudes in increasing degrees of severity and the subject has to endorse one of them. This is done with reference to the past week. Each item is then scored on Likert scale from 0–3. Scores range from 0–63.

### Data Analysis

1. The correlation between measures of impulsivity and levels of suicidal behavior were measured by Pearson Product Moment Correlation Coefficients.
2. The adolescents who had attempted suicide were compared to adolescents who had not attempted suicide using a Student’s *t*-test.
3. All data were entered into an electronic database and the calculations were done using the Statistical Package for the Social Sciences (SPSS).

### Results

1. There were no significant correlations between severity of suicidal behavior as measured by the CSPS and any of the measures of impulsivity when the entire group of subjects was assessed. The correlation between CSPS and the ICS was 0.13 and between the CSPS and the TOVA commission errors was 0.20.
2. There was a significant correlation between the self-report form measuring impulsivity and the TOVA measure of impulsivity (*r* = 0.34; *p* < .05)
3. On the *t*-test the suicidal patients showed significantly higher levels of impulsivity and inattention as measured by TOVA than the nonsuicidal patients. There were no differences on the self-report measures (see Table 1).
4. There was no significant correlation between BDI scores and measures of impulsivity and inattention on the TOVA which could account for these differences

### Discussion

The results of this study support the notion that different forms of suicidal behavior occur in adolescents. One is perhaps connected to impulsivity and serotonin abnormalities and another more related to depression and dysfunction of the norepinephrine system (Apter et al., 1995).

In a previous study we showed that there is a significant and positive correlation between impulsivity, aggressive behaviors, and suicidal. This was true especially in boys, although the correlations between suicidality and impulsivity alone were not very high, yielding a maximum correlation of *r* = 0.35. In that report, however, only a self-report form was used. In this study we attempted to replicate those findings using a computerized measure of impulsivity in addition to the self-report form.. Although the computerized measure seems to be a better measure than the self-report form, the correlations (*r* = 0.430)—although significant—are moderate and not very high.

#### Table 1. Comparison between suicide attempters and non-attempters on measures of impulsivity.

<table>
<thead>
<tr>
<th></th>
<th>Suicide attempters (n = 37)</th>
<th>Nonattempters (n = 23)</th>
<th><em>p</em> value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impulse Control Scale</td>
<td>14.26 (3.18)</td>
<td>13 (4.54)</td>
<td>&gt; .05</td>
</tr>
<tr>
<td>CPT measure of impulsivity</td>
<td>3.80 (7.56)</td>
<td>0.38 (1.03)</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>CPT measure of inattention</td>
<td>1.66 (1.10)</td>
<td>2.71 (1.99)</td>
<td>&lt; .05</td>
</tr>
</tbody>
</table>
As noted before, Otto (1972) and Motto (1984) report that adolescent boys hospitalized for suicidality are at a much higher risk for eventual suicide (9%) than girls hospitalized for suicidal behavior (1%). It could be speculated that somehow this differentially high risk in males might be in some way related to differences in impulsivity and the use of more sophisticated measures of impulsivity might help to elucidate these interactions.

These results perhaps indicate one of the points at which the cycle of suicidal behavior can be attacked. If, indeed, impulsivity is a serotonin-related trait, as postulated by Linnoila et al. (1983) and Depue and Spoont (1986), then the impulsive suicidal patient may respond to specific serotonin reuptake blockers such as fluoxetine, clomipramine (Eichelman, 1988), and paroxetine (Verkes et al., 1998). It may also become feasible to measure impulsivity in a clinically useful manner and then devise specific cognitive and behavioral measures to reduce impulsivity in the appropriate suicidal adolescents (Plutchik & Van Praag, 1989).

The limitations of the study are that it is restricted to hospitalized adolescents (a risk group for eventual suicide) and is not representative of the community. In addition none of the adolescents had comorbid substance abuse which although at the time of the study was representative for Israel, makes these results less generalizable to most European countries.

Conclusion

Impulsivity is a potential area for further study of suicidal behavior. The development of sophisticated measures may help both the clinician and the researcher to understand some forms of suicidal behavior in greater depth. TOVA is one method, but obviously greater refinements are called for. TOVA should not be regarded as a substitution for self-report or interview measures.

References


About the author:

Dr. Horesh is a graduate of the Tel Aviv University where she did her doctoral dissertation on life events and affective disorders. She has served as Senior Psychologist at the Sheba Medical Center and as Chief Psychologist at the Shalvata Mental Health Center. She is presently Chairperson of the Department of Clinical Psychology at Bar Ilan University in Ramat Gan, Israel.

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