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ORIGINAL PAPER

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Suicidal behavior among Finnish fire setters

Abstract Histories of serious suicide attempts and slashing were investigated among Finnish fire setters. Medical and criminal records of 304 fire setters were examined to compare those who had attempted suicide with those who had not, and those who had slashed themselves with those who had not using biological, diagnostic, and demographic variables. Major mood disorders, father's alcoholism, and suicidal motive of fire setting (self-immolation) were significantly associated with suicide attempts. Paternal violent alcoholism, father's criminality, and suicidal motive of fire setting were significantly associated with slashing. Among fire setters, non-lethal slashing is a predictor of serious suicidality. Associations between psychiatric diagnoses, family history, and suicidality among fire setters are similar to those reported for suicidal patients with mood and substance abuse diagnoses. Therefore, studying fire setters, who exhibit an extremely high incidence of suicidal behavior, is an effective way to elucidate psychobiology of suicidal behaviors.

Key words Fire setting · Suicide attempt · Slashing

Introduction

Previous studies concerning suicidal behavior among fire setters

As compared with other psychiatric patients, suicidal and self-injurious behaviors are common among fire setters undergoing pretrial psychiatric evaluation [6, 7, 17, 30]. The suicide rate of psychotic fire setters has been reported to be several-fold compared with other hospitalized psychiatric patients [24]. A history positive for suicide attempts has been observed among more than a third of fire setters [24]. Inability to express interpersonal aggression [12] or anger [8] have been considered as causative variables for the high rate of self-injurious behavior among fire setters. Self-immolation is a suicidal act with high mortality committed usually by severely psychotic patients. Those who have mild psychotic symptoms tend to select other methods [13]. Sometimes self-immolation occurs as an epidemic [40].

Suicide attempts, slashing, and psychiatric diagnoses

Suicide attempts are associated with many psychiatric disorders, but they are most common among patients with depression [4, 9, 16], personality disorders [5], and various psychoactive substance use disorders including alcoholism [4, 19, 20]. Family history positive for completed suicide has been shown to increase the risk for suicide attempts among patients with various mental disorders including schizophrenia as well as mood and personality disorders [26]. Six to eight percent of suicide attempters have a family history positive for completed suicide [18].

"Non-lethal self-harm," such as wrist slashing, has been studied both combined with serious suicide attempts and as a separate form of self-destructive behavior. In DSM-III-R, self-wounding is included as a symptom of borderline personality disorder [2]. It is also associated with other personality disorders (trait diagnoses) especially characterized by disturbances of impulse control [29]. Among patients with antisocial personality disorder, slashing oneself has been found to be associated with other self-destructive behaviors, social withdrawal, anxiety, and a family history positive for paternal alcoholism [31]. Among axis-I diagnoses, self-injurious behavior is commonly associated with eating disorders, mood disorders, panic disorder, schizophrenia, and psychoactive substance use disorders. Poor affect regulation has been suggested to be the underlying psychopathological dimension conducive to self-injurious behavior [10].

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Are there common causes for self-destructive and fire-setting behavior?

At least for a century, "irresistible impulse" has been postulated as the root cause of apparently senseless fire setting [14, 25]. The causes for a lack of impulse control among fire setters have been investigated extensively. Impulsive fire setting has been associated with hypoglycemic tendency during an oral glucose tolerance test (GTT) [15, 32], and a low concentration of the serotonin metabolite, 5-hydroxyindoleacetic acid (5HIAA), in cerebrospinal fluid (CSF) [33]. Several recent studies have provided evidence suggesting that impaired impulse control, impulsive violence, family history of paternal alcoholism, and multiple suicide attempts are associated with a low central serotonin turnover rate [5, 15, 34, 35]. Low CSF 5HIAA concentration has been found to predict both suicide attempts and completed suicides [3, 22, 23], as well as violent criminal offenses and fire setting [37]. Furthermore, central serotonin and peripheral glucose metabolism regulate each other [38]. Low blood glucose nadir during an oral GTT [34] and a history positive for past suicide attempts [6] have predicted recidivist criminal offenses among fire setters. On the other hand, inadequate socialization and impaired communication skills have been reported to be the psychological variables which contribute to reduced interpersonal aggressiveness [12] and impaired ability to express anger among fire setters [8].

The goals of this investigation were to elucidate among fire setters the following:

1. Are serious suicide attempts a characteristic of a different group of subjects than non-lethal slashing?
2. Is a high risk for suicidal behavior independent of specific psychiatric diagnoses?
3. Are serious suicide attempts associated with a history positive for paternal alcoholism, violence and criminality, maternal alcoholism, or early loss of parents?
4. Is low blood glucose nadir during an oral GTT associated with a high risk of suicidal behavior?
5. Are recidivist criminal offenses similar and equally common among subjects who have or have not attempted suicide?

Materials and methods

History of suicidal behavior was investigated among 304 male arsonists referred for a forensic psychiatric pretrial evaluation in the Helsinki University Central Hospital. Hospitalization lasted 6 weeks on the average. All suicide attempts before the fire-setting episode that resulted in the victim receiving medical attention were examined. Information was collected from first-degree relatives and all available medical records. The history of non-lethal self-destructive behavior by slashing was obtained from the subjects, and scars (in wrists, forearms, chest, and neck) were examined directly. The information concerning suicidal motivation of the index fire-setting episode was obtained from the police records during the forensic psychiatric evaluation.

An oral GTT was administered after a 12- to 16-h overnight fast. At 8:00 a.m. the subjects received 1 g/kg of body weight of glucose solution, which they consumed as rapidly as possible. Blood samples were collected before glucose administration and after 30 min and 1, 2, 3, 4, and 5 h. Blood glucose concentrations were determined enzymatically [11].

Psychiatric diagnoses were made according to the criteria of DSM-III-R [2] except for "intermittent explosive disorder" that was diagnosed according to DSM-III [19]. Wechsler total intelligence quotient was routinely determined during pretrial psychological testing.

Family history was obtained using a structured questionnaire which was sent to all living first-degree relatives of the fire setters. It contains 11 groups of questions concerning:

1. Parents
2. Second-degree relatives
3. Siblings
4. Offspring

It elicits information concerning physical and mental health, substance abuse and alcoholism, criminality, and time and cause of death. Concerning the offender, it queries about:

5. Development and behavior up to the age of 14
6. Circumstances at home, including discipline, parenting, separations, and divorces
7. Education, including interests, strengths and weaknesses, absenteeism, and discipline (this information is checked against official school records)
8. Employment history
9. Mandatory military service (this information is checked against official military records
10. Character as an adult
11. Unusual or disturbed behaviors after the age of 14

This questionnaire has been an integral part of the forensic psychiatric evaluation administered by this clinic for the past 25 years. For this study a condition or behavior in a relative was accepted as positive when reported independently by a minimum of two relatives.

The criminal registry of Finland was searched for information concerning all criminal offenses including fire setting. This registry contains a lifetime accumulative record of an individual's criminal convictions starting at the age of 15 years. The mean age of the offenders at the time of the pretrial assessment was 33.0 ± 11.3 years. When the criminal registry was searched the mean age of the offenders was 39.2 ± 10.8 years. The mean follow-up period for criminal recidivism was 8.1 ± 3.9 years.

Statistical analyses

The analyses consist of tests of significance of the relationship between positive history of suicide attempts or positive history of slashing and the remaining variables. The Pearson χ^2 test was used for the categorical variables and the Mann-Whitney U-test was used for the continuous variables. The $p = 0.01$ was set as the statistical level of significance because of the number of tests performed. All analyses were computed using the STATISTICA for Windows Program [28].

Results

Twenty percent of the fire setters (62 of 304) had made serious suicide attempts, and 16% (49 of 304) had slashed themselves prior to the fire-setting episode. Forty percent of the serious suicide attempters (25 of 62) had slashed themselves. A history positive for slashing was significantly more often associated with a history positive than negative for serious suicide attempts ($\chi^2 = 33.747$, $p = 0.000$). One half of those who had exhibited non-lethal self-destructive behavior had also made serious suicide attempts (25 of 49).

Table 1 Distribution of psychiatric diagnoses and the history of suicide attempts and slashing. NOS not otherwise specified

	Group I (n = 242) %	Group II (n = 62) %	χ^2	p	Group III (n = 255) %	Group IV (n = 49) %	χ^2	p
DSMIII axis-I schizophrenia or delusional disorder	15.7	9.7	1.447	0.229	15.3	10.2	0.860	0.354
Alcohol dependence	71.5	85.5	5.069	0.024	73.3	79.6	0.844	0.358
Major mood disorders[a]	5.0	16.1	9.174	0.002	7.8	4.1	0.866	0.352
Dysthymic, anxiety and adjustment disorders	21.5	19.4	0.135	0.713	21.6	18.4	0.253	0.615
Impulse control disorders NOS intermittent explosive disorder	36.8	45.2	1.466	0.226	38.4	38.8	0.002	0.964
Pyromania	14.9	8.1	1.963	0.161	12.2	20.4	2.398	0.121
DSMIII axis-II antisocial personality	15.3	12.9	0.223	0.637	13.3	22.5	2.708	0.100
Borderline personality	7.4	12.9	1.884	0.170	7.5	14.3	2.455	0.117
Schizophrenia spectrum[b]	11.2	8.1	0.501	0.479	10.6	10.2	0.006	0.936
Neurotic cluster[3]	10.3	17.7	2.597	0.107	12.2	10.2	0.150	0.698

Pearson χ^2, df = 1; group I no history of suicide attempts; group II history of suicide attempts; group III no history of slashing; group IV history of slashing

[a] Includes 12 unipolar, 5 bipolar, and 1 NOS depressions, and 4 cyclothymic disorders

[b] Includes paranoid, schizoid, and schizotypal personality disorders

[c] Includes avoidant, passive-aggressive, and dependent personality disorders

Thirty-seven percent of the fire setters (113 of 304) had committed violent criminal offenses in their lifetime. One half (50.9%) of the fire setters who had a history positive for suicide attempts and 37.8% of those who had a history negative for suicide attempts had committed violent offenses. Lifetime violent criminal offenses were found among 40.6% of fire setters with a history negative for slashing and among 38.6% of fire setters with a history positive for slashing.

Suicidal motive for the arson (an attempt or intent of self-immolation) was significantly more common among the fire setters who had previously attempted suicide (30.6%) than among the fire setters who had not made prior suicide attempts (9.5%) (χ^2 = 18.526, p = 0.000). Of those who had a history positive for slashing, 32.7% had a suicidal motive for the arson contrary to 10.2% of those who had no history of slashing (χ^2 = 17.409, p = 0.000).

The mean age of fire setters who had a history positive for suicide attempts was 34.5 ± 10.8 years. The mean age of those who had not attempted suicide was 32.7 ± 11.4 years. The mean age of fire setters who had slashed themselves was 30.5 ± 11.5 years, and those who had exhibited no self-wounding behavior 33.5 ± 11.2 years. Wechsler's total intelligence quotient was within the normal range among fire setters who had a history positive for suicide attempts (100.6 ± 18.4) and those who had not attempted suicide (94.6 ± 16.2), as well as among the fire setters who had a history positive for slashing (94.9 ± 14.8).

Depression was significantly more common among suicide attempters than among non-attempters (Table 1). Alcohol dependence was more common among fire setters with a history positive for suicide attempts than among non-attempters, but the difference did not reach the significance level of 0.01. (Table 1). 23.5% of the alcohol dependent and 45.5% of the depressed fire setters had attempted suicide. Non-lethal slashing was not significantly associated with any psychiatric diagnosis (Table 1).

More than half (53.1%) of the fire setters who were alcohol dependent had an alcoholic father. 30.8% of the fire setters who were not alcohol dependent also had an alcoholic father (χ^2 = 11.596, p = 0.001). A significantly higher proportion of suicide attempters and slashers had an alcoholic father as compared with the fire setters with a history negative for self-destructive behaviors. Non-lethal slashing was associated with a family history positive for father's criminality (Table 2).

The blood glucose nadir during an oral GTT was not different between fire setters who had a history positive or negative for suicide attempts (2.77 ± 0.67 and 2.86 ± 0.60 mmol/l, respectively). It was also not different between fire setters who had a history positive or negative for slashing (2.84 ± 0.79 and 2.84 ± 0.58 mmol/l, respectively). The blood glucose nadir during an oral GTT was marginally lower among fire setters with a history positive for both suicide attempts and lifetime violent offences (n = 21, 2.62 ± 0.46 mmol/l) than among fire setters who had a history negative for suicide attempts but positive for violent offenses (n = 69, 2.86 ± 0.51 mmol/l), but the difference did not reach the significance level of 0.01 (p = 0.037). No difference was found in the blood glucose nadirs between violent fire setters with a history positive (n = 11 or negative (n = 80) for slashing (2.63 ± 0.73 and 2.81 ± 0.51, respectively).

During the follow-up period after the pretrial psychiatric evaluation (8.1±3.9 years), recidivist criminal offenses in general, recidivist fire setting, and recidivist violent offenses were not more common among fire setters who had a history positive for suicide attempts or slashing (Table 3).

Table 2 Family history and the history of suicide attempts and slashing

	Group I (n = 242) %	Group II (n = 62) %	χ^2	p	Group III (n = 255) %	Group IV (n = 49) %	χ^2	p
Father alcoholic	43.4	62.9	7.539	0.006	43.9	65.3	7.539	0.006
Father violent	29.8	37.1	1.239	0.266	29.0	42.9	3.663	0.056
Father violent alcoholic	27.7	33.9	0.918	0.338	26.7	40.8	4.001	0.045
Father absent[a]	20.3	24.2	0.462	0.497	18.8	32.7	4.730	0.030
Father convicted of crimes	8.3	12.9	1.270	0.260	6.7	22.5	12.243	0.000
Mother alcoholic	7.9	3.2	1.642	0.200	6.7	8.2	0.143	0.705
Mother dead early[b]	5.0	11.3	3.377	0.066	5.9	8.2	0.365	0.546

Pearson χ^2, df = 1; group I no history of suicide attempts; group II history of suicide attempts; group III no history of slashing; group IV history of slashing

[a] Since the subject's birth

[b] Before the subject's age of 18 years

Table 3 Recidivist fire setting, all recidivist criminal offenses, recidivist violent offenses and previous suicidal behavior

	Group I (n = 213) %	Group II (n = 48) %	χ^2	p	Group III (n = 221) %	Group IV (n = 40) %	χ^2	p
Recidivist fire setting	11.7	14.6	0.295	0.587	10.9	20.0	2.630	0.105
Recidivist criminal offenses	47.4	58.3	1.867	0.172	48.9	52.5	0.179	0.673
Recidivist violent offenses	14.6	12.5	0.136	0.712	14.0	15.0	0.026	0.871

Pearson χ^2, df = 1; group I no history of suicide attempts; group II history of suicide attempts; group III no history of slashing; group IV history of slashing

Discussion

The sample of fire setters included in this study represents a selected group of high-risk individuals. Therefore, any generalizations have to be made very cautiously. It can be estimated that in Finland roughly 10% of all arsonists are referred for a pretrial psychiatric evaluation [21, 27]. The frequency of suicidal behavior observed in this study is not the highest reported for fire setters [24], although Finland belongs to countries with a very high incidence of suicides in general [19]. The apparently lower rate found in this study may be due to the strict criteria used to determine a suicide attempt. It is likely that a larger proportion of the patients had exhibited less severe self-injurious behavior that was not known to health care providers.

Among clinicians, non-lethal slashing is often considered as demonstrative behavior without implications for serious suicidality. In the present sample, slashing and serious suicide attempts were strongly associated with each other. Almost a half of the fire setters who had made a serious suicide attempt had previously slashed themselves. Suicidal motive for arson was associated with a history positive for both suicide attempts and slashing.

Alcohol dependence has been shown to be associated with suicidal behavior among the general population [4, 16, 19]. Furthermore, alcohol dependence and comorbid depression and other substance abuse are well-known risk factors for attempted and completed suicide [4, 9]. Among the present sample, alcohol dependence was associated with a history of suicide attempts. Mood disorders are well-known risk factors for attempted and completed suicide among the general population [4] and among psychiatric patients [5, 26]. In this study, major mood disorders and cyclothymia were combined because of the small number of patients meeting the diagnostic criteria. Combined, these mood disorders were found to be associated with a higher risk for suicide attempts than minor depressions. These associations between psychiatric diagnoses and suicidality among the fire setters, which are similar to the general population, support the use of the fire setters, who exhibit an extremely high incidence of suicidal behavior, to elucidate psychobiology of suicidal behaviors.

Family history positive for paternal alcoholism has previously been reported to be associated with violent offending and impulsive fire setting [15]. According to the present findings such a family history also increased the risk of suicide attempts among fire setters. Over half of the fire setters who had a history positive for suicide attempts had an alcoholic father. These fathers who had also been often convicted for crimes were usually violent alcoholics. These findings are indicative of associations between paternal violent alcoholism and the sons' suicidal behavior as well as non-lethal slashing.

A reactive hypoglycemic tendency during the glucose tolerance test has been observed among impulsive fire setters in general [32, 33], and among violent offenders and fire setters with intermittent explosive disorder [36]. Slashing has been found to be associated with antisocial personality disorder [31]. The blood glucose nadir during GTT among patients with antisocial personality disorder was not, however, found to be different from healthy volunteers [36].

Recidivist fire setting and other recidivist criminal offenses were also more common among those who had a

history positive for suicide attempts. This finding did not reach the level of statistical significance different from our previous study, which showed that a history positive for suicide attempts predicted criminal recidivism among fire setters [6]. Lifetime criminal histories positive for violent offenses were somewhat more common among fire setters who had attempted suicide. Thus, these different forms of violent behavior may be indicative of a general impairment of impulse control. Although suicidal behavior is commonly found among Finnish fire setters, their aggressive impulses are often directed outwards and result to violent offenses. In this regard our findings differ from the earlier literature [12]. The present findings provide support for combining fire setters with other violent offenders as was done in our most recent follow-up study [37].

In conclusion, familial alcoholism that is characterized by father's criminality, and major mood disorders, are the most common psychiatric diagnoses associated with suicidal behavior among Finnish fire setters. Non-lethal slashing often precedes serious suicide attempts among these patients.

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