



## Preliminary communication

## Is suicide under the influence of alcohol a deliberate self-harm syndrome? An autopsy study of lethality

Lucie Pennel<sup>a,b,c</sup>, Jean-Louis Quesada<sup>d</sup>, Laurent Begue<sup>e</sup>, Maurice Dematteis<sup>a,c,f,\*</sup><sup>a</sup> Université Grenoble Alpes, Faculty of Medicine, Grenoble F-38042, France<sup>b</sup> INSERM U836, Team 10, Grenoble F-38042, France<sup>c</sup> University Hospital, Department of Addiction Medicine, Grenoble F-38043, France<sup>d</sup> University Hospital, Clinical Research and Innovation Direction, Grenoble F-38043, France<sup>e</sup> Inter-university Laboratory of Psychology, EA4145, University of Grenoble 2, France<sup>f</sup> INSERM U1042, Grenoble F-38042, France

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## ABSTRACT

**Background:** Alcohol is a risk factor for suicide and is often involved in violent actions. The aim of the study was to assess the involvement of alcohol in suicides and its relationship with the lethality of suicide methods. **Methods:** In a retrospective study on autopsy reports, we compared suicide and non-suicide victims, suicides with positive and negative blood alcohol concentration (BAC), and studied the lethality of suicide methods using a multivariate analysis.

**Results:** Suicide victims ( $n=88$ ) were not different to non-suicide victims ( $n=270$ ) for positive BAC and narcotics, but were more often positive for prescription medications (59.1 vs. 35.6%,  $p=0.003$ ) and medications in blood (72.7 vs. 54.8%,  $p=0.004$ ). Whereas non-suicidal victims died mainly of traumas (60%,  $p < 0.001$ ), two populations of suicides emerged with regard to BAC, self-poisoning predominating with positive BAC (38.9%,  $p=0.039$ ) and asphyxiation with negative BAC (41.4%,  $p=0.025$ ). Positive BAC appeared as the unique and strong independent predictive factor, increasing the risk of self-poisoning suicide by 4.36 [1.29–14.76], and decreasing the risk of suicidal asphyxiation by 84% (OR=0.16 [0.03–0.83]). Positive blood narcotics tended to behave in the similar way to alcohol.

**Limitations:** Recruitment bias (victims declared by the Forensic authorities) and incomplete autopsy reports are the two main limitations.

**Conclusions:** Characteristics of suicide victims with positive BAC are suggestive of Deliberate Self-Harm Syndrome (low lethality methods, substance misuse). These being at high risk of repeated suicide attempts, previous self-harm involving alcohol may represent a warning sign and access to medication should be limited to prevent recidivism.

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## 1. Introduction

Many studies have shown an increased risk of suicide in alcohol abuse and dependence, respectively 10% and 51% (Kölves et al., 2006). Suicide attempts are concomitant to alcohol consumption in 36% to 62% of cases (Hayward et al., 1992; Suokas and Lonqvist, 1995). The lifetime risk of suicide has been estimated at 7% for alcohol dependence, 6% for affective disorder and 4% for schizophrenia (Inskip et al., 1998). Finally, alcohol abuse or dependence could multiply the risk of suicidal crisis by 7.5 compared to abstinent subjects (Rossow and Admundsen, 1995).

The comorbid relationship between alcoholism and depression is well known, either as the “alcoholic melancholy”, or as the “chronic suicide” referring to the self-destructive behaviour of alcoholics mentioned by Menninger (1938). 98% of alcoholics have depressive symptoms at least once in their lifetime (Cadoret and Winokur, 1974; Miller, 1995). The National Longitudinal Alcohol Epidemiologic Survey showed that the prevalence of depression in patients with alcohol abuse or dependence was 36.3% in the year and 40% over the entire lifetime (Grant and Harford, 1995). These symptoms can increase the severity and the consequences of alcoholic behaviour. But not all the alcoholics committing suicide are depressive (Murphy et al., 1979). Cornelius et al. (1995) showed that a recent increase in alcohol consumption was frequently found in subjects who had attempted suicide. An increase in alcohol consumption of one litre per capita per week is associated with a 1.9% increase in the male suicide rate (Skog et al., 1995). This overconsumption may facilitate acting out by increasing impulsivity. Aggressiveness is another link between alcohol use and suicide, because

Abbreviations: BAC, blood alcohol concentration

\* Correspondence to: Addictologie, Hôpital Michallon, Centre Hospitalier Universitaire, CS 10217–38043 Grenoble Cedex 9, France. Tel.: +33 476766236.

E-mail address: [MDematteis@chu-grenoble.fr](mailto:MDematteis@chu-grenoble.fr) (M. Dematteis).<http://dx.doi.org/10.1016/j.jad.2015.02.006>

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of a common biological substrate (Sher et al., 2005). Indeed Cloninger described a subtype of alcoholism (type II) characterised by a reduced central serotonin turnover, and a high risk of hetero-aggressive behaviour and suicide (Virkkunen and Linnoila, 1996), probably due to greater impulsivity. The reduction in serotonin turnover would be an individual trait, a predictive factor and an inheritable characteristic (Linnoila, 1996; Staner and Mendlewicz, 1998). In practice, suicide attempts in alcoholics are more impulsive and less related to the level of suicidal intent (Suominen et al., 1997). Moreover, it has been experimentally demonstrated that self-aggression is more severe after alcohol ingestion, which confirms the close relationship between acute alcohol intoxication and self-aggressive behaviour (McCloskey and Berman, 2003). Also, many individual, social, and environmental risk factors are common to alcoholic and suicidal behaviours (Roske et al., 1994). But alcoholics who attempt or commit suicide may undergo more separation, grief, abandonment, job loss and other stressful life events, which seem to trigger acting out (Sher, 2006a, 2006b).

Given the growing evidence that alcohol increases violence and represents a risk factor for suicide, one would logically expect that suicide carried out under the influence of alcohol would be more violent. Therefore, we performed a retrospective study on autopsy reports including suicide with positive and negative blood alcohol concentration, and assessed the lethality of the suicide methods, as well as the role of alcohol and other factors in the lethality of suicide methods.

## 2. Methods

We performed a retrospective observational study on 502 autopsy reports collected from January 1st 2004 to 31th of December 2008 at the Department of Forensic Medicine at the Grenoble University Hospital. The autopsies were carried out in cases of obvious or suspected non-natural death after the decision of the public prosecutor according to European guidelines (Council of Europe, 2000).

The following data were collected: age at the time of death, presence of prescription medications before death regardless of the type of medication as this information was not systematically mentioned in the autopsy reports, blood measurements at the time of death for both alcohol, medications and narcotics (illicit drugs: heroin, cocaine, ecstasy and amphetamines). Deaths were classified into two categories: non-suicides (homicide, accidental or natural deaths) and suicides. For the latter, the methods were specified: firearms, knives, asphyxiation by drowning or hanging, self-poisoning, trauma, or other. Medications and/or illicit drugs were considered to be the cause of the death if lethal concentrations were found in the blood.

### 2.1. Statistical analysis

Three analyses were performed: first, we compared the characteristics between the suicide and the non-suicide groups. Then among the victims of the suicide group, we compared the characteristics between victims with positive versus negative blood alcohol concentrations (BAC) at the time of autopsy. Third, we assessed in the entire suicidal group for whether alcohol and other factors had a role of in the lethality of the method chosen.

Results were expressed as the mean and standard deviation, and were analysed using either the *t*-test for numerical variables or the Mann-Whitney U-test for small sample size (less than 30 subjects) with heterogeneous variances. The chi-square test was used for the categorical variables, while the Fisher's exact test was used when the expected values in any of the cells of a contingency table were below 5.

We found that self-poisoning (a low-lethality suicide method) was rather observed in victims with positive BAC, whereas asphyxiation

(a high-lethality method) predominated in victims with negative BAC. Therefore, we assessed the contribution of alcohol and other factors to these two methods using uni- and multivariate logistic regression. For self-poisoning, the model integrated positive BAC and adjustment for confounding variables such as the age, positive prescription medications, and positive narcotics in blood. For asphyxiation, the model integrated the same variables plus positive medications in blood. The results are presented using the odds ratio with a confidence interval of 95%. The significance was set at  $p < 0.05$ . The statistical analysis was performed using SPSS 20.0 software.

## 3. Results

### 3.1. Characteristics of the population studied

Of the 502 autopsies examined, 144 were excluded because blood measurements at the time of death for alcohol, illicit drugs and medications were not indicated in the autopsy reports. Of the remaining 358, 270 deaths were not considered to be suicides and 88 were suicide-related (Table 1).

One fifth of the suicide victims had positive BAC but this was not significantly different from non-suicide victims as around 30% of them were also alcohol-positive. Regarding BAC levels, most of the victims of both groups had low or moderately high BAC. In the suicide group, 55% of victims had BAC that was clearly below levels of alcohol poisoning (0.1–1.5 g/L).

Similarly, the number of victims who were positive for narcotics, with or without lethal concentrations, was not significantly different in the suicide and non-suicide groups. In contrast, suicide victims were more often positive for medications in blood (around 73%

**Table 1**  
Characteristics of suicide and non-suicide victims.

	Suicides <i>n</i> =88	Non-suicides <i>n</i> =270	<i>p</i>
<b>Age (m, SD)<sup>a</sup></b>	48.6 (18.7)	42.1 (20.6)	0.012
<b>Blood alcohol concentration</b>			
- positive/negative, <i>n</i> (%)	18/70 (20.5/79.5)	80/190 (29.6/70.4)	NS
- blood concentration, <i>n</i> (%)			
0.1–0.5 g/L	5 (27.7)	30 (37.5)	
0.6–1 g/L	2 (11.1)	13 (16.3)	
1.1–1.5 g/L	3 (16.7)	6 (7.5)	
1.6–2 g/L	1 (5.6)	11 (13.7)	
2.1–2.5 g/L	4 (22.2)	2 (2.5)	
> 2.5 g/L	3 (16.7)	18 (22.5)	
<b>Medications</b>			
Blood concentration			
- positive/negative, <i>n</i> (%)	64/24 (72.7/27.3)	148/122 (54.8/45.2)	0.004
Positive blood concentration			
- lethal/non lethal, <i>n</i> (%)	14/50 (21.9/78.1)	21/127 (14.2/85.8)	NS
<b>Prescription medications<sup>b</sup></b>			
- yes/no, <i>n</i> (%)	52/36 (59.1/40.9)	96/174 (35.6/64.4)	0.003
<b>Narcotics</b>			
Blood concentration			
- positive/negative, <i>n</i> (%)	8/80 (9.1/90.9)	37/233 (13.7/86.3)	NS
Positive blood concentration			
- lethal/non lethal, <i>n</i> (%)	1/7 (12.5/87.5)	4/33 (10.8/89.2)	NS
<b>Method used, <i>n</i> (%)</b>			
- Firearm	24 (27.3)	28 (10.4)	0.000
- Knife	2 (2.3)	14 (5.2)	NS
- Asphyxiation	31 (35.2)	31 (11.5)	0.000
- Poisoning	17 (19.3)	35 (13.0)	NS
- Traumatic/other	14 (15.9)	162 (60.0)	0.000

Abbreviations: m=mean; SD=Standard Deviation; *n*=number of subjects; *p*=statistical significance; NS=Not Significant.

<sup>a</sup> Age was missing for 35 subjects (1 suicide and 34 non-suicides).

<sup>b</sup> Data about medication were missing for 35 subjects including one suicide.

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