

An Investigation of Psychological and Neurobiological Factors Influencing The Ideation or Usage of a Violent Suicide Method in Depression Patients

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Introduction

- Suicide is a leading cause of death worldwide, and most deaths by suicide in the U.S. involve violent methods.
- Violent suicide methods (VSM), including use of firearms, hanging, and jumping from height, are all high-lethality methods characterized by greater likelihood of visible body disfigurement and death.
- Non-violent suicide methods (NVSM) include overdose, gas poisoning, and drownings, these methods are much less likely to result in death and body disfigurement comparatively.
- Despite the important difference in risk of death per suicide attempt between methods and the public health emergency posed by suicide in general, there is insufficient research to understand the neurobiological and psychological basis of VSM and NVSM to guide clinicians and other stakeholders.
- The role that brain areas related to depression have in explaining suicidality is not fully understood, but areas that evaluate external-to-internal experiences including insula and other salience network areas are implicated.
- The purpose of this study is to investigate what neurobiological and psychological factors are linked with history of VSM over NVSM post ideation and attempt.

Methods

Participants:

Fifty-two participants with bipolar or unipolar depression who indicated the presence of lifetime suicidal ideation or past suicide attempt and described methods used in past attempts or ideated about using were selected from patients recruited for the Neurobiology of Suicide study (NCT02543983). Based on methods indicated on items from the C-SSRS that asked about past ideation and attempts with a specified method, they were grouped into NVSM (n=33) and VSM (n=19).

Suicide Method Group	N	Mean Age (years)	Sex (% Male)	Attempters (%)
Nonviolent	33	42 (sd = 14.2)	24%	82%
Violent	19	43 (sd = 14.3)	58%	63%

Measures:

- Columbia Suicide-Severity Rating Scale (C-SSRS) – Suicide risk.
- Beck Hopelessness Scale (BHS) – Future hopelessness, motivation, and expectations.
- Hamilton Depression Rating Scale (HDRS) – Depression severity.
- Montgomery-Åsberg Depression Rating Scale (MADRS) – Depression severity.
- Childhood Trauma Questionnaire (CTQ) - Major early life stress.

Life/Death Implicit Association Task (LD-IAT):

24 of the 52 participants completed a modified Life-Death Implicit Association Task, a computer task measuring associations of oneself to either life or death based on reaction times to words that represent each category. The D-score defined the difference in mean reaction times between self-death and self-life trials. A negative D-score indicates a greater self-life implicit association, and a positive D-score indicates a greater self-death implicit association. (Fig. 3A)

Magnetoencephalography (MEG):

MEG data was collected using a CTF 275-channel whole-head MEG scanner to examine electrophysiological correlates of implicit self-death and self-life associations for 20 of the 52 participants. During scanning, participants completed a LD-IAT. The MEG data were source-localized in the gamma (30-58 Hz) frequency, a proxy measure for excitation-inhibition balance and thought to be a biomarker in the insula for suicidal ideation and attempt. Source localization was done using synthetic aperture magnetometry (SAM) from word onset to 1 second for each trial type. The analysis used CTF SAM software.

Analyses were completed in SPSS (IBM), R, and AFNI.

Results

Figure 1. VSM individuals report higher inability to feel, guilt, hopelessness, and overall depression severity compared to NVSM.

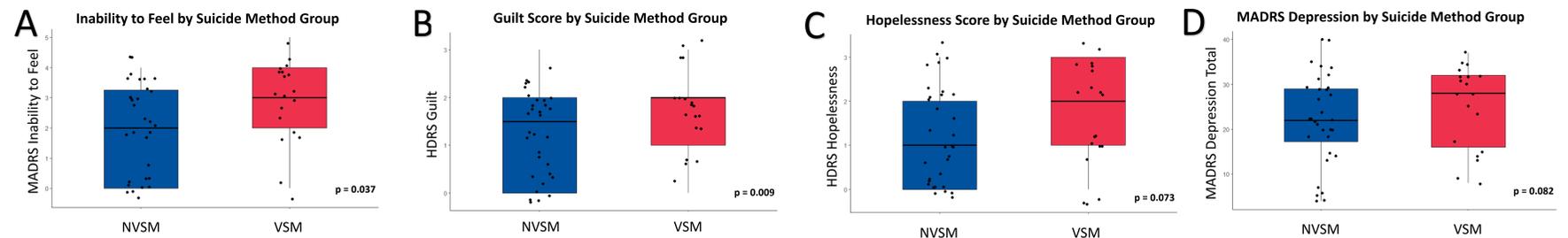


Figure 1. In this preliminary cohort, two clinical outcomes were significantly different between VSM and NVSM ($p < 0.05$), with A) higher inability to feel in the VSM group, B) higher guilt in the VSM group. C) There was a trend for higher overall hopelessness in the VSM group ($p = 0.07$), and D) higher overall depression score for the VSM group ($p = 0.08$).

Figure 2. VSM individuals report higher perceived childhood neglect and lower childhood abuse than NVSM.

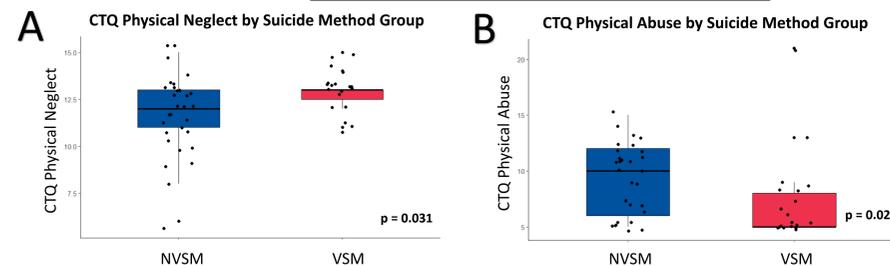
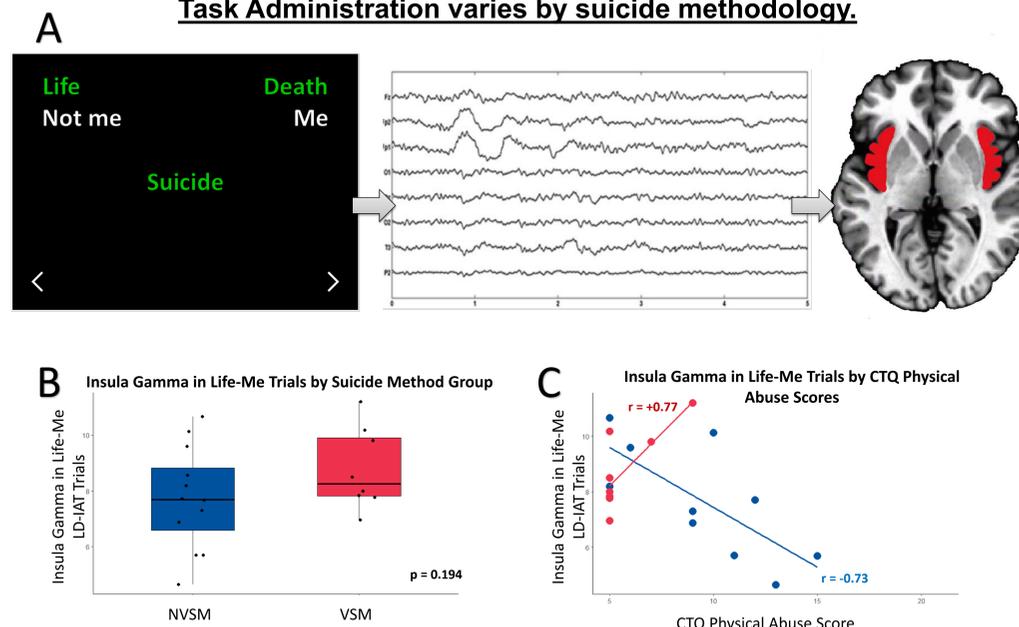


Figure 2. A) There was higher CTQ physical neglect in the VSM group and B) higher CTQ physical abuse in the NVSM group ($p < 0.05$).

Figure 3. Life/Death Implicit Association Task and Insula Gamma Power During Task Administration varies by suicide methodology.



A) Participants were administered the LD-IAT task within the MEG scanner where they were prompted to group the word centered on the screen with either “Life / Not me” or “Death / Me” in the Death and Me condition and vice versa in the Life and Me condition. MEG gamma power estimates within the insula were extracted for life-me and death-me trials and compared across groups. B) During Life-Me trials of the LD-IAT, groups did not show a significant difference in gamma power within the insula, but this may be due to a small sample size. C) Within the insula, there was a positive association between gamma power and CTQ physical abuse during self-life trials of the LD-IAT in within the VSM group ($r = +0.77$, $p < 0.02$), but a negative association in subjects within the NVSM group ($r = -0.73$, $p < 0.02$), supporting diverging salience network activity based on developmental trauma.

Conclusion/Discussion

- Subjects in the VSM group scored higher in hopelessness, inability to feel, guilt and slightly higher in overall depression but not significantly differently from NVSM in other depression and suicide risk measures providing evidence for distinct psychological constructs of VSM and NVSM independent of overall severity.
- Subjects in the VSM group scored significantly higher in the CTQ Physical Neglect subdomain and significantly lower in the CTQ Physical Abuse subdomain than those in the NVSM group. These findings suggest that differing types of childhood trauma may influence which suicide method an individual may ideate about or use in a suicide attempt later on in life.
- Subjects within the VSM group showed a positive correlation between insula gamma power and CTQ physical abuse scores while those in the NVSM group showed a negative correlation.
- This preliminary analysis suggests that early developmental experiences may alter processing in a key integrative brain area at the intersection of major salience and self-evaluative processes also implicated in suicidality, including psychological concept of the self, risk-reward processing, body representation and interception, and affective experience. Together, this suggests a potential neurobiological locus influencing a preference for violent suicide methods.

Limitations

- Generalizability of research based on patient population.
- Selection bias of sample.
- Survivorship bias of sample based on suicide methodology and sex interaction.
- Reliability of self-report measures.

References

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