Strokes Following Attempted Suicide: Frequency, Mechanisms, Outcome and Review of the Literature

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Case report

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Abstract

Background: Only a few patients with strokes following suicide attempt (SFSA) are described in the literature and dissection of cervical arteries is the best-known mechanism. We aimed to determine the frequency, clinical presentation, mechanisms and outcomes of such patients by systematic observation in a single academic institution.

Method: We retrospectively identified in our acute ischemic stroke registry all SFSA over 11 years. A thorough work-up was performed to establish the stroke mechanism. We also searched all published SFSA in the world literature for further analysis of demographics, comorbidities and long-term outcome.

Results: Work-up showed multiple stroke mechanisms as well as multiple psychiatric. After adding 7 already published SFSA and comparing all SFSA with our stroke registry, SFSA were younger, had similar stroke severity, higher early mortality, and similar long-term functional outcome.

Conclusions: SFSA is rare, affects younger patients and may be missed without an appropriate level of suspicion and neuroimaging. Long-term outcome seems comparable to other stroke patients despite an increased early mortality.

Introduction

Ischemic stroke is one of the leading causes of death and disability-adjusted life years (DALYs) (1) and is caused by multiple mechanisms including cardiac diseases, atherosclerosis, cervical artery dissection, and microangiopathy. On the other hand, suicide is also a major public health issue, being the 15th leading cause of death worldwide (2) and self-harm accounting for a significant number of DALYs. Suicide attempt (SA) is approximately 20 times more frequent than completed suicide (2) and is the most important risk factor for suicide.(3–6) Although a debate exists about the exact proportion,(7) the majority of suicide is related to mental disorders,(8) mainly mood disorders including bipolar disorders, substance use related disorders, schizophrenia and personality disorders. Methods of suicide vary with time and between countries.(2) In Switzerland in 2013, men used hanging (32%), firearm (27%), precipitation (24%) and drug poisoning (10%), while women used precipitation (31%), drug poisoning (26%), hanging (25%) and drowning (10%) as most frequent methods to commit suicide.(9)

Whereas suicide, SA and depression are well studied after stroke, strokes following suicide attempt (SFSA) are rarely reported: we only identified 7 cases in the world literature.(10–16)

Here we report a consecutive series of SFSA over 11 years in a single University hospital with the aim to better understand the clinical stroke presentation, mechanisms, and outcome of SFSA.

Methods

We retrospectively reviewed the discharge diagnoses from all hospitalized patients between 2003 and 2013 (11 years) from the Acute STroke Registry and Analysis of Lausanne (ASTRAL), the associated ASTRAL-E (TIAs, subacute strokes, ICH) and the electronic hospital archives. ASTRAL is a prospective cohort of all acute ischemic stroke patients admitted to the stroke unit and/or intensive care unit of CHUV within 24 hours of last-well time, as published previously(17). Stroke was defined according to the WHO definition as “a new syndrome of rapidly developing clinical symptoms and/or signs of focal disturbance of cerebral function lasting longer than 24 hours with no apparent cause other than vascular origin, regardless of whether infarction was evident on cerebral radioimaging”(18). We defined SFSA as strokes within 7 days following SA and compared them to all other consecutive patients from ASTRAL. To ascertain that no SFSA were missed, we also searched our electronic medical records, combining the terms “stroke” or “TIA” with “suicide attempt” or “suicide”.

Demographics, vascular risk factors and acute clinical and radiological findings were collected, including type of suicide attempt, mechanism of stroke, initial clinical deficit and findings on neurovascular imaging. Psychiatric comorbidities were considered present if an ICD-10 diagnosis used in the Elixhauser comorbidity classes “depression” and “psychosis”, was documented in the medical records in the past, or diagnosed currently. Clinical outcome measured by the modified Rankin scale (mRS) was determined at 7 days and 3 months from stroke onset and was considered favorable when the mRS was ≤ 2.

In addition, we performed a literature search on Medline from 1964 onwards using the terms “suicide attempt”, “stroke”, “hanging”, “near-drowning”, “hara-kiri”, “toxic ingestion”, “carotid dissection”, “vene/venous section” in English, as well as screening the references of identified articles for further reports in any language. Native-speaking physicians extracted data from articles published in language other than the English. NIHSS and mRS were reconstructed from the clinical descriptions in the identified cases.

We then combined available data from our patients with SFSA and those published and compared it with all patients from ASTRAL without SFSA between 2003–2013 by a univariate analysis. Continuous variables were described as median ± interquartile range (IQR) and compared with the Student’s T test. Categorical variables were expressed as percentages and compared using the Pearson $\chi 2$ test or Fisher's exact test, as appropriate.

The study (collection, analysis, and publication of data) was performed according to the ethical guidelines of the commission for research on humans of the Canton of Vaud.

Results

During the observational period, 5'448 patients with ischemic strokes or TIAs were admitted to our hospital and a SA preceded 5 of them (0.08%). We excluded a 6th patient with SA from benzodiazepine overdose who did not fulfill our definition of SFSA: towards the end of an ICU stay with multiple clinical complications and interventions, a subacute stroke of undermined timing was diagnosed following extubation after four weeks.

Of the included patients, four were male, and the median age was 52 years (Table 1). Initial stroke severity in our patients was a median of 3 (range 0–7); patients had few stroke risk factors and a history of psychiatric disorders.

Table 1
Characteristics of all reported AIS preceded by SA, and univariate comparison with a consecutive sample of 2'967 AIS from our stroke registry. Statistical comparison was done between all 12 reported cases (ours and the literature) and the control population from the acute stroke registry (ASTRAL).

Characteristics	Strokes related to suicide attempts in our center	Adding 7 reported cases in the literature	Control group (ASTRAL)	Odds ratio	CI	p-value
N	5	12	2'967	–	–	–
Female gender	1 (20%)	4 (33%)	1292 (43%)	0.39	0.08–1.44	0.14
Age, y, median (IQR)	52 (44–58)	58 (48–60)	73 (60–81)	0.95*	0.92–0.98	< 0.01
Admission NIHSS, median (IQR)	3 (0–5)	6 (2–31)[1]	6 (3–14)	1.00	0.99-1.0	0.93
Psychiatric comorbidity	5 (100%)	NA	368 (12%)	5.04*	1.25–18.56	0.01
Favorable outcome at 7 days	3 (60%)	5 (42%)	1617 (54%)	0.59	0.14–2.19	0.40
Favorable outcome at 3 months	4 (80%)	7 (58%)[1]	1803 (61%)	0.90	0.24–3.62	1.00
Mortality at 7 days	1 (20%)	3 (25%)	144 (5%)	6.53*	1.12–26.5	0.01
Mortality at 3 months	1 (20%)	3 (25%)	426 (14.4%)	1.98	0.34-8.0	0.40
NA = not available						
[1] For the patients identified in the literature, the admission NIHSS and long term favorable outcome were estimated from the descriptions (see Online table)						
[2] For this comparison, only data from our 5 reported patients were used because of missing data in the published cases.						

The mechanisms leading to stroke were variable and linked to the type of suicide attempt. Two suicide attempts were by hanging, two by hemorrhage (one venosection and the other arterial section – Hara-kiri) and one by attempted self-drowning in a lake. The self-drowning patient (patient #1) had embolus from insufficiently anticoagulated atrial fibrillation (AF) as the presumed stroke mechanism, occurring simultaneously with the SA. In the hanging attempts (patients #2 and #5), carotid dissection was the mechanism, whereas in the patients with extensive systemic hemorrhage (patients #3 and #4), several stroke mechanisms can be suspected: A) hypotension due to hypovolemia with borderzone mechanism, B) activation of the coagulation cascade (such as factor VII expression) from acute bleeding with systemic hypercoagulability, and/or C) hypothetic cardiac arrhythmia related to the acute blood loss activation of the coagulation cascade, leading to thromboembolic stroke.

We summarize below each patient's SFSA and the circumstances, with more details provided in Table 2. The mechanisms leading to stroke were variable and linked to the type of suicide attempt.

Table 2
Description of our 5 patients with SFSA.

Patient number	#1	#2	#3	#4	#5
Age, sex	80y, F	52y, M	58y, M	44y, M	26y, M
Type of suicide attempt	Self-drowning in a lake; found comatose and hypothermic at 26.8°C	Found hanging by a rope from a tree, probably after a few minutes.	Venosection in the neck, both wrists and legs with a kitchen knife, then called for help	Hara-kiri -like self-stabbing with a kitchen knife, injuring left thoracic cage, pleura, pericardium, diaphragm, stomach walls, transverse colon, liver and section of gastroepiploic artery.	Found hanging from a balcony, found after 5 minutes
Stroke diagnosis and presumed mechanism	Right deep MCA embolic stroke. Patient with diagnosis of intermittent AF 5d earlier. Also episode of AF on admission	Right embolic MCA stroke from occlusive right ICA dissection	Multilevel posterior circulation strokes. Potential mechanisms: A) hypotension due to hypovolemia; B) systemic hypercoagulability from acute bleeding; C) cardiac arrhythmia related to acute blood loss	Right embolic posterior MCA, and left posterior junctional stroke. Presumed mechanism: see patient #3	Occlusive dissection of the left common and internal carotid artery
Initial neurologic deficit	Left brachio-crural hemiparesis.	Left-side SM HS and multimodal hemineglect; left lateral homonymous hemianopia; left asterognosis	Partial Wallenberg syndrome with cerebellar syndrome, dysarthria, right Horner syndrome, left corticospinal signs and discrete contra-lateral sensitive HS	Anhedonia, amnesia, and ideomotor apraxia	Likely epileptic seizure when found. Slight asymmetry of contraction of the left soft palate
Psychiatric diagnosis, cerebrovascular risk factors, comorbidities	Left MCA TIA 5 days earlier with new onset intermittent AF; this diagnosis lead to acute adjustment disorder with probable anxiety and depression. Hypertension, diabetes type II	MDD Acute fracture of the thyroid cartilage	Recurrent MDD with psychotic features and not otherwise specified personality disorder. Suicide attempt with benzodiazepines 1.5m earlier. Non-specified personality disorder. Type II diabetes IR. Smoking 90UPA. Mild hyper-homocysteinaemia	MDD with psychotic features. Traumatic pericardic tamponade Voluntary hospitalization in a psychiatric hospital 2 months before admission for insomnia and depression	Suspected bipolar disorder. Cervical and supraglottic edema with involvement of the left recurrent laryngeal nerve and paralysis of dilator muscle of the left vocal cord
Imaging findings	CT 1d: Right subcortical frontal stroke. MRI 6y: unchanged	Hyperacute CT: right MCA cortical swelling. CT d1: right MCA cortico-subcortical effacement. CTA: occlusion on probable dissection right internal carotid CT 3m: right MCA chronic stroke	Hyperacute CT, CTP and CTA: mild atherosclerosis. CT d1: bilateral cerebellar (right > > left PICA), left PCA. CT d3: same, and mass effect right PICA lesion CT d20: mild hemorrhagic transformation right PICA and left PCA lesions. (see Fig. 1)	CT 5d and MRI 6d: right posterior superficial MCA and left posterior borderzone lesions MRa 6d: normal (see Fig. 2)	Hyperacute CT: normal. CTA: occlusion left distal CCA. CTP normal. CT d1: normal. CTA: partial recanalization: stenosing thrombi at origin of left internal and external carotid. MRI d6: small left deep and superficial posterior borderzone lesions. MRA 3m: irregular bifurcation of the left ICA

MCA: Middle cerebral artery; ICA: Internal carotid artery; PCA: Posterior cerebral artery; PICA: Posterior inferior cerebellar artery; SM: sensorimotor; HS: Hemisyndrome; TIA: Transitory ischemic attack; AF: Atrial fibrillation; PFO: Patent foramen ovale; CT: Computed tomography; CTA: Computed tomography angiography; CTP: Computed tomography perfusion; MRI: Magnetic resonance imaging; MRA: Magnetic resonance angiography; ECG: Electrocardiogram; US: Ultrasound; NIHSS: National Institutes of Health Stroke Scale; mRS: Modified Rankin Scale. MDD: Major depressive Disorder

*None were thrombolysed and each received acetylsalicylic acid 100 mg after stroke confirmation. Patient #1 (confirmed AF) and patient #5 received long-term and transitory oral anticoagulation, respectively.

Patient number	#1	#2	#3	#4	#5
Complementary exams	ECG monitoring: intermittent AF Cardiac US: normal except for bi-atrial dilatation; PFO not searched	None	ECG monitoring showed no arrhythmias. Cardiac US: preserved left ventricular function without segmental dysfunction; negative PFO	Cardiac US: preserved left ventricular function without segmental dysfunction; negative PFO	None
NIHSS on admission, at 24h, 7d and 3m	3, 1, 0	7, 7, 0	5, 5, 2	0, 36, 36	0, 0, 0
Clinical outcome*: mRS at 7d, 3m and 12m	0, 0, 0	1, 0, 0	4, 2, 1	Completed suicide by defenestration 6d after stroke (mRS: 6, 6, 6)	0, 0, 0
MCA: Middle cerebral artery; ICA: Internal carotid artery; PCA: Posterior cerebral artery; PICA: Posterior inferior cerebellar artery; SM: sensorimotor; HS: Hemisyndrome; TIA: Transitory ischemic attack; AF: Atrial fibrillation; PFO: Patent foramen ovale; CT: Computed tomography; CTA: Computed tomography angiography; CTP: Computed tomography perfusion; MRI: Magnetic resonance imaging; MRA: Magnetic resonance angiography; ECG: Electrocardiogram; US: Ultrasound; NIHSS: National Institutes of Health Stroke Scale; mRS: Modified Rankin Scale. MDD: Major depressive Disorder					
*None were thrombolysed and each received acetylsalicylic acid 100 mg after stroke confirmation. Patient #1 (confirmed AF) and patient #5 received long-term and transitory oral anticoagulation, respectively.					

Patient #1: Self-drowning in a lake, found comatose and hypothermic at 26.8°C and Glasgow Coma Scale of 8, leading to intubation and not seeing a moderate left hemisyndrome. Diagnosis of right deep MCA embolic stroke made on the next day on CT, after extubation. The SA occurred following the diagnosis of a TIA due to new onset AF 5 days earlier. A vitamin-K antagonist had been started before the SA (INR = 1.1 on admission); therefore, the likely stroke mechanism was AF related to insufficient anticoagulation. There was no psychiatric diagnosis except for an adjustment disorder following the TIA.

Patient #2: Found hanging by a rope from a tree, probably after a few minutes; right embolic MCA stroke from right ICA dissection. Diagnosed with recurrent major depressive disorder (MDD).

Patient #3: Venosection in the neck, both wrists and legs with a kitchen knife and then called the daughter; multilevel posterior circulation strokes with the fall of hemoglobin from 155 to 109. In patients with extensive systemic hemorrhage (patients #3 and #4 below), several stroke mechanisms can be suspected: A) hypotension due to hypovolemia with borderzone mechanism, B) activation of the coagulation cascade (such as factor VII expression) from acute bleeding with systemic hypercoagulability, and/or C) hypothetic cardiac arrhythmia related to the acute blood loss activation of the coagulation cascade, leading to thromboembolic stroke. Figure 1 shows the neuroimaging for this patient. Patient diagnosed with recurrent MDD with psychotic features and not otherwise specified personality disorder.

Patient #4: Hara-kiri -like self-stabbing with a kitchen knife, with multiple thoracic and abdominal injuries, requiring multiple blood transfusions. Potential stroke mechanisms are as above (Fig. 2 for neuroimaging). Diagnosed with MDD with psychotic features, committed suicide 4 days after SA.

Patient #5: Found hanging from balcony after 5min; occlusive dissection of the left common and internal carotid artery. Patient with a suspected diagnosis of bipolar disorder.

None of the patients had anoxic encephalopathy clinically or on the subacute MRI performed in three patients. None were thrombolysed and each received acetylsalicylic acid 100 mg after stroke confirmation. Patient #1 (confirmed AF) and patient #5 received long-term and transitory oral anticoagulation, respectively.

The clinical outcome was globally positive, with mRS at 3 months of 0 in four patients, except patient #4 who committed an in-hospital suicide by defenestration on day 4, after having been transferred from the ICU to the visceral surgery floor. He had no major neurologic deficit at the time of his suicide. This patient was not formally evaluated by a psychiatrist but had a suspected bipolar disorder.

Psychiatric comorbidity included acute depressive episodes (n = 2, one after a recent TIA), recurrent depressive disorder (n = 2, one with a previous SA) and bipolar disorder (n = 1).

After reviewing the literature, 7 other cases were described from 1989 to 2014 (Table 3)(10–16). Similar to our case-series, SA methods were variable, leading to different types of strokes.

Table 3
Characteristics of all reported case-reports of SFSA in the literature.

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Article/Author	H. Onishi et al. (1989)	K. Noguchi et al. (1992)	R. Hausmann et al. (1996)	Ikenga et al. (1996)	Garaci, F. G., et al. (2009)	Šupe, S., et al. (2013)	Yasushi Nishiyori et al. (2014)
Age, sex	84y, M	50y, F	58y, M	63y, M	37y, F	59y, M	64y, F
Type of suicide attempt	Hanging with a rope	Hanging with a rope	Hanging (after jumping the rope tears with 3m fall)	Hanging with a rope	Hanging	Hanging (found 2min after)	Ingestion of unknown dose of glyphosate surfactant herbicide
Stroke localization	Both anterior and left middle cerebral arteries	Right Common carotid artery	Massive bilateral carotid territory strokes (autopsy; not imaging)	Left ICA	Right thalamus and left cerebellum	Right MCA territory	Left hippocampus
Stroke diagnosis and presumed mechanism	Bilateral internal carotid artery dissection with embolic strokes	Dissection of the right CCA	Bilateral common carotid occlusion from carotid trauma (probably dissection)	Dissection of the left common carotid artery	Ischemic-arterial event	Artheriosclerotic (right ICA subocclusive stenosis and left ICA with 70% stenosis	Unclear origine; hippocampal infarction leading to psychiatric symptoms before drug overdose? Or, infarction occurred after the overdose, leading to 'window period' in which she was able to acknowledge? No other toxic systemic manifestations of the drug were found.
Neurological deficit	Semicoma, right hemiparesis. Estimated NIHSS = 36	Loss of consciousness, strangulation on the neck, facial edema and multiple conjunctiva petechiae. Estimated NIHSS = 36	Initially no neurologic deficit. Fractures of the calcaneous bones on both sides. On day 4, acute hemiplegia. Estimated initial NIHSS = 36. Died a few hours later of central regulation failure. 7d mRS = 6.	Total aphasia, right hemiparesis and left ptosis. Estimated NIHSS = 30	Disturbed eye movement, delirium with memory and executive functions impairment. No other deficit. Estimated NIHSS = 5	On arrival: deeply somnolent, without any focal neurological deficits 25min later: left-sided hemiplegia NIHSS 14	Several hours after admission she manifested delirium, confusion, and severe anxiety; short-term memory loss was prominent (the patient forgot her suicide attempt). Estimated NIHSS = 2

MCA: Middle cerebral artery; ICA: Internal carotid artery; CCA: Common carotid artery; hCT: head Computed tomography; CTA: Computed tomography angiography; MRI: Magnetic resonance imaging; NIHSS: National Institutes of Health Stroke Scale; mRS: Modified Rankin Scale.

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Imaging findings	hCT: massive cerebral infarction of the territory of both anterior and left middle cerebral arteries Cerebral angiography: linear shadow defect of the left extracranial internal carotid artery corresponding with the site of the ligature.	hCT(after 2 year): atrophic changes. Angiography (after 2 year): approximately 80% stenosis of the right CCA.	No cerebral imaging	hCT: no abnormal finding MRI(after 2 days): multiple infarctions in the left fronto-tenmpro-parietal and basal ganglia. MR-angiography (after 2 days): severe stenosis at the cervical portion of ICA and occlusion of the left MCA.	hCT (ER): no acute lesion CT (8d later): low density area in the right thalamus MRI (8d later): hyperintense area on both T2-weighted and FLAIR images on the right thalamus and left cerebellum. DWI no area of diffusivity restriction. No cervical arterial dissection.	hCT (ER): no acute lesion hCT (25min later): no acute lesion hCT (24 hours after thrombolytic treatment) : acute ischemic right MCA territory	hCT: no acute lesion, only an old infarction in the bilateral basal ganglia. MRI 9 days after admission: small high-intensity lesion in the dorsal part of the left hippocampal body on the DWI. Memory tests demonstrated severe short-term recall deficits
Early outcome	He was treated conservatively and transferred to another institution after 1 month. Total aphasia and the right hemiparesis have remained. Estimated 7days mRS = 6	She gradually recovered except for her left upper limb weakness, with a diagnosis of left brachial plexus injury, Estimated 7d mRS = 3	Autopsie revealed: Submucosal haemorrhages of the epiglottis. Incomplete rupture of both common carotid arteries. Mixed post-traumatic thrombosis. Diffuse encephalomalacia, haemorrhagic alveolar and interstitial lung edema.	He was treated by thiamylal infusion and his aphasia and hemiparesis gradually recovered. Estimated 7d mRS = 5.	Estimated 7d mRS = 2 One month: slight anterograde memory deficits still present	Thrombolysed. Improvement after thrombolysis NIHSS 5. Estimated 7d mRS = 2 After 4 weeks: NIHSS score of 3 (mRS 1) Six weeks after stroke, he was rehospitalized for endovascular treatment.	She gradually became less confused over the course of a week. Estimated 7d mRS = 2. Follow-up memory test revealed partial improvement in some domains, with persistent memory impairments. No abnormalities were found on a follow-up brain scan.

MCA: Middle cerebral artery; ICA: Internal carotid artery; CCA: Common carotid artery; hCT: head Computed tomography; CTA: Computed tomography angiography; MRI: Magnetic resonance imaging; NIHSS: National Institutes of Health Stroke Scale; mRS: Modified Rankin Scale.

Comparing all the 12 patients (including the five patients described here and seven published cases) to the control patients from ASTRAL in univariate analysis, we found the SFSA patients to be significantly younger with a higher incidence of psychiatric comorbidities. However, there was no clear difference in the sex distribution and initial NIHSS. Long-term functional outcome and mortality (3 months) were similar, but 7-day mortality was clearly higher in SFSA (25% vs 4.9%).

Discussion

Our retrospective review of SFSA in a single institution (n = 5) and in the literature (n = 7) show that this association is rare, potentially missed and that underlying stroke mechanisms are heterogeneous. Compared to other stroke patients, patients with SFSA are younger and have higher psychiatric comorbidities. Whereas short-term mortality was higher in SFSA patients, long-term outcome was similar to other stroke patients.

We found variable mechanisms of SFSA, the most frequent being carotid artery dissection from hanging. This is the most frequent type of suicide method described in Switzerland (8), and therefore cervical artery dissection is likely to be the more common mechanism of stroke in SFSA in our population.

Regarding psychiatric comorbidities we found a significant difference between our case-series and the ASTRAL database; all five patients had significant psychiatric illness, compared to only 12.4% in usual stroke patients. This difference is explained by the fact that psychiatric disorders are the most common cause of completed suicide and of severe SA, defined as a SA that "would have been fatal had it not been for rapid and effective prehospital care or other emergency treatment or, in some cases, chance"(19).

The neurological outcome in our 5 patients was globally good; however, the overall three months' mortality in the 12 reported cases was significantly higher than in other stroke patients, despite lower age. One of our patients committed suicide shortly after his SA, and the two other patients who died according to the literature did so from complications following stroke, with massive cerebral infarction of the territory of both anterior and left middle cerebral arteries (published patient #1) and diffuse encephalomalacia, hemorrhagic alveolar and interstitial lung edema (published patient #3). This confirms the potential traumatic severity of SA with different causal mechanisms. Regarding overall functional outcome (handicap and mortality combined) in all the reported cases, there was no significant difference, however.

In conclusion, SFSA is rare and may be missed without appropriate neuroimaging in patients with neurological signs after SA. Stroke mechanisms are heterogeneous and are related to the method of SA. We observed high psychiatric comorbidity and higher short-term mortality in SFSA, underlining the severity of this situation and the need for medical intervention.

Declarations

Ethics approval and consent to participate

The study (collection, analysis, and publication of data) was performed according to the ethical guidelines of the commission for research on humans of the Canton of Vaud – Switzerland.

Consent for publication

Not applicable.

Availability of data and materials

Data was extracted from the Acute STroke Registry and Analysis of Lausanne (ASTRAL), the associated ASTRAL-E (TIAs, subacute strokes, ICH) and the electronic hospital archives.

Competing interests

All the authors report no biomedical financial interests or potential conflicts of interest.

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Authors' contributions

Mauro Silva: major contribution to the design of the work, the acquisition, analysis, and the interpretation of data. Writing and revision of the article.

Laurent Michaud: substantial contribution to the design of the work, the analysis, and the interpretation of data. Revision of the article.

Pamela Correia: substantial contribution to the analysis, and the interpretation of data. Revision of the article.

Masaki Nishida: substantial contribution to the analysis, and the interpretation of data. Revision of the article.

Patrik Michel: substantial contribution to the design of the work, the analysis, and the interpretation of data. Writing and revision of the article.

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Figures

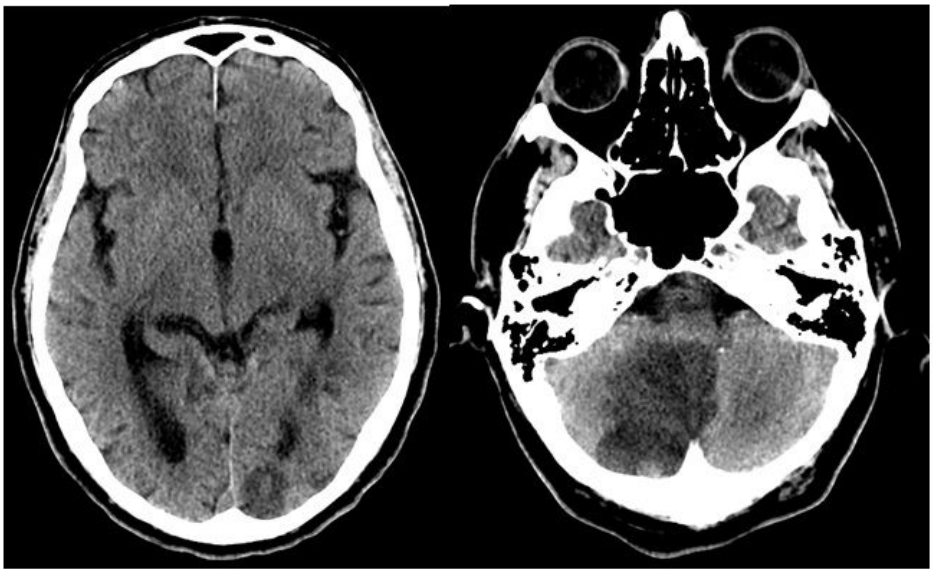

Figure 1

Figure shows the neuroimaging for this patient. Patient diagnosed with recurrent MDD with psychotic features and not otherwise specified personality disorder.

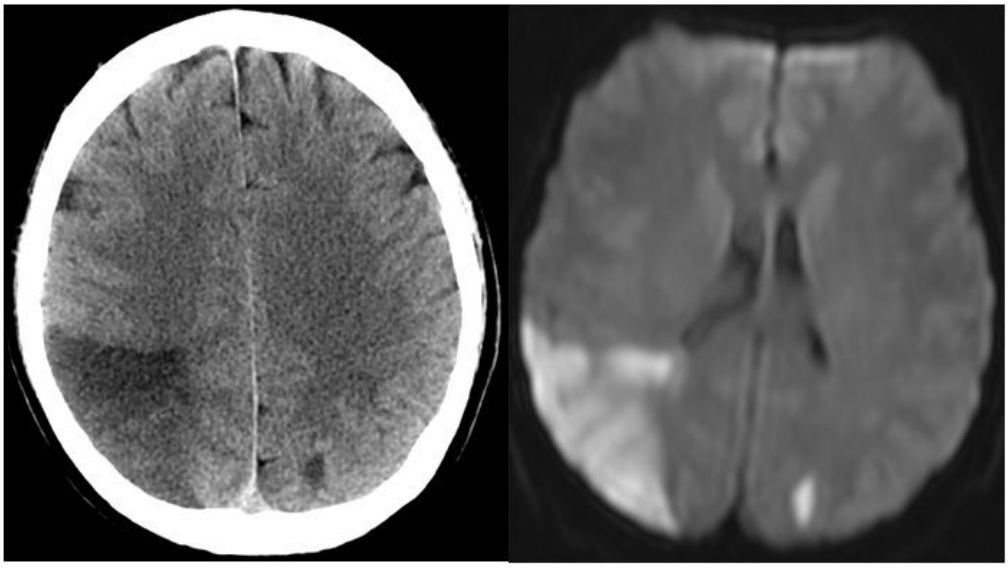

Figure 2

Figure for neuroimaging. Diagnosed with MDD with psychotic features, committed suicide 4 days after SA.