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# Psychosis-Related Matricide Associated With a Lesion of the Ventromedial Prefrontal Cortex

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Matricide, the killing of a mother by her biological child, is a rare event. We report a case of matricide associated with a woman who sustained a right ventromedial prefrontal lesion during surgery for nasal polyposis that was performed when she was 40 years old. After her surgery, she developed psychotic symptoms associated with the emergence of antisocial behavior. She committed matricide 22 years later. Neuropsychological evaluation showed decreased frontal-executive deficits, and magnetic resonance imaging revealed a lesion in the right gyrus rectus area of the ventromedial prefrontal region. This case suggests that a secondary psychotic syndrome associated with a lesion in the frontal neural network, which is disturbed in psychopathy, could facilitate homicidal behavior. Furthermore, this case has legal implications for the prosecution of murder associated with a brain lesion.

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Matricide, the killing of a mother by her biological child, is a rare event. It accounts for less than two percent of all U. S. homicides where there is a relationship between the victim and the offender.<sup>1</sup> Relatively little is known about those who commit matricide. Most cases are committed by sons, very rarely by daughters.<sup>2</sup> The few reports on those who commit matricide usually implicate psychological factors such as a high incidence of severe mental disorders, a

domineering maternal figure, a hostile-dependent relationship with the mother, and a passive or withdrawn father.<sup>3</sup>

Matricide represents an extreme form of psychopathy, since it implies a violation of one of the more elementary moral values and represents an extreme breakdown of empathy.<sup>4</sup>

Psychopathy is characterized by emotional dysfunction and antisocial behavior. Whether developmental or acquired, it is associated with dysfunction of a neural network that includes the prefrontal cortex, amygdalae, and temporal lobes.<sup>5,6</sup> Acquired antisocial behavior in general, or acquired sociopathy, can occur in patients after prefrontal lesions.<sup>7,8</sup> Matricide may be associated with antisocial behavior involving lesions in this neural network. To illustrate, the literature describes a case of matricide perpetrated by a man who sustained a brain injury from a tumor and its treatment. In this case, the authors suggested that bilateral amygdalae damage was the cause.<sup>9</sup> In addition to an association with psychopathy, homicidal behavior can be caused by psychosis with or without psychopathic traits,<sup>10</sup> and psychotic symptoms can occur in patients after prefrontal lesions.<sup>11</sup> Although an association between acquired psychopathy and psychotic symptoms with prefrontal lesions has been reported, to the best of

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our knowledge, no cases specifically involving matricide have been described in patients with prefrontal lesions.

We report a patient who murdered her mother and attempted to murder another relative. She exhibited psychotic symptoms after a prefrontal lesion, and her case suggests that lesions in the prefrontal and related regions trigger expression of aggressiveness or criminal behavior as part of a secondary psychotic syndrome.

The patient gave consent in 2012 for the publication of her case. A month later, a Committee on Scientific Ethics of a Chilean Health Service (Comité de Ética Científico del Servicio de Salud Metropolitana Oriente) also approved publication.

### Case Report

This right-handed woman in her 60s was admitted in 2009 to the Inpatient Unit of the Psychiatric Service at a hospital in Chile. She had attempted to kill a relative with whom she lived at the time. The patient had murdered her mother two years earlier.

The patient's behavioral changes began in 1985, after she had undergone otolaryngological surgery for nasal polyposis. Although the surgical report described complications involving a cerebrospinal fluid leak, neither postoperative neurological evaluation nor neuroimaging was performed. After her surgery, she experienced a salient behavioral change with the emergence of disruptive behavior. For instance, she wrote offensive letters to her best friend's father, refused to attend any birthday parties because she felt slighted by peers, and left her new job on the first day because a person had been impolite to her. Her social and interpersonal relationships exhibited a slow but steady decline. She was no longer able to keep her job and took only temporary housekeeping jobs or spent her time preaching in jails and penitentiaries.

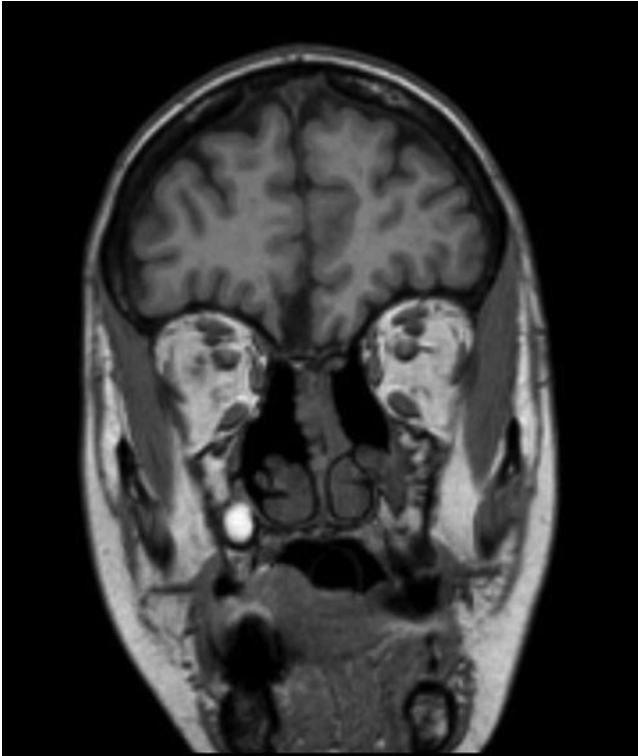
Before her surgery, the patient was described as having a normal developmental and social history. Although reserved and shy, she was a responsible and brilliant student who performed very well in high school and college. Before 1985, she had no medical or psychiatric history. More precisely, there were no symptoms suggestive of psychotic disorder, aggressive or disruptive behavior, or substance abuse. Nevertheless, she had a very negative relationship with her mother, with whom she fought constantly.

In 1993, the patient developed visual hallucinations of a religious nature and some auditory hallu-

cinations. The diagnosis, decided on in an outpatient psychiatric consultation, was one of probable paranoid schizophrenia. She received antipsychotic medications but had poor medication compliance, leading to a worsening of her hallucinations. Based on her testimony, her religious and auditory hallucinations implored her to kill her mother as a sacrifice to God; it was these voices that pushed her to commit matricide. Associated with these hallucinations, she also had an anxiety disorder, bouts of extreme fear, and feelings of guilt. In addition, she had become convinced that killing her mother was the solution to her family's economic difficulties. Acting on her hallucinations and delusions, in 2007, she committed the homicide. She first attempted unsuccessfully to strangle her mother with a scarf and then drowned her in a bathtub the following day. A psychiatric evaluation concluded that the matricide was due to her psychotic disorder. The court declared her not guilty by reason of insanity (NGRI), and she was committed to a psychiatric facility. Her psychotic symptoms subsided under treatment with antipsychotic medication and, after one year, her psychiatrists deemed her fit for discharge.

In 2009, the patient had a relapse of visual and auditory hallucinations, this time prompting her to attempt the murder of another relative. She tried to kill the relative by poisoning her and then attempted to drown her in a bathtub. After this attempted homicide, a forensic psychiatrist concluded that the patient's homicidal behavior constituted a well-organized delusion. The court once again declared her NGRI and remanded her to psychiatric care.

The patient was assessed during her psychiatric hospitalization. The results of her physical and neurologic examinations, including cranial nerve, motor, reflex, and sensory testing, were normal. Regarding her psychopathologic status, she remained psychotic with visual hallucinations of a religious nature. The patient related that she was maintaining a dialogue with God in her diary. When questioned about the killing of her mother, she declared "I was worried because the water was so cold and, I thought, 'Poor Mommy, I should cover her mouth to prevent her from swallowing water.'" Despite this apparent display of concern, she did not express feelings of guilt for the matricide. When asked why she had attempted to kill another relative, the patient complained that she was treated as "the nanny of the house, being obliged to do all the cleaning, cooking



**Figure 1.** Brain nuclear magnetic resonance. T<sub>1</sub>-weighted coronal view of the patient showing a homogeneous hypointense lesion in the right gyrus rectus in the prefrontal cortex. No other lesions were found.

and shopping. Besides, we had only my pension and no further money [on which] to live.” When describing the situation, the patient mimicked the voices of her mother and the other relative in a rather bizarre way.

Her laboratory and electroencephalographic studies were unremarkable with the exception of a magnetic resonance image (MRI) of the brain. There was a hypointense lesion on the T-weighted image involving the right gyrus rectus in the ventromedial prefrontal (VMPF) region (Fig. 1).

The patient underwent a neuropsychological evaluation with a special focus on the frontal lobes. The tests included the Modified Version of the Wisconsin Card Sorting Test, semantic and phonological verbal fluency tests, parts A and B of the Trail Making Test, and the Tower of London.<sup>12</sup> Further evaluation involved the Iowa Gambling Task (IGT), which can detect decision-making impairments in patients with VMPF and medial orbitofrontal (MOF) cortex damage,<sup>13</sup> and assessment of social cognition and theory of mind, including the Reading the Mind in the Eyes Test, Revised Version,<sup>14</sup> and Faux Pas Recognition Test (Adult Version).<sup>15</sup> This

neuropsychological evaluation revealed only low performances in tests measuring planning and decision-making. Her performance on the IGT suggested poor decision-making capacity and a doing-knowing dissociation (e.g., whenever she chose a card from a high-risk deck, she indicated that she did not have to choose that card). An additional psychodiagnostic evaluation using the Rorschach test indicated a psychotic organization of personality with serious flaws in reality testing and judgment, and the Hare Psychopathy Checklist showed a sociopathic or pseudopsychopathic profile, Hare Factor 2 (Table 1).<sup>16</sup>

The patient was successfully treated for her psychotic symptoms. After discharge, she was assigned to a protected residence for psychiatric patients. Once free of psychotic symptoms, she agreed to the study and publication of her case.

## Discussion

This is a unique patient who killed her mother and attempted to kill another relative in the context of a secondary psychotic disorder. Her behavioral changes occurred after having sustained an injury to her right VMPF region from an otolaryngological procedure. There is a prior report of two patients with frontal lobe damage resulting from nasal surgery.<sup>17</sup> The study suggests that the damage to this critical part of the brain can result in a psychotic disorder with homicidal behavior.

There is evidence for the active role of the VMPF cortex in psychotic symptoms and delusions, as was evident in this patient. Neurologic patients with delusions could have bifrontal lesions or predominant involvement of the right hemisphere.<sup>18</sup> Content-specific delusions have also been associated with prefrontal lesions.<sup>19</sup> Lesions in the VMPF cortex may be associated with an impairment in source monitoring (i.e., the ability to distinguish the source of different types of memory) and in reality monitoring (i.e., the capacity to distinguish real events from imagined or internally generated thoughts).<sup>20–23</sup> The VMPF cortex also appears to be responsible for the normal doubt-tag sensation and the intuitive, immediate feeling of rightness (FOR) that are part of monitoring the reality of a thought or belief.<sup>24</sup> The doubt tag and the FOR intervene in the process of judging whether a memory or a thought is plausible. The doubt tag results from an unconscious checking system that tags thoughts as doubtful and sends this information to a conscious monitoring process.<sup>24</sup> Al-

Psychosis-Related Matricide

Table 1 Neuropsychological Evaluation

Cognitive Domain	Test	Patient's Performances
Cognitive Efficiency	Addenbrooke's Cognitive Examination-Revised	88/100
	WAIS <sup>a</sup> Full Scale IQ <sup>b</sup> :	104
Attention	WMS-III <sup>c</sup> Mental Control	23/40
Visuospatial Abilities	Copy of the Rey-Osterrieth Complex Figure	30/36 Type I
Working Memory	Digit Span Forward	7
	Digit Span Backward	4
Verbal Episodic Memory	CVLT - II <sup>d</sup> :	Free Recall
		43/47
		Long Delay Free Recall
		9/16
		Long Delay Cued Recall
		11/16
Executive Function	WCST <sup>e</sup>	Categories:
		5/6
		Perseverative errors
		3
	Trail Making Test A	63". 0 errors
	Trail Making Test B	125". 0 errors
	Lexical Fluency (Letter A)	8
	Semantic Fluency (Animals)	14
	Tower of London	Total Correct Score
		1/10*
		Total Move Score
		107*
		Rules Violation:
		2*
		Time Violation
		7*
		Initiation Time
		79"*
		Execution Time
		896"*
		Total Time
		975"*
Decision Making	IGT <sup>f</sup>	NET Total
		-4*
		NET 1
		0
		NET 2
		2
		NET 3
		4
		NET4
		-4*
		NET5
		-6
Social Cognition	Eye Mind Reading Test	30/36
	Faux Pas	75/80
Psychopathy	Hare Psychopathy Checklist-Revised	Total:
		31
		Factor 1 (Interpersonal/ Emotional)
		7
		Factor 2 (Antisocial Life Style)
		24*

Results are expressed in raw score.

<sup>a</sup>: WAIS = Wechsler's Adult Intelligence Scale

<sup>b</sup>: IQ = Intelligence Quotient;

<sup>c</sup>: WMS-III = Wechsler Memory Scale - Third Edition;

<sup>d</sup>: CVLT - II = California Verbal Learning Test - Second Edition;

<sup>e</sup>: WCST = Modified Version of the Wisconsin Card Sorting Test;

<sup>f</sup>: IGT = Iowa Gambling Task.

\*: Abnormal scores

though functional neuroimaging studies in patients with schizophrenia have shown limbic system involvement in religious delusions,<sup>25,26</sup> other investigations suggest that our patient's VMPF lesion could have impaired the source monitoring and the FOR and resulted in an inability to challenge any false or paranoid beliefs that she might have had.<sup>27</sup>

In addition, after the VMPF cortex injury, she began to display an array of antisocial behavior and failed to conform to social norms. She expressed some culpability for the way she killed her mother, but did not show remorse for the act of matricide itself. Her behavior indicated a lack of remorse or moral emotions linked to the welfare of others. Her behavioral changes were consistent with an acquired

sociopathy that may occur from right VMPF disease.<sup>13,28</sup>

The timeline of her symptoms suggested that her right VMPF cortex lesion had led to her behavioral changes and the matricide. First, there was a temporal relationship between the surgical procedure and the emergence of psychotic symptoms associated with personality and behavioral changes. Second, the neuropsychological evaluation was consistent with an association of her lesion with dysfunction of the VMPF cortex. Investigators have described impairments in the IGT in patients with lesions in this area of the brain, including the gyrus rectus.<sup>29</sup> The doing-knowing dissociation observed during the IGT is characteristic of patients with prefrontal lesions in

whom an action program formulated in speech easily loses its regulatory role.<sup>30</sup> Finally, the topography of the lesion strongly suggested that it contributed to her crime. Loss of gray matter in prefrontal regions, especially in the dorsal gyrus rectus, has been correlated with some degree of psychopathy.<sup>31</sup> Similar to the comportment of a psychopath, this patient displayed callous behavior and did not show guilt or any other emotion when relating her crime. The display of this sort of behavior is in accordance with disturbances in the appreciation of victim-based morality, and it corresponds to the harmful intent described in patients with VMPF cortex lesions.<sup>28,32,33</sup> Indeed, the gyrus rectus and subgenual region are essential for the enactment of prosocial behavior driven by feelings of empathy and altruism.<sup>34</sup>

In contrast to our patient, most cases of prefrontal lesions do not present with either a delusional disorder or sociopathy. There is no obvious explanation as to why some prefrontal lesions manifest in behavior disturbances and others do not.<sup>35</sup> There is no evidence of predisposing factors that could have led her to develop psychotic and sociopathic behavior after having acquired a prefrontal lesion.<sup>36,37</sup> An alternative explanation could be the development of late-onset schizophrenia (LOS). LOS, however, does not start after a surgical procedure, is not associated with focal structural abnormalities, and usually lacks severe positive symptoms or prevalent episodes of hostility and aggression.<sup>38,39</sup> Nevertheless, it is not possible to exclude entirely the coincident LOS with aggression.

In addition, this case raises two important questions concerning the legal implications of the prosecution of murder associated with a brain lesion. The first is how these neuropsychiatric cases are handled across different legal systems. The Chilean court twice declared the woman NGRI. Chilean law recognizes a psychological framework to declare a patient NGRI: perpetrators may recognize and understand their crime and its consequences, but may be insane because they are unable to restrain themselves from committing the crime. In the United States, the states differ in the application of the insanity defense, therefore we cannot conclude whether she would have been declared NGRI there. The second concern raised is related to how society manages a patient who commits a crime associated with brain lesions. Even if she had been declared not guilty due to her brain lesion, she could have been institutionalized rather

than released into the community. In these kinds of patients, prolonged institutionalization may be required, not for the sake for punishment, but for the purpose of protecting the patients and society from any possible danger.<sup>40</sup>

In conclusion, this patient's lesion, by disrupting the neural circuits involved in psychopathy and aggression, may have provoked the expression of psychosis-related homicidal behavior.<sup>41</sup> A right VMPF cortex lesion could convert a vulnerable subject, such as this patient with a probable schizoid or schizotypic personality, into someone exhibiting a lack of moral inhibition and engaging in murderous behavior.<sup>42</sup> The relationship between right VMPF brain mechanisms and psychosis with homicidal behavior requires further investigation.

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