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Criminal Behavior in Frontotemporal Dementia and Alzheimer Disease

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Abstract

Importance—Neurodegenerative diseases can cause dysfunction of neural structures involved in judgment, executive function, emotional processing, sexual behavior, violence, and self-awareness. Such dysfunctions can lead to antisocial and criminal behavior that appears for the first time in the adult or middle-aged individual or even later in life.

Objective—To investigate the frequency and type of criminal behavior among patients with a diagnosed dementing disorder.

Design, Setting, and Participants—We conducted a retrospective medical record review of 2397 patients who were seen at the University of California, San Francisco, Memory and Aging Center between 1999 and 2012, including 545 patients with Alzheimer disease (AD), 171 patients with behavioral variant of frontotemporal dementia (bvFTD), 89 patients with semantic variant of primary progressive aphasia, and 30 patients with Huntington disease. Patient notes containing specific keywords denoting criminal behavior were reviewed. Data were stratified by criminal behavior type and diagnostic groups.

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Main Outcomes and Measures—Frequencies of criminal behavior and χ^2 statistics were calculated.

Results—Of the 2397 patients studied, 204 (8.5%) had a history of criminal behavior that emerged during their illness. Of the major diagnostic groups, 42 of 545 patients (7.7%) with AD, 64 of 171 patients (37.4%) with bvFTD, 24 of 89 patients (27.0%) with semantic variant of primary progressive aphasia, and 6 of 30 patients (20%) with Huntington disease exhibited criminal behavior. A total of 14% of patients with bvFTD were statistically significantly more likely to present with criminal behavior compared with 2% of patients with AD ($P < .001$) and 6.4% were statistically significantly more likely to exhibit violence compared with 2% of patients with AD ($P = .003$). Common manifestations of criminal behavior in the bvFTD group included theft, traffic violations, sexual advances, trespassing, and public urination in contrast with those in the AD group, who commonly committed traffic violations, often related to cognitive impairment.

Conclusions and Relevance—Criminal behavior is more common in patients with bvFTD and semantic variant of primary progressive aphasia than in those with AD and is more likely to be an early manifestation of the disorder. Judicial evaluations of criminality in the demented individual might require different criteria than the classic “insanity defense” used in the American legal system; these individuals should be treated differently by the law. The appearance of new-onset criminal behavior in an adult should elicit a search for frontal and anterior temporal brain disease and for dementing disorders.

Introduction

Neurodegenerative diseases can cause dysfunction of the neural structures involved in judgment, executive function, emotional processing, sexual behavior, violence, and self-awareness. These deficits can result in behaviors that are antisocial and classified by society as criminal. Often these behaviors emerge in individuals with no history of antisocial activities and have been observed in patients with a variety of dementing illnesses, including Alzheimer disease (AD), behavioral variant of frontotemporal dementia (bvFTD), semantic variant of primary progressive aphasia (svPPA), Huntington disease (HD), human immunodeficiency virus–related dementia, and alcohol-induced dementia.^{1–6} The crimes committed by people with dementia range from theft,^{1,5} traffic violations with or without the influence of alcohol, violence,⁵ and hypersexuality⁷ to homicide.^{8,9}

These behaviors, which are sometimes the first manifestation of a dementing condition, pose great personal, social, and legal burdens on the patients, their families, nursing homes, and society.¹⁰ Despite this knowledge, there have been few attempts to study criminality and antisocial behavior in the setting of dementia in a systematic way.

The aim of this study was to investigate the frequency of criminal behavior among patients with a dementing disease. We studied and contrasted the different types of criminal behavior committed by patients within the major diagnostic groups: bvFTD, svPPA, AD, and HD. Whenever applicable, we also checked the reports from the neuropathologic analysis of the deceased to evaluate the degree of clinicopathologic correlation and, hence, the certainty of the clinical diagnoses. In addition, we determined whether the antisocial behaviors occurred during the early, middle, or later stages of the illness.

Methods

We reviewed the medical records of 2397 patients who were seen at the University of California, San Francisco (UCSF), Memory and Aging Center between 1999 and 2012. Included in this study were patients who were evaluated either in the department's outpatient clinic or through one of its parent research projects, which have been previously approved by UCSF's Institutional Review Board: (1) the program project grant Frontotemporal Dementia: Genes, Images and Emotions (grant P01-AG1972403), which collects data on patients with FTD and other related dementias, and (2) the UCSF Alzheimer Disease Research Center grant (grant P50-AG023501). A retrospective design was chosen because it allowed the analysis of very large numbers of patients with rare disorders who present infrequently, even at specialized research centers such as ours, and in whom comprehensive data sets were collected regarding criminal behaviors in AD and FTD.

An electronic database containing 13 477 patient notes was screened for specific keywords to identify criminal behavior. *Criminal behavior* was defined as acts that violate the law as well as those that deviate from traditional social decorum and could potentially lead to legal ramifications. The keywords were decided on through a consensus from 2 neurologists (G.N. and D.C.P.) and included *arrest, court, criminal, detain, driving under the influence, DUI, embezzle, hit and run, incarcerate, jail, legal, loiter, malpractice, misdemeanor, police, prison, sexual harassment, shoplifting, steal, speeding, theft, trespass, violation, and violence*. These were thought to represent nearly all the criminal behavior observed in individuals with dementia. The aim was to capture patients with behaviors that could be considered illegal. This process returned 454 notes, from which 204 patients were identified as having demonstrated criminal behaviors.

The types of criminal behavior were then stratified and tabulated according to the following categories: driving under the influence, hit and run, traffic violations, speeding (classified separately because it is thought to be more common than other traffic violations), insubordination toward legal authorities, sexual advances, loitering, public urination, theft, trespassing (subdivided into volitional vs wandering secondary to confusion), and violence (including physical and verbal threats). For this study, only criminal behaviors that occurred during the patient's illness were included. The criminal behavior was considered to be the presenting symptom if the physician specifically indicated that fact in the medical record. The frequency of criminal behavior was calculated for the major diagnostic groups (bvFTD, svPPA, AD, and HD). In a subset of deceased patients, the concordance between clinical and neuropathologic diagnosis was evaluated in an attempt to validate clinical diagnoses.

In the subgroup of deceased individuals (n = 31), the postmortem analysis was performed at the UCSF Neurodegenerative Disease Brain Bank, adhering to standard procedures within the department. Cases were classified using consensus neuropathologic diagnostic criteria.¹¹⁻¹⁷

When comparing means of continuous variables, analysis of variance was applied because more than 2 groups were compared. For all other categorical variables and because of the

binary nature of the data, χ^2 analysis was used to calculate statistical significance. $P < .05$ was considered statistically significant.

Results

Quantitative Results

Of 2397 patients, 204 (8.5%) had behaviors that could be interpreted as criminal. The major diagnostic groups included bvFTD ($n = 64$), svPPA ($n = 24$), AD ($n = 42$), and HD ($n = 6$). The demographic information for these groups is summarized in Table 1. The other diagnoses were excluded from this analysis due to their small numbers (Table 2), as was a group diagnosed with mild cognitive impairment ($n = 9$) due to the relative lack of diagnostic specificity within this category. All major groups were similar demographically except for age at time of criminal behavior; this variable was significantly lower among the patients with bvFTD and patients with svPPA than in those with AD. The diagnostic group with the highest percentage of patients with criminal behaviors (Table 2) was bvFTD (37.4%) followed by svPPA (27.0%), while patients with AD were among the least likely to commit crimes (7.7%; $P < .001$). The odds ratio for criminal behavior in patients with FTD compared with those with AD was 7.2 ($P < .001$), and in patients with svPPA compared with those with AD it was 4.4 ($P < .001$). Criminal behavior as a first presentation was found in 14.0% of patients with bvFTD, 7.8% of patients with svPPA, and 2.0% of patients with AD ($P < .001$). Furthermore, 19.9% of patients with bvFTD were reported to the police for criminal behavior compared with 14.6% of patients with svPPA and 5.1% of patients with AD ($P < .001$).

The types of crimes were further investigated in the 3 major diagnostic groups (Table 3). Patients with bvFTD were significantly more likely to commit all types of crimes with the exception of hit-and-run accidents. For the bvFTD group, 6.4% of the patients exhibited some form of violence (roughly half verbal and half physical) during their illness compared with 3.4% of patients with svPPA and 2.0% of patients with AD ($P = .30$ and $P = .003$, respectively). At presentation, 4.1% of patients with bvFTD had violence as an initial symptom compared with 2.3% of patients with svPPA and 0.7% of patients with AD ($P = .008$).

When stratifying by sex, men were significantly more likely than women to make sexual advances to others (15.2% vs 5.1%, $P = .03$). All patients who urinated in public were men. No other differences between the sexes were statistically significant.

Crimes committed by patients with HD included traffic violation, trespassing, and violence. Six of 30 patients with HD (20.0%) reported criminal behavior later in the course of their disease, while it was the presenting symptom in 5 patients. Half were physically violent, and all were reported to the police for criminal behavior.

There was a 93% concordance between the clinical and neuropathologic diagnoses among the 31 deceased and autopsied patients. Of 20 patients clinically diagnosed with bvFTD, 19 had frontotemporal lobar degeneration (FTLD), whereas 1 had a pathologic diagnosis of AD. As the clinical manifestation is highly correlated with the brain area involved, it was

not a surprise that the patient with a pathologic diagnosis of AD and bvFTD syndrome showed sexual advances, violence, and theft, which was consistent with the pattern seen in patients with FTLT. Yet, in retrospect, his behavioral changes arose and abated quickly; as the disease progressed, his behavior became more socially appropriate. Of 7 patients clinically diagnosed with AD, 6 had a diagnosis of AD, whereas 1 had FTLT with TAR DNA-binding protein pathology, type A. The patient with FTLT was found to have trespassed and had been violent, a pattern seen more commonly in patients with bvFTD (Table 3). Finally, all 4 patients with a clinical diagnosis of svPPA had FTLT-spectrum neuropathology.

Qualitative Results

The following is a representative example of a patient with AD exhibiting criminal behavior. An 83-year-old woman was caught “stealing” a pie at a local grocery store. She had previously bought a pie from the same store, returned it with complaints, and was told she could exchange it on a different day. A few weeks later, she went back to the grocery store and picked out a pie without paying. The police were called but she maintained that she simply had forgotten the pie. On another occasion, she filled a cart with grocery items to give to a food bank. Upon realizing that the store did not have a food bank donation center, she wheeled the cart out without paying with the intention of taking the items to a food donation center across the street.

The following are examples of criminal behavior in patients with bvFTD. A 59-year-old woman with 2 years of progressive behavioral changes was arrested for trespassing on someone else’s property. She enjoyed visiting this particular private property daily despite being told that she would be prosecuted if she continued to visit. Also, she enjoyed emptying bags of trash from a moving car on the open road and watching each piece bounce on the ground. Another patient became obsessed with approaching strangers and asking them for their telephone numbers. He reported no remorse for his actions to the police.

The following are examples of criminal behavior among patients with svPPA. A 59-year-old woman exhibited several years of personality changes characterized by obsessions, mental rigidity, and social withdrawal. She began shoplifting, taking money from the purses of strangers, and bringing several plastic bags into stores to fill with items she intended to steal. She became obsessed with sweets and candy, and the police were summoned after she stole frozen dinners, candy, and other food items from a drug store. She also showed an attraction to bright shiny objects and would open unlocked cars to take loose change from the center consoles. Another man with several years of problems with object and facial recognition and personality changes failed to stop for the highway patrol after driving through a stop sign. The patrol officer followed him for 2 miles before the patient finally pulled off the road.

Discussion

Our study shows that new criminal behaviors emerge in association with specific neurodegenerative diseases but not with others. These new behaviors were particularly prevalent in association with bvFTD (37.4%), svPPA (27.0%), and HD (20.0%)—disorders that affect frontotemporal (bvFTD and svPPA) or frontal-subcortical circuits (HD).¹⁸

Conversely, in patients with AD, a disorder that has a predilection for hippocampal and posterior parietal-temporal circuits, criminal behaviors were far less frequent (7.7%) and rarely occurred as a presenting feature (2%).

Previous studies with smaller samples that have looked at criminal and sociopathic behavior in neurodegenerative diseases found a similar difference between bvFTD and AD. Miller and colleagues¹⁹ studied 22 patients with FTD and 22 patients with AD and determined that 10 of the patients with FTD (45.5%) and 1 of the patients with AD (4.5%) showed antisocial behaviors, which included assault, indecent exposure, shoplifting, and hit-and-run driving. Similarly, Mendez et al²⁰ reported that more than half of 28 patients with bvFTD displayed sociopathic behavior, such as unsolicited sexual behavior and traffic violations, compared with only 7% of patients with AD. In a European study by Diehl-Schmid and colleagues,¹ theft and other criminal behavior occurred in 54% of patients with bvFTD (n = 32) compared with 12% of those with AD (n = 33). Our larger cohort confirms those numbers, although we found a slightly lower proportion of patients with bvFTD exhibiting criminal behavior (37.4%).

In addition to determining the frequency of criminal behaviors, our study sheds more light on the qualitative nature of these behaviors and delineates how they differ in different diseases (Table 4). In AD, the behavioral dysfunction often, but not always, stemmed from the patients' cognitive dysfunction, and the most frequently recorded abnormalities were traffic violations. Trespassing, when it occurred, was due to wandering. Theft (n = 4), public urination (n = 1), and sexually inappropriate behavior (n = 2) were also uncommon. In addition, in patients with AD, the emergence of criminal behavior appeared in later stages of the disease.

In contrast to AD, in patients with bvFTD, sexual advances (n = 14), theft (n = 25), and public urination (n = 7) were common manifestations of the illness and occurred as the presenting symptom in 14.0% of all patients with bvFTD. Moreover, violence was more common in this patient population. These changes appear to arise from that population's vulnerability to impulsive and disinhibited behavior and have previously been reported in association with traumatic orbital frontal injury and in bvFTD.²¹ Changes in the ability to avoid punishment are characteristic of anterior insular and lateral orbital frontal injury, areas that are particularly vulnerable to bvFTD. Pathologic stealing has previously been reported as a symptom of bvFTD.^{19,22} In one report on bvFTD, theft was considered related to obsessive-compulsive behaviors, although it was poorly responsive to serotonin reuptake inhibitors.²²

The svPPA population also had a high frequency of antisocial behavior but had a different pattern than both patients with AD and those with bvFTD. The major changes were theft (n = 11) and traffic violations (n = 8); these 2 categories accounted for almost all the pathologic behaviors in the svPPA group. Even so, the traffic violations rate in a cohort of community-living persons 72 years and older was 13%²³; hence, the rates in patients with svPPA (and in the other 2 groups, for that matter) are normal if not lower, partly due to possible early driving cessation at the time of diagnosis. The anatomic substrate of svPPA is bilateral anterior temporal with some involvement of the orbitofrontal region. In some of these

patients, there is an intense visual preoccupation and compulsive attraction to small objects. This anterior temporal degeneration, in combination with disinhibition due to orbitofrontal dysfunction, probably accounts for the propensity to theft. Hence, the distinctive anatomy of bvFTD, svPPA, and AD predispose to the new appearance of antisocial behavior, but their anatomy leads to different patterns of dysfunction and different frequencies of antisocial dysfunction.

While they are able to understand their actions and sometimes even able to verbalize that they were wrong, patients with bvFTD lack the inhibitory circuitry in the orbitofrontal, anterior insular, and anterior cingulate cortex to prevent inappropriate behavior. Despite these profoundly disabling brain changes, patients with bvFTD often show relatively normal performance on traditional cognitive tests of memory and even executive control.²⁴ This ability makes patients with bvFTD particularly vulnerable to legal systems, as the traditional insanity defense requires that defendants do not understand that their actions are wrong. The US law states that if a person does know the nature of the act he or she is doing and knows that it is wrong, he or she could be held culpable. Because patients with bvFTD have been shown to be able to identify and verbalize inappropriate actions, they may not meet this legal standard.

The findings from this study suggest that individuals who care for middle-aged and elderly patients need to be vigilant in the diagnosis of degenerative conditions when behavior begins to deviate from the patient's norm and work hard to protect these individuals when they end up in legal settings (eAppendix in the Supplement). Specifically, when older adults start displaying behaviors that are criminal and a change from their baseline behavior, an evaluation for neurologic disorders and possibly neuropsychological testing, coupled with neuroimaging, is helpful in ruling out a neurodegenerative disease. If identified, these individuals can then be appropriately channeled to available social resources. A recent article even advocates for the systematic screening of first-time offenders 55 years and older and the use of palliative placement.²⁵ We agree with this conclusion.

Our study has some limitations. The lack of access to criminal records limits our ability to categorize the legal consequences of potentially criminal behavior among patients with neurodegenerative diseases. In that regard, further studies are needed to examine actual criminal cases in which patients with various neurodegenerative diseases were involved. In addition, an underreporting bias in this study is likely, as family members may not wish to report potentially shameful or embarrassing incidents that lead to legal consequences.

The Memory and Aging Center at UCSF is a tertiary care center, which may lead to referral bias. Patients with more behavioral problems than the general population may be referred to our center. This possibility may lead to an overestimation of criminal behavior in patients; however, we would expect overestimation in all diagnostic groups equally, and therefore this factor may not affect the comparison. That being said, we found a lower frequency of criminal behaviors in patients with AD, who may be referred to our clinic more often because of behavioral problems, whereas a referral bias would potentially lead to the opposite observation.

Finally, retrospective medical record reviews may lack important details surrounding the circumstances of the criminal behavior, and thus prospective studies specifically designed to evaluate criminality are still needed. Moreover, the choice of keywords may lead to potentially missing some patients who may still have criminal behaviors in their notes.

Conclusions

Our study demonstrates that criminal behavior can be the first manifestation of patients with bvFTD and is much more common in these patients than in patients with AD. Theft and traffic violations are highly prevalent in a temporal lobe–predominant language disorder, svPPA, suggesting that the anatomy of these neurodegenerative disorders drives not only the frequency of criminal behavior but also the types of behavior. Judicial evaluations for such patients will require different criteria than the classical insanity defense, and neurodegenerative diseases, including bvFTD, should be treated differently by the legal system, such as obtaining a neurologic evaluation when suspected and channeling to palliative and medical institutions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Demographics at the Time Criminal Behavior Was First Noted

Demographic	AD (n = 42)	bvFTD (n = 64)	svPPA (n = 24)
Age, mean, y (95% CI) ^a	71 (67–74)	59 (57–61)	63 (59–66)
Right handedness, No. (%)	33 (89.2) ^b	58 (90.6)	21 (87.5)
Sex, No.			
Male	25	45	12
Female	17	19	12
White race, No.	32	46	15
Educational level, mean, y (95% CI)	18 (14–22)	17 (14–21)	15 (13–17)
CDR score ^c			
0.5	3	7	5
1	10	22	7
2	6	18	7
3	1	5	1

Abbreviations: AD, Alzheimer disease; bvFTD, behavioral variant of frontotemporal dementia; CDR, Clinical Dementia Rating scale; MMSE, Mini-Mental State Examination; svPPA, semantic variant of primary progressive aphasia.

^a Age was the only statistically significant difference between groups.

^b Total number is 37 because there were 5 missing values.

^c CDR score was not collected from all patients, and only available scores are shown.

Table 2

Frequency of Criminality Across Different Diagnostic Groups

Clinical Diagnosis	Total No.	Frequency of Criminality, No. (%)
bvFTD	171	64 (37.4)
svPPA	89	24 (27.0)
AD	545	42 (7.7)
HD	30	6 (20.0)
VaD	61	9 (14.8)
PSP	63	4 (6.3)
CBS	73	4 (5.5)
MCI	243	8 (3.3)
Other	1122	43 (3.8)
Total	2397	204 (8.5)

Abbreviations: AD, Alzheimer disease; bvFTD, behavioral variant of frontotemporal dementia; CBS, corticobasal syndrome; HD, Huntington disease; MCI, mild cognitive impairment; PSP, progressive supranuclear palsy; svPPA, semantic variant of primary progressive aphasia; VaD, vascular dementia.

Table 3

Major Crime Categories Across Diagnoses

Category	No. (%)			<i>P</i>
	AD (42 of 545)	bvFTD (64 of 171)	svPPA (24 of 89)	
DUI	2 (0.37)	4 (2.34)	0	.02
Hit and run	4 (0.73)	1 (0.58)	1 (1.12)	.89
Traffic violation	12 (2.20)	23 (13.45)	8 (8.99)	<.001
Speeding	1 (0.18)	5 (2.92)	2 (2.25)	.003
Insubordination	4 (0.73)	8 (4.68)	2 (2.25)	.002
Sexual advances	2 (0.37)	14 (8.19)	2 (2.25)	<.001
Loitering	2 (0.37)	4 (2.34)	1 (1.12)	.05
Public urination	1 (0.18)	7 (4.09)	0	<.001
Theft	4 (0.73)	25 (14.62)	11 (12.36)	<.001
Trespassing	2 (0.37)	12 (7.02)	2 (2.25)	<.001
Due to wandering	2 of 2	3 of 12	0 of 2	
Violence				
Toward people	11 (2.02)	11 (6.43)	3 (3.37)	.02
Toward animals	0	2 (1.17)	0	.02

Abbreviations: AD, Alzheimer disease; bvFTD, behavioral variant of frontotemporal dementia; DUI, driving under the influence; svPPA, semantic variant of primary progressive aphasia.

Table 4

Provisional Framework for Criminal Behavioral Classification in bvFTD, svPPA, and AD

Characteristic	bvFTD	svPPA	AD
Frequency of criminal behavior, %	37.43	26.97	7.71
Onset during disease	Early	Early	Late
Types of criminal behavior	Sexual advances, theft, public urination, violence	Theft, traffic violation	Traffic violation, trespassing due to wandering
Underlying substrate	Disinhibition, impulsivity, reward/punishment dysfunction	Compulsive attraction to visual stimuli, disinhibition	Cognitive dysfunction
Anatomy	Anterior insular, orbitofrontal, ventral striatum, anterior	Bilateral anterior temporal lobe,	Hippocampus, parietal lobe

Abbreviations: AD, Alzheimer disease; bvFTD, behavioral variant of frontotemporal dementia; svPPA, semantic variant of primary progressive aphasia.

Supplement. **eAppendix.** 18 U.S.C. § 17