Rage Attacks in Children and Adolescents With Tourette's Disorder: A Pilot Study

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Background: Sudden, explosive episodes of rage occur in a significant number of clinically referred children with Tourette's disorder and cause considerable psychosocial morbidity. The etiology of these symptoms is unknown. We conducted a pilot study of 12 consecutive children with Tourette's disorder and rage attacks to determine whether comorbidity of Tourette's-associated disorders is related to these symptoms.

Method: Twelve consecutive children with Tourette's disorder who presented with rage attacks were evaluated, including 2 females and 10 males. Tourette's disorder diagnosis, presence of comorbid disorders, and tic severity were assessed using DSM-IV diagnostic criteria and standardized rating scales.

Results: All 12 children met diagnostic criteria for Tourette's disorder, obsessive-compulsive disorder (OCD), and attention-deficit/hyperactivity disorder (ADHD). Two children were also diagnosed with comorbid oppositional defiant disorder, and 4 children were diagnosed with comorbid conduct disorder. None of the subjects met diagnostic criteria for a mood disorder. All subjects had only mild tic severity.

Conclusion: The clinical phenomenon of rage attacks in children with Tourette's disorder resembles intermittent explosive disorder and may reflect specific underlying neurologic disturbances. This pilot study suggests that rage attacks in Tourette's disorder may be related to the presence of comorbid disorders.

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Reprint requests to: Cathy L. Budman, M.D., Departments of Neurology and Psychiatry, North Shore University Hospital, New York University School of Medicine, 400 Community Drive, Manhasset, NY 11030. **R** age is characterized by unpredictable and primitive displays of physical or verbal violence that are out of proportion to the provoking stimuli, often threatening serious self-injury or harm to others.¹ Attacks of rage are a common symptom among children and adolescents who present for psychiatric treatment of Tourette's disorder at our specialty clinic. Although rage outbursts appear to be much less common among uncomplicated cases of Tourette's disorder, the actual prevalence and etiology of these symptoms are unknown.

According to some studies, approximately 23% to 40% of all Tourette's disorder patients report experiencing sudden and explosive anger, irritability, temper outbursts, and aggression, which is referred to as "rage."²⁻⁶ At our institution, at least 25% of children with Tourette's disorder who are referred for psychiatric treatment suffer from recurrent attacks of rage (C.L.B, R.D.B., unpublished data, 1996), and such children comprise a disproportionate number of the cases requiring residential treatment.

Typically, rage outbursts in Tourette's disorder children have an explosive quality and are accompanied by a highly charged affect and autonomic activation. The attack has a sudden onset, increases to a peak, and is often accompanied by a subjective sense of loss of control. A feeling of increasing tension or hyperarousal may precede the episode, followed by a sense of relief once the episode has ended. These attacks are easily distinguished from the more common "temper tantrum" by their magnitude, with the result of excessive destruction of property and/or personal injury. Although these episodes usually occur in the absence of situational triggers, some cases may be associated with a situational predisposition, such as with sleep deprivation or hunger or during a particular type of activity. In contrast to predatory aggression, for which violence is part of more enduring generalized character traits, rage symptoms observed in most Tourette's disorder patients are atypical of baseline character; these symptoms resemble what has been described in the adult neurologic literature as "episodic dyscontrol."

Episodic dyscontrol is a phenomenon that has been associated with a number of neuropsychiatric conditions, including Alzheimer's disease, Huntington's disease,

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Parkinson's disease, head trauma, and viral encephalitis.¹ In such cases, the underlying neuropathology is implicated in causing the explosive behavioral outbursts.

A phenotypically related condition is the DSM-IV diagnosis of intermittent explosive disorder, which is characterized by discrete episodes of failure to resist aggressive impulses, where the degree of aggressiveness expressed during an episode is grossly out of proportion to any provocation or precipitating psychosocial stressor. However, current DSM-IV criteria preclude a diagnosis of intermittent explosive disorder when a general medical condition or other mental disorder can better account for the aggressive episodes.

Most often, parents describe a child with Tourette's disorder who at baseline is well adjusted, caring, and empathic but who experiences episodes of explosive rage lasting from a few minutes to less than 1 hour, although in some cases episodes of rage may be sustained for longer periods of time. These symptoms may occur spontaneously but more often appear as a response to a seemingly trivial frustration or intrusion. In most cases, the recipient of the rage attacks is a family member (typically the child's mother), although less frequently episodes occur with others and outside the home setting.

The following brief vignettes exemplify common presentations of rage symptoms in Tourette's disorder: A mother reports that her 12-year-old son punches a hole in the wall when advised that there are no more cans of soda left. Minutes later he begs for forgiveness and expresses shame about his lack of control. A 9-year-old boy violently throws all the books off the examiner's desk and picks up his chair threateningly when told there are no blue crayons in the office, then collapses in a chair in tears of intense remorse. Explosive outbursts such as these typically lack the intentional quality associated with more goal-directed expressions of anger or manipulation.

Parents of children with Tourette's disorder who suffer from rage attacks have provided the following descriptions:

"It is as if he enters a tunnel and as soon as he starts down this path, there is no way back."

"She has the temperament of Dr. Jekyll and Mr. Hyde. We joke about calling an exorcist, but when she is having these rage attacks it seems as if she is possessed."

"It seems as if another being has taken over his body and he has to wrestle with it until the demon is purged."

"He gets a look in his eyes like a wild animal, and I know there is no way to stop the rage from running its course."

Often, the onset of rage symptoms, if untreated, marks a perilous course for Tourette's disorder patients, leading to deterioration in home functioning, severe demoraliza-

back."

tion, poor self-esteem, and ultimately to problems in other areas of functioning such as school and peer socialization. Although behavioral interventions may sometimes attenuate rage attack frequency and severity, it has been our experience that these symptoms increase relentlessly without the intervention of medication.

Because Tourette's disorder is a neuropsychiatric condition associated with diverse neurobehavioral symptoms, rage attacks may be symptoms of episodic dyscontrol, demonstrating disturbances of executive function and of regulation of affect and impulses. However, such symptoms may be more closely related to the presence of associated or comorbid disorders than to the specific tic diathesis. It has been estimated that obsessive-compulsive disorder (OCD) occurs in approximately 50% of patients with Tourette's disorder.⁷ Similarly, attention-deficit/ hyperactivity disorder (ADHD) occurs in approximately 40% to 60% of patients with Tourette's disorder.^{6–8} Our hypothesis, based on clinical experience working with Tourette's disorder children with rage attacks, is that these symptoms occur only in cases of Tourette's disorder complicated by the associated disorders. We therefore performed a pilot investigation of 12 consecutive children with Tourette's disorder who presented for treatment of rage attacks, in an attempt to determine whether these symptoms may be related to Tourette's-associated disorders.

METHOD

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Twelve children with Tourette's disorder between 10 and 17 years of age who presented consecutively for treatment of rage attacks were studied as outpatients through the Movement Disorders Center at a general hospital. This represented 20% (N = 60) of all children with Tourette's disorder evaluated at our center during a 3-month time period. Subjects underwent complete neurologic and psychiatric evaluations to establish the DSM-IV diagnosis of Tourette's disorder. A full-scale IQ < 80 on the Wechsler Intelligence Scale for Children-Third Edition (WISC-III),⁹ evidence either on exam or by history of a previously established cause of rage attacks (such as prior head trauma, autism, or seizure disorder), or recent change (i.e., within the past 6 weeks) in psychotropic medication excluded participation. In no case was a history of physical or sexual abuse elicited, nor was there evidence of trauma from home visits, school reports, or previous medical records.

All subjects and their parents/guardians were interviewed and examined in person by a board-certified psychiatrist with expertise in Tourette's disorder (C.L.B., R.D.B.) and met DSM-IV diagnostic criteria for Tourette's disorder. All subjects and/or parents completed the following formal rating scales (which were administered by a research assistant [K.S.P.] who was blinded to all diagnoses to minimize ascertainment bias) to assess tic severity and the presence or absence of several disorders commonly encountered in Tourette's disorder patients: the Tourette Syndrome Global Scale (TSGS),¹⁰ the Diagnostic Interview for Children and Adolescents (DICA) for mood disorders, DSM-III-R version,¹¹ the DICA for attention-deficit/hyperactivity disorder (ADHD), oppositional defiant disorder, and conduct disorder, DSM-IV version (DICA-IV),¹² the Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS),¹³ the Conners' Parent Symptom Questionnaire (CPSQ),¹⁴ and the Achenbach Child Behavior Checklist (CBCL).¹⁵

The assessment of rage symptoms was made by modification of the DSM-IV diagnostic criteria for intermittent explosive disorder with the elimination of criterion C, as follows: all children suffered from discrete episodes of rage that occurred ≥ 3 times per week, during which they had explosive or aggressive behavior grossly out of proportion to any provocation or stress that included both verbal attacks and physical attacks to property. These symptoms were judged to be atypical of the child's usual personality by both child/parent and clinician.

Statistical analysis was performed to compute mean age, total tic severity, and total TSGS scores and employed an exact binomial 95% confidence interval (CI) for the percentage of subjects who had comorbid disorders (i.e., the binary variable was whether or not a subject had a comorbid disorder). Because the reported rates of comorbidities in Tourette's disorder are widely variable in the literature, no formal comparison was made between rates obtained in this pilot investigation and those reported in the literature. However, an informal comparison was made using expected rates of OCD and ADHD based on clinical studies.^{6–8,16}

RESULTS

Ten males and 2 females ranging in age from 10 to 17 years (mean \pm SD = 12.08 \pm 2.89) participated in this study. All 12 children (100%) met diagnostic criteria for ADHD. Both females and 5 males met diagnostic criteria for ADHD, predominantly inattentive variant or mixed variant (58%); the remaining 5 males met diagnostic criteria for ADHD, predominantly hyperactive type (42%). One female and 1 male also met diagnostic criteria for oppositional defiant disorder (17%); 4 males met diagnostic criteria for conduct disorder (33%). All 12 children met diagnostic criteria for OCD (100%). No children in the group met diagnostic criteria for a mood disorder (0%).

The tic domain of the TSGS comprises the following 4 dimensions: (1) simple motor tics, (2) complex motor tics, (3) simple phonic tics, and (4) complex phonic tics. Each dimension is rated for frequency (on a scale of 0 to 5 with 5 = highest frequency) and degree of disruption (on a scale of 1 to 5 with 5 = highest degree of disruption). For

each tic category, frequency and disruption scores are multiplied and summed to yield a total severity score. The social function domain contains 3 dimensions: behavioral problems, motor restlessness, and level of school and occupational functioning. The social dimensions are rated on a continuous scale of 0 (no impairment) to 25 (severe impairment). The tic and social functioning scores are then inserted into a formula, which yields a global score.¹⁰ These 2 scores can be used separately and contribute equally to the global score. Ranges for TSGS tic scores are as follows: mild tic severity (0-24), moderate tic severity (25-39), severe tic severity (40-59), and extreme tic severity (60–100).¹⁷ Tic severity scores ranged from 2 to 14; the mean \pm SD score for the group was 6.96 ± 3.99 . Total TSGS scores reflected the considerable behavioral symptoms in this group, ranging from 12 to 47.3; the mean \pm SD total score was 32.5 ± 9.05 .

Our pilot study found that all 12 children (100%) with Tourette's disorder and rage also met diagnostic criteria for both ADHD and OCD (95% CI = 78% to 100%). This interval is inconsistent with rates published in prior studies, $^{6-8,16}$ which ranged from 50% to 80% for ADHD and 28% to 67% for OCD.

DISCUSSION

Rage attacks are a disabling symptom that seems to occur more frequently than expected in some children with Tourette's disorder. There has been some evidence suggesting that these behavioral symptoms correlate with tic severity.¹⁷ However, this pilot investigation revealed that total tic scores ranged from 2 to 14, with all subjects having tic scores that fell in the mild range of severity.

This preliminary clinical investigation suggests that symptoms of rage in patients with Tourette's disorder may instead be related to comorbid conditions. On the basis of previous studies, it is reasonable to estimate that the comorbidity of Tourette's disorder with OCD is 50% and with ADHD is 60%. Assuming these 2 rates, if the occurrence of either comorbid condition is independent of the other, then the expected percentage or rate of comorbidity in Tourette's disorder with both disorders should be approximately 30% (i.e., $50\% \times 60\%$). However, our formal calculation of the confidence interval suggests that the rate of double comorbidity is far in excess of 30%. One can argue that even if one approximated the rates of OCD and ADHD at 80% each, the expected comorbidity would be 64%, which is also discordant with our calculated confidence interval of 78% to 100%. This also suggests that our observed rate of double comorbidity in Tourette's disorder patients with rage is markedly higher than that expected according to previous studies of associated disorders in patients with Tourette's disorder. Future studies will need to evaluate the presence and rates of various comorbidities in Tourette's disorder to further

clarify the potential relationship of these disorders with rage attacks.

For example, rage attacks have also been described in patients suffering from major depression.^{18,19} Surprisingly, in this small sample no children met diagnostic criteria for a mood disorder. This was an unexpected finding, since there is evidence that impulsive, irritable, aggressive behaviors, or "affective storms," are common symptoms in children suffering from an underlying mood disturbance, particularly mania.^{20–25} However, the small size of this sample may not have been adequate to demonstrate the possible role of comorbid affective disturbances in this population. In addition, this pilot study did not adequately screen for non-OCD anxiety disorders, which may potentially play a role in these symptoms. The possible role of comorbid non-OCD anxiety disorders should be considered in follow-up studies.

It is possible that our findings in this small sample simply reflect the referral bias inherent in studies performed at a specialty clinic. We have no data on whether these trends are found in children with Tourette's disorder in the community who do not present for psychiatric treatment. Another significant limitation of this small study is that we did not directly assess parent-child interaction, parental psychopathology, or family functioning, which might play a role in the genesis or perpetuation of rage symptoms. Nor was it possible to exclude the possibility that rage symptoms may reflect chronic neurobehavioral toxicity in children exposed to psychotropic medication. At the time of this investigation, 7 (58%) of 12 of the children were taking neuroleptic medication; 8 (67%) of 12 were taking antiobsessional medications or anti-ADHD medications. However, all participating children had been taking stable doses of psychotropic medication prior to entry into this study and had histories of symptoms of rage, which had been an enduring problem despite different medication trials.

There is considerable evidence implicating both serotonergic and noradrenergic neurotransmission as playing a role in aggressive behaviors. Low serotonin has been correlated with increased aggression in adults and hyperactive children.^{26,27} Animal studies have implicated the 5-HT_{1B} receptor in aggressive behavior.²⁸ While dysfunction of serotonin neurotransmission appears related to impulsivity and aggression, noradrenergic neurotransmission appears related to impulsivity and environmental reactivity.²⁹ Furthermore, norepinephrine and dopamine play a role in facilitating or triggering affective aggression while inhibiting predatory aggression.³⁰ Hence, rage attacks observed in children with Tourette's disorder may be the consequence of imbalances within diverse neurotransmitter systems.

The cause of rage symptoms in children with Tourette's disorder is not clear and may be related to a combination of both biological and psychological factors. The question of whether tic severity is related to rage attacks is not answered by these pilot data since it would require comparison with a control group of Tourette's disorder patients without rage attacks. It was an interesting observation, however, that tic severity was mild in all our subjects. This preliminary study suggests that the association of comorbid disorders may be predictive of rage attacks; a larger controlled trial comparing Tourette's disorder children with rage attacks with Tourette's disorder children without rage attacks is currently underway.

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