

Clinical phenomenology of episodic rage in children with Tourette syndrome

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Abstract

Objective: Episodic rage of unknown etiology causes significant morbidity in children with Tourette's syndrome (TS). Using modified Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria for intermittent explosive disorder (IED), we developed a screen and symptom questionnaire to explore rage attack phenomenology and to preliminarily investigate whether symptom clusters can identify clinical subgroups of TS children with rage attacks. **Methods:** 48 children with TS between ages 7 and 17 years consecutively presenting with rage attacks completed the Rage Attacks Screen and Questionnaire.

Data was subjected to factor analysis. Cluster analytic procedures were used to identify clinical subgroups. **Results:** Final cluster solution revealed four homogeneous subgroups of TS children with rage who were differentiated by predominant clinical characteristics: specific urge resolution, environmentally secure reactivity, nonspecific urge resolution or labile nonresolving. **Conclusion:** Episodic rage in TS has stereotypic features, but diverse and complex etiologies. Identifying particular symptom clusters may facilitate improved treatment strategies. © 2003 Elsevier Inc. All rights reserved.

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Introduction

Tourette's syndrome (TS) is a neuropsychiatric disorder of childhood onset characterized by multiple motor and phonic tics, with a prevalence of 10 cases per 10,000 [1]. TS is increasingly identified among children in special educational settings [2]. In adults, TS prevalence appears lower, with a minority suffering debilitating tic symptoms [3].

The natural course of tic symptoms includes fluctuations in type, location and impairment. Tic severity appears to peak between ages 8 and 15 years, often followed by a steady decline in symptoms by late adolescence [4]. Factors influencing the natural history of TS are largely unknown but may involve psychiatric comorbidity, endocrine mech-

anisms or environmental exposures such as infections, stress and medications [5–7].

Clinical studies show TS associated with a variety of behavioral symptoms and psychiatric disorders [8–10]. Referral and selection bias in such populations tends to distort the relationship of psychopathology with tics, yielding relatively high rates of comorbidity compared with community samples [11]. Nonetheless, while the relationship of behavioral symptoms with the underlying tic diathesis has been difficult to untangle, it is clear that psychiatric comorbidity including attention-deficit hyperactivity disorder (ADHD), obsessive compulsive disorder (OCD), non-OCD anxiety disorders and mood disorders are commonly associated with higher levels of TS morbidity and impairment [5,12,13].

Among the most disruptive behaviors in some children with TS are recurrent episodes of explosive anger or aggression (commonly termed *rage attacks*). Approximately 25–70% of patients with TS in clinical settings report experiencing episodic behavioral outbursts and anger control problems [14–19]. When present, episodic

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rage is often identified by families as the most impairing symptom in their children with TS [20]. Similar symptom clusters have been described in other medical and psychiatric conditions and by the DSM-IV diagnosis of intermittent explosive disorder (IED) (when the episodes cannot be better accounted for by another mental disorder, substance or general medical condition) [21–25]. Recent studies demonstrate an association between comorbid psychiatric disorders and episodic rage in TS [14,27,28]. However, specific treatment interventions require a better understanding of rage phenomenology and potential etiologies. For this reason, we developed a screen and questionnaire to explore rage attack phenomenology and to preliminarily investigate whether symptoms clusters can identify clinical subgroups of TS children with episodic rage.

Method

Patients were voluntarily recruited from the Movement Disorders Center, Departments of Psychiatry and Neurology at North Shore University Hospital. Attempt was made to enroll 50 consecutive outpatients referred for assessment of TS and comorbid rage attacks; at the time of presentation, no subject was being medicated specifically for rage symptoms. Parental and child informed consents for participation were obtained by a clinician not involved in their care. Assessments of comorbidity and rage status were made by a research clinician blinded to the patient's previous diagnosis, comorbidity, rage status and concurrent medication usage. Ethics approval was obtained from the Office of the Internal Review Board, North Shore-Long Island Jewish Health System.

TS diagnoses were made by a TS specialist after comprehensive evaluation using the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria [25]. An independent assessment battery including the Schedule for Affective Disorders and Schizophrenia for School-Age Children—Epidemiologic version (K-SADS-E) [26] was administered by a research clinician not involved in the subjects' care. Children with evidence from medical records or examination of mental retardation, head trauma, seizure disorder, autism or pervasive developmental disorder, psychosis, alcohol or substance abuse, sexual or physical abuse, or known organic causes of rage were excluded. Episodic rage attacks were characterized as unpredictable, uncontrollable and atypical of the child's baseline personality; cases of overtly goal-directed or predatory aggression were excluded. All participants were on stable doses of medication for a minimum of 2 months prior to entry into the study, and no medication changes were permitted until evaluation was completed.

Clinical diagnosis of episodic rage was made using modification of DSM-IV diagnostic criteria for IED with the omission of criterion C (i.e., that aggressive episodes are

not better accounted for by another mental disorder, medication or drug, or general medical condition) as follows:

Several discrete episodes of failure to resist aggressive impulses that result in serious assaultive acts or destruction of property.

Degree of aggressiveness expressed during the episodes is grossly out of proportion to any precipitating psychosocial stressors.

Parents provided examples of a typical rage attack to confirm that the above criteria were satisfied. In addition, the following frequency thresholds were selected to establish symptom severity, based on standard research criteria for IED [29,30], to insure a minimal frequency over time that is critical in order to make the diagnosis of episodic rage reliable across clinicians and to ensure that subjects with only occasional impulsive aggressive outbursts were not assigned with episodic rage:

At least three episodes per week \geq
four episodes during a 1-month period of time.

After rage attacks were documented by the rage screen, the subject and his/her parent or guardian were asked to complete the 22-item parental and self-report questionnaire designed to assess the presence or absence of specific characteristics believed to be associated with episodic rage.

The Rage Attacks Questionnaire was factor analyzed and a six-factor solution was utilized. Factor scores were normalized with Z transformations and the profiles were subjected to cluster analysis. The cluster analytically derived subgroups were checked with a K-Means iterative partitioning procedure in which the means for each variable were used to specify the basis for cluster membership. Univariate

Table 1
KSADS-E psychiatric comorbidities

Diagnoses	n (%)
ADHD	37 (77)
Inattentive subtype	11 (23)
Hyperactive subtype	2 (4)
Combined subtype	24 (50)
Bipolar disorder	12 (25)
I	7 (15)
II	1 (2)
Not otherwise specified	4 (8)
Unipolar depression	21 (48)
Major depressive disorder	8 (17)
Dysthymic disorder	7 (15)
Not otherwise specified	6 (13)
OCD	25 (52)
Non-OCD anxiety disorders	26 (54)
Generalized anxiety disorder	11 (23)
Separation anxiety disorder	5 (10)
Panic disorder	2 (4)
Simple phobia	2 (4)
Oppositional defiant disorder	20 (42)

Table 2

(A) Rage: general characteristics (derived from Rage Attack Questionnaire)

Variable	Reported frequencies
Intensity	
Mild	19%
Moderate	54%
Severe	21%
Extreme	4%
Suppressibility	
Cannot be suppressed	65%
Can be suppressed	23%
Target	
Mother	92%
Father	83%
Siblings	81%
Inanimate objects	60%
Friends	35%
Classmates	33%
Extended family members	25%
Setting	
Home	94%
School	35%
Other	35%
Physical precipitants	
Fatigue	67%
Time of day	29%
Hunger	29%
Illness	25%
Increased tics	19%

(B) Rage: subjective characteristics (derived from Rage Attack Questionnaire)

Remorse following rage attack	
Guilt/regret	85%
No guilt/regret	15%
Psychological precipitants	
Frustration	90%
Not getting one's way	90%
Being told to give up what one is doing	81%
Being teased or embarrassed	81%
Being told "no"	81%
Being told they were wrong	79%
Response to a change in plans	75%
Having to compete for attention	50%
Feelings of things "not being right"	46%
No reason	48%
Anticipatory anxiety of recurrent rage	25%

(C) Rage: somatic characteristics

Mental urge preceding rage attack	15%
Sensory urge preceding rage attack	10%
Sensory overstimulation preceding rage attack	35%
Physiological arousal during rage attack	
Feeling out of control	71%
Reddened face/hot flashes	56%
Sweating	40%
Increased heart rate	38%
Shortness of breath	27%
Intense fear/panic	25%
Shaking/trembling	23%
Lightheadedness	19%
Numbness	4%
Chest pain	4%

Table 2 (continued)

(C) Rage: somatic characteristics

Variable	Reported frequencies
Physiological state following rage attack	
Fatigued	83%
Activated	17%
Irritability following rage attack	
Some decrease in irritability	63%
Significant decrease in irritability	15%
Unchanged	17%
More irritable	4%

ANOVA analyses were utilized to analyze the differences between the subgroups in regards to comorbidity and current medication usage.

Results

Forty-eight children between ages 7 and 17 consecutively diagnosed with both TS and clinically significant rage attacks were willing to participate and met inclusion criteria during the study period. Two children did not meet frequency criteria for rage attacks and were excluded. Eighty-three percent (40) of the subjects were male and 17% (8) were female. The mean age of subjects was 11.4 years \pm 2.9 98% (47) were Caucasian and 2% (1) was African American. The majority were socioeconomic status (SES) II (40%) and III (48%); 6% were SES I and IV, respectively. High rates of psychiatric comorbidity were detected by KSADS-E (see Table 1); the mean number of current psychiatric comorbidities was 2.8 (S.D. = 1.3, range = 0–5). The mean number of weekly rage attacks was 3.07 (S.D. = 2.79, range = 0–10). The majority of subjects (83%) were on psychotropic medications at the time of evaluation. Of those medicated, 35% were receiving monotherapy with the majority (65%) on more than one psychotropic medication (see Table 5).

Rage questionnaire descriptive data

For descriptive purposes, the Rage Attacks Questionnaire data was broken down into "general," "subjective" and "somatic" characteristics (see Table 2A–C).

Factor analysis data

Principal components factor analysis using varimax rotation with kaiser normalization was performed on the Rage Attacks Questionnaire to summarize the many variables of the questionnaire into fewer factors. Principal components analysis maximized the distance between group means and varimax rotation made the loadings for each factor more extreme. A six-factor solution accounted for 62.5% of the variance. Table 3 summarizes items contributing to the six factors.

Table 3
Principal components factor analysis with varimax rotation

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Sensory antecedent	.81					
Object directed	.72					
Cognitive antecedent	.60					
Outside home occurrence		.71				
Rage anticipatory anxiety		.64				
Consequent remorse		.58				
Interpersonal reactivity		.47				
Home occurrence		–.46				
Consequent fatigue			.80			
Personal reactivity			.75			
Parent directed				.72		
Excessive stimulation				.66		
Somatic arousal				.50		
Consequent activation					.84	
Consequent irritability					.70	
Rage suppressibility						.76
Excessive tic related						.66

The first factor extracted was interpreted as “compulsion-associated” and accounted for 12.7% of the total variance explained by the analysis. This factor relates whether or not an uncomfortable cognitive and/or sensory urge was experienced prior to a rage attack.

Factor 2 was interpreted as “situation-associated” and accounted for 11.6% of the total variance explained by the analysis. This factor describes rage associated with specific situations or environmental settings (e.g., always occurring in the car) versus specific relational or interpersonal contexts. Such rage was more likely to be associated with anticipatory anxiety and to occur outside the home.

Factor 3 was interpreted as “impulse-associated” and accounted for 10.2% of the total variance explained by the analysis. This factor describes a type of rage that lacked premeditation and was a quick response to a given stimulus.

Factor 4 was interpreted as “relational-associated” and accounted for 9.9% of the total variance as explained by the analysis. This factor describes an interpersonally reactive state related to dyadic dynamics between the child and another individual.

Factor 5 was interpreted as “lability-associated” and accounted for 9.5% of the variance. This factor was related to arousal resolution following the rage attack (i.e., whether the child is able to return to baseline or remains in a hyper-aroused state).

Factor 6 was interpreted as “control-associated” and accounted for 8.8% of the total variance explained by the analysis. This factor related to the perceived degree of control to suppress rage and/or tics, as experienced by the child.

Cluster analysis data

The six factors obtained from the Rage Attacks Questionnaire were then subjected to cluster analytic procedures to determine homogeneous subgroups. A four-cluster solu-

tion was identified via Hierarchical Cluster Analysis. The solution was identified by tracing the value of E (an estimate of potential error for combining two groups) through each stage of the clustering process. A dramatic shift in the rate of change in this error term occurred during the transition from four to three clusters. A shift of this kind suggested that relatively heterogeneous clusters would have been forced together in the transition from the four-group to the three-group solutions. Thus, the four-group solution appeared most appropriate for further analysis.

The four-cluster solution was then subjected to the K-Means Cluster Analysis, which confirmed a four-cluster solution. In this procedure, the means for each factor score for the four groups were used to specify the basis for cluster membership. The K-Means procedure reduces within cluster variance, increases subgroup homogeneity and decreases overlap between the groups.

Cluster 1 contained 19 children who displayed a pattern of specific urge-related reactivity. Rage characteristically resolved with specific urge satiation. Scores for compulsion factor (0.20), situation factor (0.01), impulse factor (0.37), relational factor (–0.28) and control factor (–0.28) were average. This subgroup exhibited a low score on lability factor (–0.72).

Cluster 2, which contained six children, displayed a pattern of environmentally secure reactivity. Rage occurred primarily within secure settings and relationships. The scores on impulse factor (0.47), lability factor (0.58) and control factor (–0.28) were average. High scores were for compulsion factor (0.83) and relational factor (1.31). A low score for this subgroup was situation factor (–1.09).

Cluster 3, which contained 11 children, displayed a pattern of nonspecific urge-related reactivity. Resolving rage appeared linked with variable urges and subjective control states. Compulsion factor (0.28), situation factor (–0.03), relational factor (–0.24) and lability factor (0.18) were

Table 4
Psychotropic medication and cluster membership

Psychotropic medication	Cluster #, <i>n</i> (%)			
	1	2	3	4
α-Adrenergic agonists	8 (42)	1 (20)	5 (45)	4 (33)
Conventional neuroleptics	2 (11)	1 (20)	3 (27)	3 (25)
Atypical neuroleptics	1 (5)	1 (20)	1 (9)	2 (16)
Anticholinergics	1 (5)	0 (0)	2 (18)	0 (0)
Lithium	2 (11)	0 (0)	1 (9)	0 (0)
Anticonvulsants	0 (0)	2 (40)	1 (9)	0 (0)
Selective serotonin reuptake inhibitors	3 (16)	1 (20)	6 (55)	6 (50)
Psychostimulants	4 (21)	2 (40)	2 (18)	4 (33)
Tricyclics	1 (5)	0 (0)	0 (0)	1 (8)
Novel antidepressants	5 (26)	0 (0)	2 (18)	0 (0)
Benzodiazepines	0 (0)	0 (0)	2 (18)	1 (8)
Buspirone	1 (5)	0 (0)	0 (0)	1 (8)
β-Adrenergic blockers	0 (0)	0 (0)	0 (0)	1 (8)
Antibiotic prophylaxis	0 (0)	1 (20)	0 (0)	0 (0)

# of concurrent medications	Cluster 1	Cluster 2	Cluster 3	Cluster 4
No medication	2	1	1	3
1 medication	8	2	4	1
2 medications	8	1	3	4
3 medications	1	2	0	2
4 medications	0	0	2	2
5 medications	0	0	0	0
6 medications	0	0	1	0

Cluster 4 contained 12 children who displayed a pattern of nonresolving, persistent reactivity. Rage was associated with prolonged agitated irritability. The scores on situation factor (0.47), impulse factor (0.40), context factor (0.11) and control factor (−0.09) were average. A high score for this subgroup was on lability (0.73) and a low score on compulsion (−0.93).

No significant differences in psychiatric comorbidity were found among the four clusters. No significant differences in types of current psychotropic usage were found among the four clusters with the exception of increased anticonvulsant usage in Cluster 2 ($P=.05$). The types and number of concomitant psychotropics at time of evaluation for all four clusters are depicted in Tables 4 and 5. Although statistical analysis by logistic regression was not possible, there appeared to be a tendency for poly-pharmacy in Cluster 4.

This exploratory study obtained descriptive data on 48 children with TS presenting for treatment of episodic rage attacks, with the goal of generating hypotheses. Findings suggest that, while episodic rage in TS presents with several stereotypic characteristics, it should not be considered an independent disorder and loss of control of aggressive impulses must be viewed as a nonspecific symptom that may result from a wide range of psychological, biological and environmental conditions. This conclusion is supported by tentative evidence for clinical subgroups based on characteristics surveyed by the Rage Attacks Questionnaire, which showed four possible clinical clusters. These clusters are consistent with roles for nonsocial and social information processing, situational contingencies and affective arousal in episodic rage.

effects and interactions also posed serious limitations, since both medicated and unmedicated subjects were included in our sample. For example it is not clear whether the finding of increased anticonvulsant usage in Cluster 2 is meaningful since there were fewer subjects in this group. Therefore, these preliminary results must be viewed with caution and cannot be generalized to all persons with TS.

Rage Attacks Questionnaire

- If you answered “Yes” to *all* of the above questions, please take a few minutes to answer the following questions.

6. How many rage attacks of this type has your child had over the past week? _____
7. Does your child feel guilty about these rage attacks or regret his/her actions afterwards?
0 = Never 1 = Sometimes 2 = Often 3 = Always
8. Is it possible to interrupt your child or divert them from a rage attack?
0 = No 1 = Yes 2 = Not sure
9. Does your child feel tired or drained after these rage attacks?
0 = Never 1 = Sometimes 2 = Often 3 = Always
10. Please indicate the intensity of most attacks on the scale of 1 to 4 provided below:
1 = Yells and screams, but still can control anger somewhat.
2 = Anger escalates to threatening, hitting people or things with little control over anger.
3 = Destructive; has no control over anger.
4 = Violent; dangerous; must be restrained.
11. During at least one of these rage attacks, did your child report experiencing, or did you observe any of the following symptoms? (Circle all that apply)
(a) accelerated heart beat, heart pounding
(b) face reddening or hot flashes
(c) tightness of the chest, chest pain or pressure
(d) numbness or tingling sensations of arms or legs
(e) lightheadedness, dizziness or feelings of unsteadiness
(f) shortness of breath or difficulty breathing
(g) sweating
(h) shaking or trembling
(i) intense fear, panicky feelings, anxiety
(j) feeling out of control or like he/she was about to explode
(k) feeling like physically attacking or yelling at people
(l) physically or verbally attacking people
(m) throwing things around or destroying objects
12. Please indicate below how often these rage attacks occur at:
0 = Never 1 = Sometimes 2 = Often 3 = Always
- _____ school
_____ home
_____ other (specify) _____
13. Please indicate how often these rage attacks are directed towards:
0 = Never 1 = Sometimes 2 = Often 3 = Always
- _____ things or objects
- _____ classmates
_____ friends
_____ siblings
_____ mother
_____ father
_____ other family members
_____ others (specify) _____
14. Please indicate below how often the rage attacks are related to:
0 = Never 1 = Sometimes 2 = Often 3 = Always
- _____ frustration
_____ being told to give up what he/she is doing
_____ not getting his/her way
_____ being teased or embarrassed
_____ in response to a request or a change in plans
_____ things not being "perfect"
_____ having to compete with others for attention
_____ having something taken from him/her
_____ being told he/she is wrong about something
_____ for no reason at all
_____ others (specify) _____
15. If you ask your child why they had a rage attack, what would they generally say? _____
16. Does your child report having a mental urge or a thought that they have to carry out before a rage attack occurs?
0 = No 1 = Yes 2 = Not sure
17. Does your child report having a sensory urge (premonitory) or a feeling that they have to carry out before a rage attack occurs?
0 = No 1 = Yes 2 = Not sure
18. Does your child display an extreme sensitivity to auditory, visual or tactile stimulation before a rage attack occurs?
0 = No 1 = Yes 2 = Not sure
- If yes, please specify which type of stimulation:
Auditory Visual Tactile
Other (specify): _____
19. How would you describe your child's irritability immediately after he/she has had a rage attack as compared to before the rage attack occurred:
0 = Relaxed 1 = Less tense 2 = As tense 3 = More tense
20. How would you describe your child's activity level immediately after he/she has had a rage attack as compared to before the rage attack occurred:
0 = Calm 1 = Less active 2 = As active 3 = More active

21. Does your child ever express a fear that a rage attack may occur?
 0 = No 1 = Yes 2 = Not sure

If yes, please explain: _____

22. Do you attribute any of these circumstances or factors to be related to your child's rage attacks: (Please circle all that apply)
- (a) Time of day
 - (b) Decrease in tics
 - (c) Excessive tics
 - (d) At bedtime
 - (e) Fatigue
 - (f) Illness
 - (g) Before a meal
 - (h) Weather

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