Childhood Abuse and Platelet Tritiated-Paroxetine Binding in Bulimia Nervosa: Implications of Borderline Personality Disorder

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Background: Co-occurrence of bulimia nervosa and borderline personality disorder has been attributed to shared factors, including childhood abuse and disturbances in central serotonin (5-hydroxytryptamine; 5-HT) mechanisms. To explore this notion, we conducted a controlled assessment of childhood abuse and 5-HT function in bulimics with and without borderline personality disorder.

Method: Forty patients with bulimia nervosa, confirmed with the Eating Disorders Examination interview (14 with borderline personality disorder and 26 without), and 25 normal-eater controls were assessed for clinical symptoms (eating disturbances, mood lability, impulsivity, and dissociation) and childhood sexual and physical abuse. We also conducted tests of platelet tritiated-paroxetine binding in blood samples from 27 of the bulimics (11 with borderline personality disorder and 16 without) and 16 of the controls.

Results: Relative to normal eaters, bulimics showed greater affective instability, overall impulsivity, and a history of physical abuse. However, borderline bulimics alone showed elevated motor impulsivity, dissociation, and rates of sexual abuse. Paroxetine-binding tests indicated no differences attributable to comorbid borderline personality disorder, instead linking bulimia nervosa with or without borderline personality disorder to substantially reduced 5-HT transporter density.

Conclusion: Results suggest relatively autonomous pathologic entities: one, relevant to bulimia nervosa, being associated with abnormal 5-HT transporter function and affective instability, but relatively independent of childhood sexual abuse; another, relevant to borderline personality disorder, onto which sexual abuse, dissociative symptoms, and behavioral impulsivity converge. We propose that abnormal 5-HT function may, however, constitute one basis for the frequent co-occurrence of bulimic and borderline disturbances.

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Bulimia nervosa is defined by dietary dyscontrol and bodily concerns, but is generally a polysymptomatic syndrome with a strongly characterological flavor. From 20% to 30% of persons with bulimia nervosa are, for example, reported to have borderline personality disorder,[1,2] for which dysregulation of affects, impulsivity, recurrent self-harm, and transient dissociative states are pathognomonic.[3] Co-aggregation of bulimia nervosa and "borderline-spectrum" pathology has been attributed to shared factors—thought to explain concurrent dysregulation of impulse controls and mood and eating behaviors[1,4,5]—and recent attention has focused on (1) childhood sexual and physical abuse[6] and (2) disturbances in central serotonin (5-hydroxytryptamine; 5-HT) mechanisms.[4,5] The present study examined the specificity of association, for bulimic and borderline syndromes, of childhood abuse and 5-HT disturbances.

Developmental abuse and bulimia nervosa. Studies indicate 30% to 45% of persons with bulimia nervosa report childhood sexual abuse, and more still, physical abuse.[6] Such associations need not, however, imply a bulimia-specific link, given studies (1) reporting heightened prevalences of childhood abuse in bulimic individuals showing comorbid personality pathology, and especially borderline personality disorder,[7,8] and (2) showing half or more of patients with borderline personality disorder to have a positive history of childhood sexual abuse.[9] In light of such findings, the question arises: Is childhood

abuse associated with bulimia nervosa, or with borderline personality disorder found in only some bulimic patients? The present study addressed this question.

Serotonin dysfunction and bulimia nervosa. Evidence shows 5-HT to moderate mood, impulsive behavior, and satiety,[4,5] and this creates a rationale for the hypothesis that central 5-HT mechanisms act in the predisposition to (or perpetuation of) bulimia nervosa. Empirical support for this notion has been impressive. Jimerson et al.[10] found high-frequency binge eaters (in a normal-weight bulimic sample) to have significantly lower levels of 5-HT metabolites in cerebrospinal fluid than did low-frequency binge eaters or controls. Goldbloom et al.[11] reported 22 active bulimics to have higher platelet 5-HT uptake rates than did 20 age-matched controls, and interpreted this to imply an adaptation to reduced 5-HT. Similarly, several studies in bulimia nervosa have documented blunted prolactin responses to 5-HT agonists or partial agonists[4] (implying down-regulation at postsynaptic 5-HT sites). Finally, the selective serotonin reuptake inhibitor (SSRI) fluoxetine is found to yield clinically significant reductions in binge-eating episodes.[12] While such findings indicate association between bulimia nervosa and 5-HT anomalies, they need not imply bulimia-specific effects. Compared with healthy controls, patients with borderline personality disorder also show signs of decreased 5-HT tone, or anomalous hormonal responses to 5-HT agonists,[9] and clinical trials show fluoxetine to be effective in treatment of dysphoria, impulsivity, and self-mutilation in some patients who have this disorder.[13] The possibility exists, therefore, that "borderline" phenomena may account for some aspects of the 5-HT anomalies observed in bulimia nervosa. Our study also addressed this second issue.

Limited data are available that bear upon the implications of borderline features for 5-HT function in bulimia nervosa: Verkes and colleagues[14] found bulimics with borderline personality disorder (N = 5) to show elevated platelet 5-HT content relative to bulimics without borderline personality disorder (N = 10) and argued that this might reflect increased uptake associated with reduced circulating 5-HT. Likewise, Waller and colleagues[15] noted self-reportedly impulsive bulimics in a small (N = 6) sample to show greater blunting of prolactin responses following buspirone treatment (which they presumed to be largely a 5-HT_{1A} agonist).

The present study. A first goal in this study was to determine whether bulimics with and without borderline personality disorder spanned a continuum of disturbances (with respect to psychiatric symptomatology, childhood abuse, and 5-HT function) or showed distinct areas of disturbance (as might suggest distinct psychopathologic spectra). Another goal of this study was to allow an exploration into the association between abuse history and 5-HT function. We assessed borderline personality disorder, childhood abuse, and eating symptoms by structured interview, and concurrent psychiatric symptoms (affective instability, impulsivity, and dissociation) by questionnaire. Serotonin function was assessed by measuring binding, in blood platelets, of the selective 5-HT reuptake inhibitor [^{3}H]-paroxetine.

There are various reasons for the assumption that platelet paroxetine binding models central 5-HT transporter (or reuptake) mechanisms[16,17]: (1) Platelets possess high affinity-uptake sites for 5-HT, which seem morphologically and kinetically comparable with 5-HT reuptake sites in brain.[16,17] (2) Platelet binding is selectively associated with binding in brain tissue.[16] (3) Antidepressant response in depressed outpatients coincides with normalization of 5-HT reuptake inhibitor binding in the periphery.[18] (4) Platelet paroxetine binding has been applied as a model of 5-HT function in various clinical syndromes.[19,20] While ours is (to our knowledge) the first application of paroxetine binding in bulimia nervosa, Marazziti and colleagues[21] have used platelet imipramine binding as a model of 5-HT function and found transporter density (B_{max}), but not affinity (K_d), to be reduced in bulimic versus nonbulimic women.

METHOD

Participants

Bulimic group. Forty women with bulimia nervosa were recruited through a specialized outpatient service. Eating-disorder status was confirmed at the start of the study using the Eating Disorders Examination (EDE) interview.[22] On the basis of the EDE, 33 (82.5%) women met *Diagnostic and Statistical Manual for Mental Disorders, Fourth Edition* (DSM-IV)[3] criteria for bulimia nervosa, purging subtype; 1 (2.5%) for bulimia nervosa, nonpurging subtype; and 4 (10.0%) for a subclinical bulimia nervosa purge type (bingeing once versus the requisite twice weekly). According to interviews, our bulimic participants binged on a mean ± SD of 16.96 ± 7.03 days monthly at a frequency of 24.55 ± 14.35 episodes monthly. Those who vomited did so on a mean of 16.74 ± 9.95 days monthly, at a mean frequency of 47.17 ± 50.80 times monthly. Mean ± SD age and body mass index (BMI) in this sample were 26.30 ± 6.19 years and 22.01 ± 3.48 kg/m^2, respectively.

Normal-eater control. Members of the normal-eater control group (N = 25) were recruited through advertisements or university classes and were admitted to the study if they had no past or present eating disorder upon interview and no overt psychiatric history upon inquiry. All denied bingeing, purging, or use of psychoactive medications. Mean ± SD age and BMI in this group were 20.80 ± 3.69 years and 20.72 ± 1.85 kg/m^2, respectively.

Measures

Rating scales. Well-known interviews and questionnaires were selected for demonstrated psychometric

strengths and relevance to constructs of interest. We used the EDE[22] interview and the Eating Attitudes Test (EAT-26)[23] to tap clinical eating-disorder symptoms and BMI to reflect nutritional status. We also measured personality disorders using the Structured Clinical Interview for DSM-IV Axis II (SCID-II),[24] which we used to classify all patients as either having or not having borderline personality disorder. The borderline personality disorder criterion referring to overeating was excluded. Interrater reliability checks on a subsample of 17 interviews (selected pseudorandomly to represent adequate numbers of probable "borderline" and "nonborderline" diagnoses) yielded a kappa of 0.68 (representing 88.2% agreement) for a borderline/nonborderline distinction.

Additional psychopathologic characteristics were evaluated using the Dissociative Experiences Scale (DES)[25]; the Barrat Impulsivity Scale (BIS: version 10),[26] producing scores measuring cognitive, motor, and nonplanning impulsivity; and the affective instability subscale from the Dimensional Assessment for Personality Pathology-Basic Questionnaire (DAPP-BQ).[27] Finally, to assess childhood abuse, we used the Childhood Trauma Interview (CTI).[28] We used CTI severity and age indices to isolate experiences involving frankly inappropriate sexual or physical contacts occurring prior to age 13 years and then up to age 18 years. Given a bilingual population, we employed official, validated French translations of the DES and EAT-26 and developed French translations for other scales using careful forward and back translation techniques. On global indices, translations were psychometrically equivalent to corresponding English questionnaires.

Paroxetine binding. Blood samples were always drawn between 8:30 and 9:00 a.m., after an overnight fast. Participants were asked to refrain from alcohol or nonprescription drug use for 48 hours prior to testing and from binge eating for 24 hours prior to testing. Whole blood was collected in Vacutainer tubes containing the anticoagulant EDTA and kept on ice (for no more than 30 minutes) until platelets were isolated by differential centrifugation. Platelet rich plasma was first isolated at 280*g* for 15 min at 4°C. Platelets were then isolated from the platelet rich plasma at 18,000*g* for 15 min. Next, the pellets were washed in buffer containing EDTA/Tris/NaCl, pH 7.5, and homogenized using a Polytron (Brinkman Instruments, Roxdale, Ontario, Canada). The lysed membranes were stored in a small volume of buffer at –80°C until analyzed. Blood work was done under blind conditions. The binding experiment was performed as described by Langer et al.[29] Lysed membranes (0.8 to 2.0 mg protein) were incubated in a Tris/EDTA/NaCl/KCl buffer containing 0.05 to 10 nM of [^{3}H]-paroxetine (26.5 Ci/mmol [980.5 GBq], NEN [Life Science Products, Boston, Mass.]) for 90 min at 20°C. The bound and free ligands were separated by filtration on GF/B Whatman filters, washed 3 times with buffer, and counted. Specific binding, determined by incubating [^{3}H]-paroxetine in the presence and absence of an excess amount of citalopram (3 μM), was found to be between 70% to 90% of total binding. The apparent B_{max} and K_d were obtained by Scatchard analysis of binding curves for the different concentrations of [^{3}H]-paroxetine.

Procedure

All participants provided written informed consent for research. Measures of psychopathology and childhood abuse were obtained from all participants, and blood samples from a subset of 27 bulimics (11 with borderline personality disorder [BN/BPD] and 16 without [BN/nonBPD]) and 16 normal-eater control (NC) participants. The 5-HT indices thus represented diagnostic classifications well. Potential sources of extraneous variation on 5-HT measures necessitate controls or comment: (1) Contraceptive use: Given reports suggesting absence of marked effects of oral contraceptives on blood 5-HT indices,[30] we did not treat contraceptive use as an exclusion criterion. We did, however, test for differences (on paroxetine-binding indices) among individuals who were or were not taking contraceptives and found no significant effects. (2) Seasonal effects: Seasonal variations have been observed on various 5-HT indices, with studies in healthy volunteers reported to yield reduced paroxetine binding in summer/fall.[31] Our recruitment of participants was skewed over time in such a way that any bias due to seasonal variations should have run toward reduced binding in normal controls versus bulimics. Nevertheless, we applied statistical controls for possible confounds due to seasonal effects, using previously published values[31] for seasonal variations in platelet paroxetine binding (see Results). (3) Menses: To optimize sample size, we combined one group of participants tested during follicular phase only with another in whom testing took place on nonmenstrual days. We tested for (and ruled out) potential confounding effects of menstrual phase on paroxetine-binding findings. (4) Medication: Six cases providing blood samples (5 BN/BPD and 1 BN/nonBPD) had started medication (always an SSRI) at the time of recruitment. To optimize sample sizes for data on childhood abuse, we retained these participants and applied statistical procedures (described below) to rule out confounds attributable to medication effects. We note, also, that a recent report indicates absence of acute effects of various antidepressants (including paroxetine) upon platelet paroxetine binding in healthy volunteers.[32]

RESULTS

Descriptive Data

According to SCID-II criteria, none of our NC participants had borderline personality disorder. A more sizable number of our bulimic participants met borderline personality disorder criteria (N = 14; 35.0%). When a borderline

personality disorder diagnosis was present, we assigned the participant to the BN/BPD group, and when not, to the BN/nonBPD group. Mean ± SD age (26.50 ± 6.25 and 26.20 ± 6.28 years, respectively) did not differentiate BN/BPD from BN/nonBPD groups. Bulimic participants were, however, slightly (and significantly) older than were control participants ($F = 7.96$, $df = 2,62$; $p < .01$). Where the age variable was correlated with other indices (affective instability, BIS attention and nonplanning, and B_{max}), findings were confirmed using analyses of covariance with age as a covariate. BMI yielded no group differences: mean ± SD values across BN/BPD, BN/nonBPD, and NC groups were 21.75 ± 3.16, 22.15 ± 3.70, and 20.72 ± 1.85 kg/m^2, respectively.

Table 1. Mean ± SD for Borderline-Bulimic (BN/BPD), Nonborderline-Bulimic (BN/nonBPD), and Normal-Eater Control (NC) Groups on Indices of Eating and Psychopathologic Symptoms†

	Group						
	BN/BPD (N = 14)		BN/nonBPD (N = 26)		NC (N = 25)		Statistic
Variable	Mean	SD	Mean	SD	Mean	SD	t (df = 38)
Binge days/mo	19.18	6.52	15.77	7.12	0.00	0.00	–1.49
Binge episodes/mo	30.81[a]	14.45	21.18[b]	13.37	0.00	0.00	–2.11*
	(N = 13)		(N = 22)		(N = 25)		t (df = 33)
Vomiting days/mo	17.67	9.96	16.18	10.14	0.00	0.00	–0.42
Vomiting episodes/mo	63.58[a]	58.77	37.47[b]	44.04	0.00	0.00	–1.50
	(N = 14)		(N = 26)		(N = 25)		F (df = 2,62)
Eating Attitudes Test	39.21[a]	11.72	36.00[a]	15.03	4.19[b]	4.33	65.96**
Dissociation (DES)	22.73[a]	14.79	10.95[b]	11.41	8.47[b]	4.44	9.12**
Motor impulsivity (BIS)	27.08[a]	4.36	23.23[b]	3.58	20.76[b]	4.12	11.37**
Cognitive impulsivity (BIS)	21.68[a]	2.25	19.54[b]	2.23	16.28[c]	2.26	28.61**
Nonplanning impulsivity (BIS)	27.79	3.74	28.32	4.69	25.26	5.14	2.80
Total impulsivity (BIS)	76.56[a]	7.48	71.09[a]	7.67	62.30[b]	9.14	14.90**
Affective instability (DAPP-BQ)	62.66[a]	9.36	58.58[a]	13.15	37.86[b]	12.13	26.54**

†Abbreviations: BIS = Barrat Impulsivity Scale, DAPP-BQ = Dimensional Assessment for Personality Pathology-Basic Questionnaire, DES = Dissociative Experiences Scale.
[a,b,c]Means with different letters in their superscripts differ at the .05 level or better.
*$p < .05$.
**$p < .001$.

Eating Symptoms

Table 1 shows mean ± SD scores for BN/BPD, BN/nonBPD, and NC groups on EDE mean monthly binge and vomit indices (the latter values computed for cases who were vomiters only) and the EAT-26. Results of t tests revealed significant borderline/nonborderline differences on mean monthly binge episodes, borderline patients showing the higher frequencies. No corresponding differences were obtained on measures of mean days of bingeing or vomiting per month, or of mean vomiting episodes per month. On EAT-26 scores, analysis of variance (ANOVA) revealed a significant group effect (see Table 1), Newman-Keuls tests indicating reliable bulimic versus nonbulimic differences but no borderline/nonborderline differences.

Psychiatric Symptoms

Table 1 also provides mean ± SD results for BN/BPD, BN/nonBPD, and NC groups on measures of dissociation (total score), impulsivity (motor, cognitive, nonplanning, and total scores), and affective instability (total score). One-way multivariate ANOVA on the total dissociation, impulsivity, and affective instability scores yielded an omnibus group effect (Wilks lambda = 11.07, $df = 6,120$; $p < .001$), and we therefore proceeded to univariate ANOVAs. Reliable univariate group effects were obtained on all but the nonplanning impulsivity variable (see Table 1); those on affective instability ($F = 20.80$, $df = 2,61$; $p < .001$) and cognitive impulsivity ($F = 24.18$, $df = 2,61$; $p < .001$) remained after age effects were removed through analyses of covariance (ANCOVAs). Nonsignificant results on nonplanning impulsivity were unchanged when age effects were removed through ANCOVAs. Group comparisons (Newman-Keuls) showed the following: on dissociation and motor impulsivity (arguably the most pathognomonic features of borderline personality disorder measured), pathologic elevations occurred in BN/BPD cases, but not in BN/nonBPD cases.

Childhood Abuse

Table 2 shows numbers (and proportions) of participants in each group who reported sexual abuse, physical abuse, or any abuse (i.e., either form of abuse), both before age 13 years and up to age 18 years. Group effects (or trends) were obtained for data reflecting sexual abuse prior to age 13 ($\chi^2 = 5.22$, $df = 2$, $p < .08$) and up to age 18 ($\chi^2 = 10.22$, $df = 2$, $p < .01$). Pairwise group comparisons for prevalences prior to age 13 were (given low frequencies in some cells) conducted using Fisher exact tests, and a significant difference was obtained between BN/BPD and NC groups ($p < .03$) alone. Hence, elevated childhood sexual abuse seemed to be characteristic largely of BN/BPD cases and only nonsignificantly elevated among BN/nonBPD bulimics.

To further explore an apparent association between sexual abuse and borderline personality disorder, we conducted an analysis to reflect associations between each diagnostic classification and type of abuse, computing proportions of cases in each group who reported

Table 2. Number and Percentage of Cases in BN/BPD, BN/nonBPD, and NC Groups Reporting Sexual Abuse, Physical Abuse, or Either Form of Abuse Prior to Age 13 Years and up to Age 18 Years†

	Sexual Abuse		Physical Abuse		Any Abuse	
Group	N	%	N	%	N	%
BN/BPD (N = 14)						
Prior to age 13 y	7	50.0	10	71.4	11	78.6
Up to age 18 y	9	64.3	11	78.6	12	85.7
BN/nonBPD (N = 26)						
Prior to age 13 y	6	23.1	9	34.6	13	50.0
Up to age 18 y	6	23.1	10	38.5	13	50.0
NC (N = 25)						
Prior to age 13 y	4	16.0	1	4.0	4	16.0
Up to age 18 y	4	16.0	1	4.0	4	16.0

†Abbreviations: BN/BPD = borderline-bulimic, BN/nonBPD = nonborderline-bulimic, NC = normal-eater control.

Table 3. Mean ± SD for BN/BPD, BN/nonBPD, and NC Groups on B_{max} and K_d Indices From Platelet [^{3}H]-Paroxetine-Binding Tests†

	BN/BPD (N = 11)		BN/nonBPD (N = 16)		NC (N = 16)		F
Variable	Mean	SD	Mean	SD	Mean	SD	(df = 2,40)
Mean B_{max} (fmol/mg protein)	529.09[b]	172.84	566.13[b]	357.89	1047.25[a]	467.95	9.02*
Mean K_d	0.29	0.25	0.32	0.30	0.28	0.25	.07

†Abbreviations: B_{max} = transporter density, BN/BPD = borderline-bulimic, BN/nonBPD = nonborderline-bulimic, K_d = binding affinity constant, NC = normal-eater control.
[a,b]Means with different letters in their superscripts differ at the .05 level or better.
*p < .001.

intrafamilial abuse (involving a first-degree relative as perpetrator) or extrafamilial abuse (involving another perpetrator), and dividing each type into less-severe forms (involving nongenital contacts) and more-severe forms (involving genital contact). In this analysis, cases reporting more than one class of abuse were counted more than once. Respective proportions of cases in BN/BPD, BN/nonBPD, and NC groups who reported each class of abuse prior to age 13 were as follows: less-severe intrafamilial abuse: 35.7%, 15.4%, and 12.0%; more-severe intrafamilial abuse: 21.4%, 0.0%, and 0.0%; less-severe extrafamilial abuse: 14.3%, 7.7%, and 4.0%; more-severe extrafamilial abuse: 0.0%, 7.7%, and 0.0%. The pattern of results links intrafamilial abuse, especially in more-severe forms, with the BN/BPD classification (and not with BN/nonBPD).

Chi-square analysis also showed significant group effects for physical abuse prior to age 13 ($\chi^2 = 21.55$, df = 2, p < .001) and up to age 18 ($\chi^2 = 25.61$, df = 2, p < .001). Here, exact tests (performed on values prior to age 13) differentiated BN/nonBPD cases and BN/BPD cases from NC cases (p < .01 and p < .001, respectively), and BN/nonBPD and BN/BPD groups from each other (p < .05). Results thus indicated elevated physical abuse in both bulimic groups, although here, too, BN/BPD cases showed extreme rates (see Table 2). Finally, we compared the groups for proportions of any abuse (combined sexual and physical abuse), and found significant effects for abuse prior to age 13 ($\chi^2 = 16.28$, df = 2, p < .001) and up to age 18 ($\chi^2 = 18.16$, df = 2, p < .001). Here, exact tests (for abuse prior to age 13) differentiated BN/BPD from control (p < .001) and BN/nonBPD from control (p < .02), and tended to differentiate BN/BPD from BN/nonBPD groups (p = .10).

Paroxetine Binding

Results reflecting receptor B_{max} and K_d are shown for the 3 groups (11 BN/BPD, 16 BN/nonBPD, and 16 NC cases) in Table 3. One-way ANOVAs revealed a significant group effect on B_{max}, but not on K_d (see Table 3). Group contrasts indicated mean B_{max} for both bulimic groups to be significantly lower than that for the NC group. BN/BPD versus BN/nonBPD differences were not, however, obtained. To ensure that the group effect obtained on B_{max} was not a function of age (which was correlated with B_{max}), affective problems (known to be associated with 5-HT function), or seasonal variations in platelet paroxetine binding,[31] we repeated the analysis using as covariates age, affective instability, and finally, season of testing. In line with reported findings,[31] we coded season as a dichotomous winter/spring (high-binding) versus summer/fall (low-binding) distinction. Although covariates never yielded significant effects, group effects in each case remained significant: covarying age: F = 6.24, df = 2,39; p < .004; covarying affective instability: F = 5.58, df = 2,39; p < .01; and covarying season: F = 5.12, df = 2,39; p < .02.

Similarly, to verify the possible impact of medication on B_{max} values, we repeated the ANOVA on B_{max} on data from unmedicated subjects only (6 BN/BPD, 15 BN/nonBPD, and 16 NC). The group effect remained reliable (F = 6.55, df = 2,34; p < .005), with corresponding values for BN/BPD, BN/nonBPD, and NC groups being 562.00 ± 146.39, 580.00 ± 365.97, and 1047.25 ± 467.95 fmol/mg protein, respectively. Newman-Keuls comparisons again indicated reliable differences between bulimics and normal eaters, but no borderline/nonborderline differences. Hence, results were quite comparable with those obtained in our full sample (see Table 3). As a final test, we computed mean B_{max} scores for medicated (N = 6) and unmedicated (N = 21) participants who had bulimia nervosa. Resulting values (467.67 ± 195.82 and 574.86 ± 314.93 fmol/mg protein, respectively) did not differ (t = –0.79, df = 25, NS).

Association Between Transporter Density and Other Indices

To explore possible links between altered transporter density and nutritional factors, we computed correlations

(in subjects with bulimia nervosa only) between B_{max} values and indices of nutritional status (BMI) and severity of eating-disorder symptoms (EAT-26 and mean monthly binge days, vomit days, binge episodes, and vomit episodes). None of the resulting correlations (0.28, –0.02, –0.11, –0.11, –0.20, –0.24, respectively) were significant, implying absence of direct connection between eating behaviors and reduced transporter density. We also explored correlations (and partial correlations, after removing variance due to bulimic versus nonbulimic status) between B_{max} values and presence of childhood abuse (coded dichotomously as present or absent). Resulting correlations for variables reflecting presence or absence of sexual abuse prior to age 13 (r = –0.18; partial r = –0.17) or up to age 18 (r = –0.21; partial r = –0.14) and for physical abuse prior to age 13 (r = –0.11; partial r = 0.15) or up to age 18 (r = –0.15; partial r = 0.12) were nonsignificant. Hence, presence of childhood abuse did not seem to be strongly predictive of alterations in paroxetine binding.

DISCUSSION

Clinical Symptoms

On certain psychopathologic indices applied in this study, we found rather clear evidence of a phenomenological discontinuity between bulimic patients with and without borderline personality disorder. Relative to normal-eater control participants, bulimics with the disorder displayed remarkable levels of motor impulsivity and dissociation; bulimics without it, on the other hand, showed no striking (or statistically significant) elevations on these characteristics (see Table 1). Hence, the bulimic patients with borderline personality disorder seemed to show a relatively unique propensity toward psychopathology of a behaviorally impulsive or dissociative type. With respect to impulsive/dissociative potentials, our findings therefore suggest that bulimia nervosa and borderline personality disorder represent rather distinct psychopathologic spectra.

Corroborating the same theme, eating-symptom measures provided evidence of a similar separation between bulimic and borderline components of disturbance. Although bulimics with borderline personality disorder tended to binge more repeatedly when they did binge, all bulimics otherwise tended to display comparable proportions of days per month on which they binged and vomited and similar levels of attitudinal distortion pertaining to eating (on the EAT-26). These trends again point to the conclusion that eating-specific and characterological components of disturbance in bulimia nervosa are relatively independent and parallel several previous reports that have suggested absence of overall differences in bulimic symptoms attributable to Axis II comorbidity.[1] Nevertheless, to explain trends toward more dyscontrolled bingeing observed in borderline patients, we propose that bulimic manifestations in patients with borderline personality disorder, although existing independently of the borderline personality pathology per se, may be shaped or exaggerated by certain borderline characteristics (like impulsivity).

In contrast to the preceding, measures of cognitive impulsivity and affective instability differentiated bulimic groups from normal controls, but yielded no marked borderline/nonborderline distinctions (see Table 1). One implication here, we assume, may be that there exists a propensity toward labile moods and unreflectiveness in even nonborderline bulimics.

Childhood Abuse

Consistent with the proposal (raised above) that bulimia nervosa and borderline personality disorder represent independent psychopathologic structures, we found bulimia nervosa in the presence of borderline personality disorder to coincide with substantially greater risk of childhood sexual abuse (especially in intrafamilial forms) than did bulimia nervosa without borderline personality disorder. Indeed, in the present findings, risk of childhood sexual abuse was negligibly higher among bulimics who were nonborderline (i.e., less characterologically disturbed) than it was among our normal-eater control participants. Such findings replicate previous results that have shown childhood sexual abuse to be more typical of persons who have bulimia with comorbid personality pathology, and especially in those with borderline personality disorder.[10,11] We infer from these that childhood sexual abuse may have a more specific relevance to personality pathology (in particular, borderline personality disorder) than to bulimia nervosa. Results on indices of physical abuse differed somewhat in showing a progressive increase in prevalence of abuse across normal eaters, nonborderline bulimics, and bulimics with borderline symptoms. While such findings highlight the pertinence of abuse experiences for bulimic syndromes (and probably for many forms of maladjustment), even here, a particularly strong association was indicated between borderline personality disorder and history of abuse. We add, as a note, that our data on childhood abuse do not support inferences about causality. In other words, it remains to ascertain whether findings imply causal effects of abuse for borderline personality disorder or isolate abuse as a marker of processes associated with vulnerability to borderline personality disorder.

Paroxetine Binding

Paroxetine-binding tests yielded a somewhat different pattern of findings, showing B_{max} (i.e., platelet 5-HT reuptake) to be significantly (and substantially) lower in both of our bulimic groups than it was in normal-eater controls, without differing across borderline and nonborderline bulimic subsamples (see Table 3). The pattern of group differences described seemed, furthermore, to exist indepen-

dently of seasonal variations, medication effects, associations with childhood abuse, or indices of nutritional status (i.e., BMI, EAT-26 scores, binge/vomit frequencies). The preceding invites the conjecture that we may be observing a serotonergic anomaly that is implicated relatively ubiquitously in bulimia nervosa and upon which presence or absence of borderline personality disorder has little impact. In interpreting these results, we remain aware that platelet measures need not reflect brain 5-HT functions under all circumstances. Nonetheless, if (for reasons reviewed earlier[16–21]) we assume that platelet binding often provides an approximation to central mechanisms, then our findings might be taken to imply generally reduced density of the 5-HT transporter in bulimia nervosa—a finding that would be compatible with various other observations indicating reduced 5-HT tone in bulimia nervosa.[4,5] We can envisage several accounts for the apparently reduced reuptake of 5-HT observed. One could argue that we are observing a compensatory reduction in 5-HT reuptake, associated with dietary factors that produce periodic excesses in circulating 5-HT (e.g., repeated overloading with 5-HT precursors during binge episodes). While such explanations may be viable, our findings indicate relative independence of 5-HT findings from nutritional indices and mitigate against any account couched solely in terms of dietary sequelae. Alternatively, we might be observing an adaptive reduction in 5-HT reuptake, corresponding to a constitutional deficit in 5-HT availability, or 5-HT reuptake levels that are themselves, for constitutional or other reasons, simply too low. Present findings provide no strong indications for preference among these alternative explanations. Regardless, our findings link bulimia nervosa quite strongly to a reduction in platelet paroxetine binding. If findings with paroxetine binding correspond to underactivity at the central presynaptic 5-HT terminal, our results might justify use of SSRIs in bulimia nervosa treatment, as such treatment would presumably boost 5-HT activity at an appropriate locus in the system.

In the absence of a comparison group composed of patients with borderline personality disorder but without bulimia nervosa, we cannot ascertain whether our results indicate a 5-HT anomaly that is associated specifically with bulimia nervosa (and hence found uniformly across our borderline and nonborderline bulimic groups) or is equipresent in borderline personality disorder and bulimia nervosa alike (i.e., present in both syndromes, without additive effects when the 2 are present concurrently). However, previous evidence of reduced tritiated-paroxetine binding in at least certain individuals with personality disorders[33] encourages us to speculate that we may be observing an anomaly that is common to both bulimia nervosa and borderline personality disorder, and furthermore, that this anomaly may account for frequent coaggregation between borderline and bulimic syndromes.

Indeed, we speculate that the apparently reduced 5-HT reuptake observed here could reflect a common end state associated with bulimic eating but resulting from different processes in different individuals. In some individuals, vulnerability to binge eating may arise from reduced 5-HT activity (and corresponding, adaptive reduction in density of 5-HT transporter sites) resulting, in part, from such factors as prolonged or excessive dieting. Available evidence indicates that dieting can alter 5-HT function in the fashion described[4,5] and might be responsible for 5-HT–mediated effects conducive to dietary dyscontrol. Conversely, individuals with borderline personality disorder might show a primary disturbance in 5-HT function that could underlie these patients' unique proclivities toward trait impulsivity, mood dysregulation, and related symptomatology. If the hypothetical disturbance included alterations in 5-HT mechanisms regulating appetitive behavior, it might account for concurrent susceptibility in patients with borderline personality disorder to problems with satiation (or binge eating). This proposal might account for a relatively generalized involvement of 5-HT disturbances in bulimia nervosa, regardless of comorbidity, and a special affinity between bulimia nervosa and disorders like borderline personality disorder that are presumed to be, in part, 5-HT mediated.

We add a note concerning a limitation of the present study. In interpreting findings showing borderline/nonborderline distinctions, it is necessary to consider the possible impact of uncontrolled effects arising from comorbid Axis I disorders (e.g., major depression or posttraumatic stress disorder) that have not been accounted for here. While concern about such influences is indeed legitimate, we believe that our findings, even if they reflect such confounds, are likely still to be informative from a purely phenomenological standpoint about that group of bulimic patients who meet formal borderline personality disorder criteria, and about shared and unique factors (developmental and neurobiological) that may coincide with phenomenologies of a bulimic and borderline type. Nonetheless, future work in bulimia nervosa needs, wherever possible, to include fuller controls for various forms of psychiatric comorbidity.

Drug names: buspirone (BuSpar), fluoxetine (Prozac), paroxetine (Paxil).

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