Differential DSM-III Psychiatric Disorder Prevalence Profiles in Dystonia and Parkinson's Disease

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The authors investigated the prevalence of DIS-ascertained DSM-III psychiatric disorders occurring in 28 patients with dystonia and 28 patients with Parkinson's disease (PD). In patients with dystonia, lifetime prevalences of major depression (25.0%), bipolar disorder (7.1%), atypical bipolar disorder (7.1%), social phobia (17.9%), and generalized anxiety disorder (25.0%) were significantly more common than in epidemiologic catchment area (ECA) study population controls ($p < 0.005$). Social phobia and generalized anxiety disorder preceded dystonia (primary), while bipolar disorder developed after dystonia onset (secondary). In PD patients, the lifetime prevalence of simple phobia (35.7%, $p < 0.0001$) and atypical depression (21.4%) were significantly more common. Parkinson's disease was associated with primary simple phobia and secondary atypical depression. These findings are considered in light of previous results and in terms of the differences in pallidothalamic physiologies in dystonia and PD. These data suggest distinctive profiles of psychiatric disorders in dystonia and PD.

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Dystonia and Parkinson's disease (PD) are involuntary movement disorders with different clinical features. Dystonia consists of twisting, torsional hyperkinetic movements, whereas PD is associated with hypokinesia, bradykinesia, and akinesia. Earlier studies have suggested that dystonia and PD are associated with psychiatric disorders, particularly anxiety and mood disorders. Specific globus pallidus circuits have also been associated with mood disorders.[1] We, therefore, considered it germane to evaluate the prevalence of common psychiatric disorders in conditions of differing globus pallidus (GP) physiologies, namely dystonia and PD. Although both dystonia and PD are associated with increased striatal inhibition of the external GP (GPe), dystonia is linked to excessive striatal inhibition of the internal GP (GPi), while PD is linked to reduced striatal inhibition of GPi.[2]

The prevalence of major psychiatric disorders in the United States has been determined in the Epidemiological Catchment Area (ECA) study, a large study involving door-to-door diagnostic assessments of psychiatric

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disorders.[3] The ECA study involved 19,182 community subjects dwelling in households and institutions from five geographically distinct sites across the United States. This study determined the prevalence of DSM-III psychiatric disorders utilizing the Diagnostic Interview Schedule (DIS), a structured interview designed for use by nonclinicians, which was systematically applied in order to assess subjects.[3] Used in this manner, the DIS has shown sound reliability when assessed by concurrent clinician interview and at 1-year follow-up for test-retest reliability.[4] We utilized this same diagnostic methodology to determine life and point prevalences of DSM-III psychiatric disorders in subjects with dystonia and PD. We tested the physiological hypothesis that dystonia and PD, disorders with different GPi physiologies, would differ in their profiles of psychiatric disorders. We also were interested in whether psychiatric disorders preceded movement disorder onset (*primary* psychiatric disorders, possibly predisposing to the development of movement disorder) or developed after movement disorder onset (*secondary* psychiatric disorders, possibly precipitated by movement disorder).

Few studies in the literature comprehensively examine the prevalence of psychiatric disorders in dystonia or PD, and none directly compares the two disorders using the same methodological approach. Such studies would not only provide information bearing on the above physiological hypothesis, they would also elucidate psychiatric morbidities for which people with dystonia or PD may be at special risk. Recognition and treatment of these morbidities can enhance the quality of life for patients with such movement disorders.

METHODS

Subjects

We studied 28 subjects with primarily generalized or segmental cervical dystonia and 28 subjects with PD for DSM-III psychiatric disorders. Subjects with dystonia were drawn from consecutively encountered volunteers attending a dystonia support group associated with a tertiary movement disorder referral center at Emory University in Atlanta. Subjects with PD were drawn from consecutively encountered volunteers attending a tertiary referral center movement disorder clinic at the Medical College of Georgia in Augusta, Georgia. Response-to-study recruitment rate of subjects with dystonia was 28 out of 37 subjects (75%), while the rate for subjects with PD was 28 out of 35 subjects (80%). The study was approved by the institutional review boards of each institution. After procedures were fully explained, all subjects gave written, informed consent to participate in a study involving clinical assessment of dystonia and PD. However, subjects were blind to the psychiatric purpose of the study in order to preclude selection bias in the sample. After conducting standard neurological and movement disorder examinations, dystonia and PD were diagnosed by the consensual agreement of two physicians trained in movement disorders. Other characteristics of subjects with dystonia and PD are provided in Table 1, Table 2, and Table 3.

TABLE 1: CHARACTERISTICS OF SUBJECTS WITH DYSTONIA AND WITH PD

Sample Characteristics	Dystonia	PD
Men	8 (28.6%)	18 (64.3%)
Women	20 (71.4%)	10 (35.7%)
Age	51.32 ± 9.76	64.61 ± 8.92
Duration of disease	13.61 ± 13.52 yrs	12.52 ± 10.83 yrs
Education	14.71 ± 2.59 yrs	15.25 ± 4.53 yrs
Employed	15 (53.6%)	19 (67.9%)
Retired	13 (46.4%)	9 (32.1%)
Income	$29,521 ± 26219	$39,442 ± 37248
Median income, range	$25,000, $0–90,000	$30,000, $5000–170,000
Married	19 (67.9%)	22 (78.6%)
Single	9 (32.1%)	6 (21.4%)
Modified MMSE	53.75 ± 2.91	50.67 ± 6.14
On Anticholinergics	5 (17.9%)	10 (35.7%)
Anticholinergic Dose†	4.43 ± 11.76	1.70 ± 3.06

† Trihexyphenidyl equivalents

TABLE 2: CLINICAL CHARACTERISTICS IN 28 DYSTONIA PTS

Cervical segmental	18 (64.3%)
Non-cervical segmental	3 (10.7%)
Generalized	7 (25.0%)
DMS severity scores	20.29 ± 18.79
DS disability scores	3.39 ± 3.49
Dystonic pain	17 (60.7%)
Dystonia at rest	24 (85.7%)
On GABA Agonists	15 (53.6%)
GABA Agonist Dose†	1.43 ± 2.02mg

† Clonazepam equivalents

TABLE 3: CLINICAL CHARACTERISTICS IN 28 PARKINSON'S DISEASE PTS

UPDRS severity scores	26.71 ± 14.46
Hoehn and Yahr stages	3.25 ± 1.04
Number in each stage	Stage I 1, II 7, III 6, IV 12, V 2
Freezing	12 (42.9%)
Freezes/day	1.54 ± 2.33
L-DOPA dyskinesia	7 (25.0%)
UPDRS Dyskinesia Scale Score	2.21 ± 4.33
On L-DOPA	26 (92.9%)
L-DOPA Dose	3987.37 ± 2424.76 mg

Assessment

Dystonia was evaluated by means of the clinical neurological exam and movement disorder exam for dystonia and ratings on the Dystonia Movement Scale (DMS)[5] and dystonia Disability Scale (DS).[5] Parkinson's disease was assessed by means of the clinical neurological exam and movement disorder exam for PD, ratings on the Unified Parkinson Disease Rating Scale (UPDRS), and staging according to Hoehn and Yahr.[6] Psychiatric disorders were evaluated using a structured clinical interview for the DSM-III,[7] the Diagnostic Interview Schedule (DIS).[3] Psychiatric diagnoses were determined by a psychiatrist. The temporal relation of psychiatric disorder onset to movement disorder onset was also determined (i.e., primary versus secondary psychiatric disorders). This relied on the recall of the subject in dating the onsets of the psychiatric disorder and the movement disorder. Subjects with depressive symptoms were rated on the Hamilton Rating Scale for Depression (HRSD)[8] and the Beck Depression Inventory (BDI).[9] Cognition was assessed using the Mayeux et al.[10] modification of the Folstein et al. Mini-Mental State Exam (mMMSE).[11]

Hypothesis

We evaluated the hypothesis that psychiatric prevalence profiles differ between subjects with dystonia and subjects with PD.

Analysis of Data

Lifetime primary and secondary prevalence rates of psychiatric disorders for subjects with dystonia and PD were compared to lifetime prevalence rates determined for the normal population using sex-, race-, and age-matched normative controls from the National Institutes of Health ECA study.[3] The ECA study provides point and lifetime prevalence rates for 19,182 subjects in the United States from five different geographical sites. The sample comprises data from house-to-house research but also includes subjects from institutions where the rate of psychiatric disorders is higher. As such, comparison of our data to ECA data constitutes a conservative comparison of psychiatric disorders relative to the population of the United States due to the inclusion of institutionalized subjects. Epidemiologic catchment area point and lifetime prevalence data are specified for particular demographic groups by age, race, and gender. Except for generalized anxiety disorder, each study subject was matched to 126 age-, race-, and gender-matched controls for each disorder. For generalized anxiety disorder, each study subject was matched to 53 controls because of the more limited data available from only three geographical sites. Race and gender were matched identically, while age was matched according to the age brackets defined in the ECA study: 18–29, 30–44, 45–64, and over 65 years of age. Therefore, for each age bracket, it is possible to calculate specific point and lifetime prevalence rates for men and women of different ethnicity (white, black, and Hispanic) and age. The designated number of demographically-matched ECA controls, with a specific prevalence rate for a specific psychiatric disorder, was matched to each study subject, and the number of cases (ECA subjects in whom the specific psychiatric disorder was present) among these could then be determined. The total number of ECA cases divided by the total number of ECA controls matched to dystonia subjects allowed calculation of a prevalence rate for matched controls. This procedure was undertaken for subjects with dystonia and then for the subjects with PD. Because of the age difference in PD subjects and the lesser number of ECA controls studied in this age group, each subject with PD could only be matched to 123 matched ECA controls. In generalized anxiety disorder, however, ECA data allowed matching to 57 controls.

Odds ratios (ORs) were calculated for prevalence rates of psychiatric disorders in dystonia subjects versus ECA, and in PD subjects versus ECA. For each psychiatric disorder with OR $\geq$ 4.0, statistical significance was determined using the 1-tailed Fisher's exact test with Bonferroni correction. Significant ORs were then compared between dystonia and PD to determine psychiatric disorders that occurred more frequently in one movement disorder than the other. Greater frequency of occurrence was defined by the OR of a given psychiatric disorder in one movement disorder at least 1.5 times the value of the OR of the same psychiatric disorder in the other movement disorder. Because psychiatric prevalences are related to demographic features and the dystonia and PD samples were demographically different, a comparison of ORs relative to ECA controls is more appropriate than a direct comparison of prevalence rates between the two groups. However, for the four disorders for which ECA data do not exist (cyclothymia, atypical depression, atypical anxiety disorder, and atypical eating disorder), prevalence rates between the movement disorders were inspected for ratios of 1.5 or greater.

Hypothesis Testing

Psychiatric disorders significantly more common in dystonia or PD than in ECA controls and at least 1.5 times

greater in one movement disorder than in the other were determined for each movement disorder. The onset of psychiatric disorders (primary versus secondary) was then inspected within each movement disorder. A difference in the pattern of psychiatric disorders between the two movement disorders confirmed the hypothesis.

RESULTS

The results for life, primary, and secondary prevalences in dystonia and PD are summarized in Table 4 and Table 5.

Psychiatric Disorders in Dystonia

Lifetime prevalences of DSM-III disorders significantly more common in dystonia than in ECA controls included major depression, bipolar disorder, atypical bipolar disorder, social phobia, and generalized anxiety disorder (GAD). Social phobia and GAD tended to develop before dystonia onset (primary) while major depression, bipolar disorder, and atypical bipolar disorder tended to develop after dystonia onset (secondary).

Psychiatric Disorders in PD

DSM-III simple phobia was significantly more common in PD than in ECA controls and tended to be primary in most cases.

Comparison of Psychiatric Prevalence Rates Between Movement Disorders

Matching of ECA subjects for age, gender, and race adjusts ORs for these variables, allowing normalized comparisons of ORs between dystonia and PD subjects. DSM-III disorders more common in dystonia than in PD included bipolar disorder (ORs 14.2/0), social phobia (ORs 7.5/0), and GAD (ORs 4.2/0). DSM-III simple phobia (5.178/3.33 = 1.55) was more common in PD than in dystonia. Atypical depression (of more limited symptoms and more paroxysmal and recurrent than major depression), not determined in the ECA study, was sixfold more common in PD than in dystonia (21.43% of subjects with PD versus 3.57% with dystonia).

Hypothesis Testing

The hypothesis that psychiatric prevalence profiles differ between subjects with dystonia and subjects with PD was confirmed. According to the results above, dystonia appeared to be associated with primary social phobia, primary GAD, and secondary bipolar disorder while PD appeared to be associated with primary simple phobia and secondary atypical depression.

DISCUSSION

The results of this study must be considered in light of certain methodological limitations. Chief among these are the limited sample size of the movement disorder groups, somewhat different venues of recruitment, and a comparison of two fundamentally different groups. Specifically, the groups were different with respect to age, gender, and mental status scores as seen in Table 1. Differences in age and gender, however, were corrected in the comparison to ECA subjects matched for age, gender, and race, which prevented a confounding influence on the results. Mental status would be expected to differ between the groups because PD subjects were significantly older than those with dystonia and PD is associated with dementia while dystonia is not. On the other hand, Hamilton Rating Scale for Depression (HRSD) scores were statistically similar between the two groups. Thus, after comparison to demographically specific ECA rates, the groups appear to be comparable, and the only remarkable difference between them was mental status, which is to be expected for these illnesses and is itself a neuropsychiatric morbidity of PD. Furthermore, the consecutively encountered subjects were systematically evaluated using a standardized interview procedure designed to evaluate psychiatric disorders, and they were compared to appropriate controls ascertained in the identical manner.

These data indicate distinct profiles of psychiatric disorders in dystonia and PD. Lifetime prevalences of social phobia, GAD, and bipolar disorder were increased in dystonia, while simple phobia and atypical depression were increased in PD. Primary social phobia, GAD, and secondary bipolar disorder predominated in dystonia, while primary simple phobia and secondary atypical depression characterized PD. Primary psychiatric disorders may share a common genetic linkage with dystonia and PD, or, in some other fashion, serve as risk factors for the development of these movement disorders. Although linkage of dystonia and PD to these chromosomes has not yet been made, 15q24-26 has been linked to social phobia,[12] while 20q is associated with GAD and simple phobia.[13] Whether primary psychiatric disorders represent initial manifestation of movement disorders remains a subject for future research. Second-

TABLE 4: DSM-III PSYCHIATRIC DISORDERS IN SUBJECTS WITH DYSTONIA

Disorder	DYSTONIA (n = 28)	ECA (n = 3528; 1PD:126 controls)	Odds Ratio (95% confidence interval)	Significance (1-tailed Fisher's)
Major depression	7/28 (25.00%)	195 (194.4; 5.53%)	5.697 (2.39–13.57)	p = .00073
Primary	0/28 (0.00%)		*	
Secondary	7/28 (25.00%)		5.697 (2.39–13.57)	
Dysthymic disorder	3/28 (10.71%)	138 (137.60; 3.91%)	2.95 (0.88–9.88)	
Primary	0/28 (0.00%)		*	
Secondary	3/28 (10.71%)		2.95 (0.88–9.88)	
Bipolar disorder	2/28 (7.14%)	19 (18.6; 0.54%)	14.21 (3.15–64.13)	p = .000022
Primary	0/28 (0.00%)		*	
Secondary	2/28 (7.14%)		14.21 (3.15–64.13)	
Atypical bipolar disorder	2/28 (7.14%)	6 (6.36; 0.18%)	27.06 (5.65–129.62)	p = .0038
Primary	0/28 (0.00%)		*	
Secondary	2/28 (7.14%)		27.06 (5.65–129.62)	
Cyclothymia	1/28 (3.57%)	—	—	
Primary	1/28 (3.57%)		—	
Secondary	0/28 (0.00%)		—	
Atypical depression	1/28 (3.57%)	—	—	
Primary	0/28 (0%)		—	
Secondary	1/28 (3.57%)		—	
Any phobic disorder	11/28 (39.29%)	518 (517.54; 14.67%)	3.76 (1.75–8.07)	
Primary	9/28 (32.14%)		2.75 (1.24–6.12)	
Secondary	2/28 (7.14%)		0.48 (0.11–1.89)	
Agoraphobia	3/28 (10.71%)	237 (236.5; 6.72%)	1.67 (0.4995–5.56)	
Primary	1/28 (3.57%)		0.51 (0.07–3.801)	
Secondary	2/28 (7.14%)		1.07 (0.25–4.53)	
Social phobia	5/28 (17.86%)	99 (99.4; 2.81 %)	7.53 (2.81–20.22)	p = .0011
Primary	4/28 (14.29%)		5.77 (1.97–16.95)	p = .00099
Secondary	1/28 (3.57%)		1.28 (0.17–9.54)	
Simple phobia	7/28 (25.00%)	442 (442.4; 12.53%)	3.33 (0.98–5.51)	
Primary	6/28 (21.43%)		1.904 (0.77–4.72)	
Secondary	1/28 (3.57%)		0.26 (0.04–1.91)	
Panic disorder	1/28 (3.57%)	71 (70.99; 1.98%)	1.81 (0.24–13.46)	
Primary	0/28 (0.00%)		*	
Secondary	1/28 (3.57%)		1.81 (0.24–13.46)	
Generalized anxiety disorder[a]	7/28 (25.00%)	108 (107.8; 7.28%)	4.25 (1.77–10.22)	p = .0038
Primary	4/28 (14.29%)		2.12 (0.72–6.23)	
Secondary	3/28 (10.71%)		1.53 (0.45–5.14)	
Obsessive-compulsive disorder	0/28 (0.00%)	92 (91.87; 2.60%)	*	
Primary	0/28 (0.00%)		*	
Secondary	0/28 (0.00%)		*	
Atypical anxiety disorder	4/28 (14.29%)	—	—	
Primary	2/28 (7.14%)			
Secondary	2/28 (7.14%)			
Atypical eating disorder (bulimic type)	1/28 (3.57%)	—	—	
Primary	1/28 (3.57%)		—	
Secondary	0/28 (0.00%)		—	
Alcohol abuse	3/28 (10.71%)	100 (100.21; 5.68%)	4.11 (1.22–13.85)	p = .046 (N.S.)
Primary	2/28 (7.14%)		2.64 (0.62–11.26)	
Secondary	1/28 (3.57%)		1.27 (0.17–9.44)	
Alcohol dependence	2/28 (7.14%)	293 (293.03; 8.31%)	0.849 (0.20–3.60)	
Primary	0/28 (0.00%)		*	
Secondary	2/28 (7.14%)		0.849 (0.20–3.60)	

[a]For ECA group, N = 1484; 1PD:53 controls.

*Absence of cases precludes calculation of an accurate odds ratio. —no ECA data available. N.S. not significant after Bonferroni correction (alpha = .0071). Fisher's Exact Test p values are provided for ORs exceeding 4.0. "Primary" and "secondary" refer to psychiatric disorder onset relative to movement disorder onset.

Agoraphobia—1 with panic attacks, 2 without panic attacks.

TABLE 5: DSM-III PSYCHIATRIC DISORDERS IN SUBJECTS WITH PARKINSON'S DISEASE (PD)

Disorder	PD (n = 28)	ECA (n = 3444; 1PD:123 controls)	Odds Ratio (95% Confidence Interval)	Significance (1-Tailed Fisher's)
Major depression	4/28 (14.29%)	130 (130.02; 3.78%)	4.248 (1.45—12.42)	p = .021 (NS)
Primary	2/28 (7.14%)		1.961 (0.46—8.35)	
Secondary	2/28 (7.14%)		1.961 (0.46—8.35)	
Dysthymic disorder	1/28 (3.57%)	102 (102.19; 2.97%)	1.167 (0.16—8.72)	
Primary	1/28 (3.57%)		1.167 (0.16—8.72)	
Secondary	0/28 (0.00%)	*		
Bipolar disorder	0/28 (0.00%)	7 (7.43; 0.22%)	*	
Primary	0/28 (0.00%)		*	
Secondary	0/28 (0.00%)		*	
Atypical bipolar disorder	1/28 (3.57%)	5 (5.37; 0.16%)	25.47 (2.88—225.40)	p = .0474 (NS)
Primary	0/28 (0.00%)		*	
Secondary	1/28 (3.57%)		25.47 (2.88—225.40)	
Cyclothymia	0/28 (0.00%)	—	—	
Primary	0/28 (0.00%)		—	
Secondary	0/28 (0.00%)		—	
Atypical depression	6/28 (21.43%)	—	—	
Primary	0/28 (0.00%)		—	
Secondary	6/28 (21.43%)		—	
Any phobic disorder	12/28 (42.86%)	374 (374.77; 10.88%)	6.156 (2.89—13.11)	p = .0000174
Primary	8/28 (28.57%)		3.283 (1.44—7.51)	
Secondary	5/28 (7.86%)		1.784 (0.67—4.72)	
Agoraphobia	4/28 (14.29%)	153 (153.95; 4.47%)	3.585 (1.23—10.46)	
Primary	1/28 (3.57%)		0.797 (0.11—5.90)	
Secondary	3/28 (10.71%)		2.581 (0.77—8.64)	
Social phobia	0/28 (0.00%)	64 (64.8; 1.88 %)	*	
Primary	0/28 (0.00%)		*	
Secondary	0/28 (0.00%)		*	
Simple phobia	10/28 (35.71%)	305 (305.9; 8.88%)	5.718 (2.62—12.50)	p = .0000974
Primary	8/28 (28.57%)		4.117 (1.80—9.42)	p = .00248
Secondary	2/28 (7.14%)	0.792 (0.19—3.35)		
Panic disorder	1/28 (3.57%)	35 (35.28; 1.02%)	3.607 (0.48—27.29)	
Primary	0/28 (0.00%)		*	
Secondary	1/28 (3.57%)		3.607 (0.48—27.29)	
Generalized anxiety disorder[a]	0/28 (0.00%)	40 (40.7; 2.55%)	*	
Primary	0/28 (0.00%)		*	
Secondary	0/28 (0.00%)		*	
Obsessive-compulsive disorder	0/28 (0.00%)	56 (56.37; 1.64%)	*	
Primary	0/28 (0.00%)		*	
Secondary	0/28 (0.00%)		*	
Atypical anxiety disorder	6/28 (21.43%)	—	—	
Primary	4/28 (14.29%)		—	
Secondary	2/28 (7.14%)		—	
Atypical eating disorder (bulimic type)	0/28 (0.00%)	—	—	
Primary	0/28 (0.00%)		—	
Secondary	0/28 (0.00%)		—	
Alcohol abuse	1/28 (3.57%)	98 (98.14; 2.85%)	1.265 (0.17—9.40)	
Primary	1/28 (3.57%)		1.265 (0.17—9.40)	
Secondary	0/28 (0.00%)		*	
Alcohol dependence	0/28 (0.00%)	295 (295.85; 8.59%)	*	
Primary	0/28 (0.00%)		*	
Secondary	0/28 (0.00%)		*	

[a]For the ECA group, N = 1596; 1PD: 57 controls.

*Absence of cases precludes calculation of an accurate odds ratio. —no ECA data available. N.S. not significant after Bonferroni correction (alpha = .01). NST non-significant trend. Fisher's Exact Test p values are provided for ORs exceeding 4.0. "Primary" and "secondary" refer to psychiatric disorder onset relative to movement disorder onset.

Agoraphobia—4 with panic attacks, 0 without panic attacks.

ary psychiatric disorders may occur as consequences of the movement disorders, relating either to clinical disability or neurobiology.

Social Phobia, GAD, and Bipolar Disorder in Dystonia

While increases in social phobia have been previously observed in dystonia, the observation of increases in

GAD may be a new finding. In 116 consecutive torticollis patients treated with botulinum toxin, DSM-IV social phobia was ascertained using the Structured Clinical Interview for DSM-IV (SCID), and 56% of subjects were found to have social phobia, a 10-fold increase that was unrelated to dystonia severity, pain, body image, or other psychiatric conditions.[14] However, GAD was not reported to be increased in either the study of Gundel et al. or a study of DSM-III-R psychiatric disorders in 44 torticollis patients using the SCID.[15] Yet, several psychological studies have pointed to a proclivity toward psychosomatic morbidity in torticollis patients,[16,17] and GAD is a disorder characterized by psychosomatic symptoms combined with worry. Therefore, additional anxiety prevalence determinations seem warranted. A literature search did not disclose previous studies reporting an elevated prevalence of bipolar disorder in dystonia. Further study may confirm this observation or link it to other variables such as medication exposure.

Simple Phobia and Atypical Depression in PD

We are unaware of any previous study reporting an elevated prevalence of simple phobia in PD. Further examination of this is needed. On the other hand, two prior studies have specifically searched for and identified atypical depression in PD patients.[18,19] Thus, this finding is consistent with previous work.

Neurobiological Considerations

Secondary bipolar disorder observed in dystonia but not in PD may relate to GPi disinhibition[2] of thalamic mediodorsal (MDpc), midline, and intralaminar nuclei[1] that leads to frontocortical activation, as observed in primary mania[20] and contrasting with PD wherein excessive GPi inhibition of thalamofrontal structures occurs. In PD, mania has been associated with levodopa administration, which activates thalamocortical structures.[21] Secondary atypical depression in PD may be linked to the loss of dopaminergic inhibition on the lateral striatum and the locus coeruleus. Depression related to lateral striatal disinhibition is consistent with depression observed after GPe lesions[22] and GPe stimulation,[23] resulting in thalamofrontal deactivation.[1,2] The brief and paroxysmal quality of atypical depression may be associated with both primary locus coeruleus degeneration and loss of dopaminergic inhibition on this structure in PD. Noradrenergic dysfunction is critical in both the pathophysiology of depression[24] and panic disorder (a brief and paroxysmal anxiety disorder)[25] especially in PD,[26–28] where the locus coeruleus is more sensitive to yohimbine challenge than under normal conditions.[29]

Regardless of their pathophysiological basis, these findings suggest associations of dystonia with social phobia, GAD, and bipolar disorder and associations of PD with simple phobia and atypical depression. Awareness and recognition of these treatable conditions may potentially improve quality of life for patients with dystonia and PD.

In addition to the caveats mentioned above, there are the usual limitations of recall bias and selection bias inherent to studies such as this. Recall bias in our subjects is matched by the same recall bias in ECA study subjects. Disability in the two movement disorder groups was approximately the same. While it remains possible that more distressed individuals attend support groups and, therefore, a higher prevalence of psychiatric disorders may be present in dystonia patients from a support group, a review of seven movement disorder studies and 105 neurological disorder studies revealed no evidence to support such a conclusion. Alternatively, it could equally be argued that attendance at a support group reduces stress and proclivity toward psychiatric disorders, at least through educational functions involved in such groups. An educational intervention in PD that was conducted through the mail was associated with reduced "off" time, reduced PD progression, reduced disability, and improved quality of life scores relative to a similarly assessed control group.[30] It should be noted that the main function of the support group in the present study was education about dystonia. Subjects from the dystonia support group largely came from the Emory University movement disorder clinic in Atlanta, but a few came from the Medical College of Georgia's movement disorder clinic in Augusta, Georgia. All PD subjects came from the latter facility. Both clinics are tertiary referral centers. However, Augusta, Georgia is a significantly smaller city than Atlanta. The support group was held on Saturday and cannot be assumed to have particularly attracted subjects who were unemployed due to neurological or psychiatric disability. While some might consider whether support groups generally select people with psychiatric disorders, there is no evidence in the literature that this is the case for movement disorder support groups. Indeed, affliction with a psychiatric disorder may likely impair mo-

tivation to attend such a group. Thus, an evidence-based case for significant selection bias for psychiatric disorders in the two groups we studied cannot be made.

The assessments offered above rest on limited numbers of subjects drawn from tertiary referral centers. Although many of our findings are in concert with previous observations, additional studies would be beneficial in confirming these observations.

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