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# Psychiatric Comorbidity in Juvenile Myoclonic Epilepsy

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**Summary:** *Objective:* To assess the prevalence of psychiatric disturbances among patients with juvenile myoclonic epilepsy (JME).

*Methods:* Forty-three patients with JME (22 female, 21 male, mean age 32.4 ± 13, range 15–63) were assessed by means of the Structured Clinical Interviews for *DSM-IV* (SCID-I and SCID-II). Current and lifetime psychiatric diagnoses were assigned.

*Results:* Thirty-five percent of the JME patients suffered from one or more psychiatric disorders (Axis I and Axis II). Personality disorders were present in 23% and Axis I disorders in 19%. Altogether, 47% had a psychiatric disorder at any time of their life.

*Conclusions:* Psychiatric diagnoses are slightly higher than in representative community samples. The substantially increased number of personality disorders in JME patients might be attributed to frontal lobe deficits. **Key Words:** Juvenile myoclonic epilepsy—Psychiatric disorders—Comorbidity—Personality disorders.

Juvenile myoclonic epilepsy (JME) is an age-related idiopathic generalized epilepsy characterized by an average onset around puberty, normal neurological and intellectual abilities, and a strong genetic predisposition. The predominating seizure-type are massive myoclonic jerks, often with generalized tonic–clonic seizures on awakening and less often with absences as additional seizure types. Seizures are often precipitated by sleep deprivation, alcohol intake, fatigue, and stress. Interictal EEGs show generalized rapid spike-waves and polyspike-waves without close correlation between EEG spikes and jerks (Janz, 1969; Wolf, 1992; Janz and Durner, 1997; Genton et al., 2000; Thomas et al., 2002). There is general agreement that JME does not represent a severe progressive epileptic condition and is controlled with valproate (VPA) or other appropriate drugs in 76–88% (Delgado-Escueta and Enrile-Bacsal, 1984; Panayiotopoulos et al., 1994; Gelisse et al., 2001b; Trinka et al., 2004).

In patients with JME, mild but characteristic personality problems have been initially described by Janz and Christian, (1957) and have later been reported by other authors ( Lund et al., 1976; Reintoft et al., 1976; Tsuboi, 1977; Janz and Durner, 1997). These patients were seen as "attractive but emotionally labile, switching between comradeship and distrust—rather immature, childlike behavior that can lead to difficulties in social adjustment," they show a "denying attitude towards the disease," and "often have character neurotic traits" (Janz and Durner, 1997, P. 2395). To our knowledge so far only three studies empirically assessed psychiatric diagnoses in patients with JME. Gelisse et al. (2001a) found psychiatric diagnoses in 26.5% of their JME patients, while Perini et al. (1996) reported a psychiatric diagnosis in 22%. Lund et al. (1976) investigated the personality of JME patients and diagnosed 36.4% as "character neurotic" (i.e., with personality disorders). Unfortunately, these investigations suffer from considerable methodological shortcomings: diagnoses were assigned without any clinical interview or psychometric assessment (Gelisse et al., 2001a) or were not properly defined (Lund et a., 1976), and very small sample sizes were assessed (Perini et al., 1996). The present study aims to overcome the shortcomings of the three previous studies by assessing a larger group of JME patients with a high standard diagnostic procedure, the Structured Clinical Interview for *DSM-IV* (First et al., 1997a, 1997b).

## METHODS

### Study design

Cross-sectional. From a large database (n = 4,794) of the outpatient unit for epilepsy patients of the Department

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of Neurology, Medical University Innsbruck, Austria, we identified 125 patients diagnosed as having JME.

### Patients

In February 2002, these patients were invited to participate in the study. Inclusion criteria were (1) diagnosis of JME, (2) 1-year minimum follow-up duration at our epilepsy service, (3) age of 15 or above, (4) sufficient knowledge of German language, and (5) informed consent for participation in the study. Out of 125 patients who were initially contacted by mail, 49 patients (39%) agreed to the diagnostic interview at the outpatient unit. Thirty-nine patients (31%) could neither be reached by mail nor by telephone and 38 patients (30%) refused to take part in the study. Six patients who initially agreed to take part in the study did not show up at the outpatient unit. Thus, 43 patients (34%) gave informed consent and were included into the study. Between April and July 2002 the patients were interviewed at the outpatient unit for epilepsy patients by a trained interviewer (G.K.) employing the German version of the Structured Interview for *DSM-IV* (SCID-I: Wittchen et al., 1997; and SCID-II: Fydrich et al., 1997).

The diagnosis of JME was based on classical descriptions (Janz and Christian, 1957; Janz, 1969) and the definition of the classification of the International League Against Epilepsy ([ILAE] 1989). All patients underwent a thorough neurological examination including family history, electroencephalography (EEG), and cerebral computer tomography/magnetic resonance imaging (CCT/MRI). Isolated focal spikes were not an exclusion criterion for diagnosis. Seizure freedom was defined as having no seizure of any type during the past year. None of the patients had a structural brain abnormality evidenced by high resolution MRI (n = 25) or CCT (n = 15); three patients had no structural imaging test. Forty-one patients showed the typical generalized fast polyspike-and-wave complexes on interictal EEG records. Two patients had normal EEGs. Additional EEG records after sleep deprivation were not obtained in these two patients.

### Instruments and assessments

Compliance was specifically assessed by reviewing the charts; noncompliance was rated to be present in patients who did not follow the treatment regimen and/or did not show up at the scheduled visits more than twice during treatment history.

The Structured Clinical Interview for *DSM-IV* Axis I (SCID-I: First et al., 1997b; German version: Wittchen et al., 1997) and the Structured Clinical Interview for *DSM-IV* Axis II (SCID-II: First et al., 1997a; German version: Fydrich et al., 1997) represent the American Psychiatric Association's official interview instruments for the assessment of *DSM-IV* Axis I clinical disorders and Axis II personality disorders, respectively. All *DSM-IV* diagnoses are covered by the two interviews. SCID-I provides screening questions and decision trees leading to specific questions adressing the *DSM-IV* diagnostic criteria for a particular psychiatric disorder. If the number of present diagnostic criteria exceeds the *DSM-IV* threshold, the diagnosis is given. The SCID-I assesses current (1 month before interview) and lifetime psychiatric status. The SCID-II addresses each of the 94 diagnostic criteria for the 12 personality disorders provided by the *DSM-IV* by one or more questions and a short explanation of its content. After addressing the item in a structured manner, the interviewer assesses the patients' answers, positive items are added, and the diagnosis of a personality disorder is given, if the threshold provided by the *DSM-IV* manual is exceeded.

### Statistics

For group comparisons in dichotomous variables $\chi^2$ statistics and for continuous variables, two-sided $t$ tests were employed and p values $<0.05$ were regarded as significant. We used SPSS 12.0 for windows software.

## RESULTS

Demographic characteristics of the sample are shown in Table 1.

### Psychiatric comorbidity

The SCID interviews revealed in sum 27 current psychiatric diagnoses assigned to 15 of 43 patients (35%, [95% CI: 20.6–49.1]). Eight patients (19%, [95% CI: 7.0–30.2]) showed one or more diagnoses on Axis I, 10 patients (23%, [95% CI: 10.6–35.9]) had one or more personality disorders (Axis II), and three patients out of these (7%, [95% CI: 0.6–14.6]) suffered from both, Axis I and Axis II disorders (see Table 2). None of the patients who received an Axis II disorder was under 18 years of age.

In addition, five patients who did not receive a current psychiatric diagnosis suffered from a psychiatric disorder earlier in their life. "Lifetime diagnoses" were assigned to patients with previous and/or current diagnoses (Table 3). Thus, 13 patients (30%, [95% CI: 16.5–44.0]) suffered from an Axis I diagnosis at any time of their life; moreover, 11 patients (26%, [95% CI: 12.5–38.6]) displayed a personality disorder in the past and/or at present. Four patients (9%, [95% CI: 0.6–18.0] had comorbid Axis I and Axis II disorders during their lifetime. Thus, altogether 20 patients (47%, [95% CI: 31.6–61.4]) suffered from one or more psychiatric disorders at any time of their life.

### Psychiatric comorbidity and patients characteristics

There were no statistically significant differences between patients with or without psychiatric diagnosis with regard to age at investigation, duration of epilepsy, seizure freedom, seizure types, and compliance.

**TABLE 1.** *Patient characteristics* (n = 43)

| | |
|---|---|
| Age (years) | mean: 32.4 ± 13.0<br>range: 15–63 |
| Sex | m: 21 (49%)<br>w: 22 (51%) |
| Education | |
| 8 yr of school or less without school leaving certificate | 1 (2%) |
| 8 yr of school without occupational training | 15 (35%) |
| 8 yr of school with occupational training | 16 (37%) |
| 12 yr of school (≈ high school) | 10 (23%) |
| University | 1 (2%) |
| Marital status | |
| Single | 20 (46%) |
| Unmarried with partner | 12 (28%) |
| Married or living together | 11 (26%) |
| Divorced | 3 (7%) |
| Widowed | 1 (2%) |
| Seizure-type | |
| Myoclonia | 1 (2%) |
| Myoclonia + GTCS | 30 (70%) |
| Myoclonia + absences | 1 (2%) |
| Myoclonia + absences + GTCS | 11 (25%) |
| Age at seizure onset (yrs) | mean: 15.4 ± 6.2<br>Median: 14<br>Range: 7–40 |
| Duration of epilepsy (yrs) | mean: 12.3 ± 12.1<br>Median: 9<br>Range: 1–52 |
| Seizure-free | |
| Not seizure-free | 20 (46%) |
| <3 yrs | 11 (26%) |
| ≥3 yrs | 12 (28%) |
| Medication | |
| None | 8 (19%) |
| VPA | 22 (51%) |
| TPM | 2 (5%) |
| TGB | 1 (2%) |
| PRM | 1 (2%) |
| LTG | 1 (2%) |
| VPA + TPM | 4 (9%) |
| VPA + PRM | 1 (2%) |
| VPA + LEV | 1 (2%) |
| PRM + PIR | 1 (2%) |
| Compliance[a] | |
| Poor | 12 (28%) |
| Good | 21 (72%) |

GTCS, generalized tonic–clonic seizure; LEV, levetiracetam; LTG, lamotrigine; PIR, piracetam; PRM, primidone; TGB, tiagabine; TPM, topiramate; VPA, valproate.

[a]Compliance was assesed by global rating of the treating physician after at least 1-year follow-up.

**TABLE 2.** *Current* DSM-IV *diagnoses, multiple diagnoses in one patient*

| Axes | n (%) |
|---|---|
| Axis I | |
| Adjustment disorders | |
| With anxiety (309.24) | 3 (7) |
| With mixed anxiety and depressed mood (309.28) | 1 (2) |
| With disturbance of conduct (309.3) | 1 (2) |
| Unspecified (309.9) | 1 (2) |
| Anxiety disorders | |
| Panic disorder with agoraphobia (300.21) | 2 (5) |
| Specific phobia (300.29) | 1 (2) |
| Substance-related disorders | |
| Alcohol dependence (303.90) | 1 (2) |
| Polysubstance abuse (305.80) | 1 (2) |
| Axis II | |
| Avoidant personality disorder (301.82) | 4 (9) |
| Obsessive–compulsive personality disorder (301.4) | 3 (7) |
| Paranoid personality disorder (301.00) | 3 (7) |
| Boderline personality disorder (301.83) | 2 (5) |
| Narcissistic personality disorder (301.81) | 1 (2) |
| Antisocial personality disorder (301.7) | 1 (2) |
| Personality disorder not otherwise specified (301.90) | 2 (5) |

## DISCUSSION

In our study population we found current psychiatric comorbidity in 35% of the JME patients: 19% showing Axis I disorders and 23% displaying personality disorders. Lifetime psychiatric diagnoses were found in 47% of our patients. These numbers are only slightly above those found in representative community-based samples in German-speaking countries. Jacobi et al. (2004) found 20% of Axis I disorders (19% in our sample). Schepank (1987) reported a prevalence of 27% of Axis I and Axis II diagnoses in the general population (35% in our JME patients). With regard to personality disorders, we found almost twice as much affected patients in our study group than the 13.4% reported for the general population (Torgersen et al., 2001).

It has often been stated that epilepsy in general is associated with a high risk for psychiatric comorbidity (Hermann et al., 2000; Devinsky, 2003). The numbers for comorbid psychiatric disorders vary from 19% to 80% (Fiordelli et al., 1993; Perini et al., 1996), patients with temporal lobe epilepsy (TLE) showing the highest psychiatric comorbidity: Shukla et al. (1979) found psychiatric disorders in 79%, Perini et al. (1996) in 80% of their TLE patients. In samples including varied epilepsy syndromes the psychiatric comorbidity was reported to be somewhat lower; while Cockerell et al. (1996) and Manchanda et al. (1996) reported 52% and 47%, respectively, Matsuura et al. (2003) found 42%, Stefansson et al. (1998) 35%, and Fiordelli et al. (1993) only 19% of their patients showing psychiatric comorbidity. Quite consistently an increased number of personality disorders has been reported in epilepsy patients. In patients with varied epilepsy syndromes, Arnold and Privitera (1996) as well as Manchanda et al. (1996) and Victoroff (1994) found personality disorders in 18% of their patients, Lopez-Rodriguez et al. (1999) in 21%. Shukla et al., 1979 reported personality disorders in 23% of their patients with TLE. One major problem in these studies is the variability in the psychiatric diagnostic procedures: diagnoses have been assigned in retrospect from clincal records (Stefansson et al., 1998), with clinical interviews (Shukla et al., 1979; Manchanda et al., 1996; Matsuura et al., 2003), and by means of manualized structured interviews (Fiordelli et al., 1993; Victoroff, 1994; Arnold and Privitera, 1996; Perini et al.,

**TABLE 3.** *Lifetime* DSM-IV *diagnoses, multiple diagnoses in one patient*

| Axes | n (%) |
|---|---|
| Axis I | |
| Adjustment disorders | |
| With anxiety (309.24) | 3 (7) |
| With mixed anxiety and depressed mood (309.28) | 1 (2) |
| With disturbance of conduct (309.3) | 3 (7) |
| Unspecified (309.9) | 1 (2) |
| Anxiety disorders | |
| Panic disorder with agoraphobia (300.21) | 3 (7) |
| Specific phobia (300.29) | 1 (2) |
| Substance-related disorders | |
| Alcohol dependence (303.90) | 2 (5) |
| Alcohol abuse (305.00) | 1 (2) |
| Polysubstance abuse (305.80) | 1 (2) |
| Eating disorders | |
| Anorexia nervosa (307.1) | 1 (2) |
| Eating disorder not otherwise specified (307.50) | 4 (9) |
| Mood disorders | |
| Major depressive disorder (296.2) | 2 (5) |
| Substance-induced mood disorder with depressed features (292.84) | 1 (2) |
| Impulse-control disorders not elsewhere classified | |
| Intermittent explosive disorder (312.34) | 1 (2) |
| Axis II | |
| Avoidant personality disorder (301.82) | 4 (9) |
| Obsessive–compulsive personality disorder (301.4) | 3 (7) |
| Paranoid personality disorder (301.00) | 3 (7) |
| Borderline personality disorder (301.83) | 4 (9) |
| Narcissistic personality disorder (301.81) | 1 (2) |
| Antisocial personality disorder (301.7) | 1 (2) |
| Personality disorder not otherwise specified (301.90) | 2 (5) |

1996; Lopez-Rodriguez et al., 1999). It has been argued that a selection bias might have led to the high comorbidity in some of these studies, since these investigations usually took place in specialized centers with an increased number of severly ill and refractory patients and, thus, do not represent the general population of epilepsy patients (Fiordelli et al., 1993; Baker et al., 1996). However, since our center is the only epilepsy service in the county of Tyrol, Austria, and about 80% of all incident patients with epilepsy in this region are followed in our outpatient department, this is not the case in our patient sample. Therefore, our study population can be considered as representative for the population of adults with JME in that area (Trinka et al., 2001a). However, the high percentage of patients refusing to participate in the study, in addition to those who could not have been traced, may have led to another type of selection bias in our study. Since the reason for not taking part in the interview remains obscure, we cannot rule out this bias.

In 1976 Lund et al. (1976) assessed the personality of 33 JME patients retrospectively from their clinical records and by means of a clinical interview at a follow-up investigation. Twelve patients (36.4%) were diagnosed as "character neurotic," that is, suffering from a personality disorder. Perini et al. ( 1996) assessed psychiatric comorbidity by means of a structured clinical interview ("The Schedule for Affective Disorders and Schizophrenia," SADS) (Endicott and Spitzer, 1978) in 18 patients with JME and found a psychiatric diagnosis in 22% of their patients (16.6% minor depression and 5.6% generalized anxiety disorder). Remarkably, none of the JME patients received the diagnosis of a personality disorder. Recently, Gelisse et al. (2001a) investigated a large sample of 170 JME patients from Nice and Marseille (France); psychiatric diagnoses according to *DSM-IV* (American Psychiatric Association [APA], 1994) were assigned in retrospect from a thorough analysis of the clinical records, but the patients were not seen face to face. The authors found psychiatric disorders in 26.5% of the patients, with 1.8% depressive disorders, 3.5% anxiety disorders, 2.9% psychotic disorders, 4.1% other Axis I disorders, and 14.1% personality disorders. Summarizing the previous three studies on psychiatric comorbidity in JME only one found an increased prevalence of personality disorders (Lund et al., 1976), while the other two studies reported numbers within the realm of the general population (Perini et al., 1996; Gelisse et al., 2001a). Our results are in line with Gelisse et al. and Perini et al. regarding Axis I diagnosis (Perini et al., 1996; Gelisse et al., 2001a), while they support the findings of Lund et al. of an increased comorbidity of personality disorders in patients with JME (Lund et al., 1976).

Most probably, the heterogeneity of the results of these studies can be attributed to methodological issues. Gelisse et al. (2001a) assigned diagnoses without any clinical interview or psychometric assessment, which reduces the validity of the diagnoses to a great deal. Perini et al. (1996) employed a suitable diagnostic procedure, but investigated a very small sample of 18 patients only. Finally, Lund et al. (1976) did not report their definition of the "character neuroses" they diagnosed. They probably referred to the classical psychoanalytic model of character neurosis, which is only partly compatible to the modern *DSM-IV* (American Psychiatric Association [APA], 1994) classification of personality disorders.

The results of our investigation and—taking into account the methodological limitations of this study—those of Lund et al. (1976) support the initial observation by Dieter Janz (Janz and Christian, 1957; Janz, 1969) that patients with JME "often have character neurotic traits," that is, personality disorders according to *DSM-IV*.

Devinsky et al. (1997) suggested that the personality dysfunction might be a result of frontal lobe deficits in JME patients after they found impairment on tests of concept formation, abstract reasoning and mental flexibility, cognitive speed, and planning and organization. Autopsy studies of Janz and Meencke have shown cortical and subcortical dystopic neurons and other microscopic structural abnormalities ("microdysgenesis") in the frontal cortices of patients with JME (Janz and Neimanis, 1966; Meencke and Janz, 1984; Meencke, 1985). These findings have later been supported by voxel-based magnetic resonance imaging studies (Woermann et al., 1999),

magnetic resonance spectroscopy investigations (Savic et al., 2000) as well as positron emission tomography studies (Koepp et al., 1997). Finally, generalized polyspike and wave discharges show a delicate predominace over the frontal lobes of both hemispheres in patients with JME (Janz and Christian, 1957). Functional (Soloff et al., 2000; van Elst et al., 2001; Soloff et al., 2003) and structural abnormalities (Lyoo et al., 1998; Raine et al., 2000; Rusch et al., 2003) of the frontal lobe have also been described in patients with personality disorders. It could be hypothesized that in our JME patients with personality disorders a subtle frontal lobe abnormality serves as a common base for both epilepsy and psychiatric disorder. One could argue that personality disorders can be attributed to stigmatization and psychosocial distress due to repeated seizures in childhood or early adolescence. However, in our study JME patients with personality disorders had a mean age of 15.4 years at seizure onset, which is far beyond the period of time in which psychosocial influences are usually assumed to exert their major influence on the etiology of personality disorders (see e.g., Kernberg et al. (2000)).

In a previous survey we found an influence of compliance and lifestyle on seizure outcome in a larger series of patients with JME, which could have been the result of an underlying personality disorder (Trinka et al., 2001b). However, in the present study we were not able to find any evidence to support this hypothesis since there was no association of personality disorder or psychiatric comorbidity and seizure outcome. The smaller sample size of our study, only 34% of the initially screened 125 patients, were systematically interviewed, may have contributed to a selection bias in the present series. However, the key finding of the present study remains a high prevalence of personality disorders in patients with JME.

The intriguing question, whether the high prevalence of personality disorders is specific for JME or is also found in other focal or generalized epilepsies cannot be answered by the present study. We did not investigate a control group of other types of epilepsies and are therefore unable to resolve this question. Future studies should also include other epilepsy syndromes as a control group.

## REFERENCES


American Psychiatric Association (APA). (1994) *Diagnostic and statistical manual of mental disorders*. 4th ed. American Psychiatric Press, Washington, DC.

Arnold LM, Privitera MD. (1996) Psychopathology and trauma in epileptic and psychogenic seizure patients. *Psychosomatics* 37:438–443.

Baker GA, Jacoby A, Chadwick DW. (1996) The associations of psychopathology in epilepsy: a community study. *Epilepsy Research* 25:29–39.

Cockerell OC, Moriarty J, Trimble M, Sander JW, Shorvon SD. (1996) Acute psychological disorders in patients with epilepsy: a nationwide study. *Epilepsy Research* 25:119–131.

Delgado-Escueta AV, Enrile-Bacsal F. (1984) Juvenile myoclonic epilepsy of Janz. *Neurology* 34:285–294.

Devinsky O. (2003) Psychiatric comorbidity in patients with epilepsy: implications for diagnosis and treatment. *Epilepsy Behavior* 4(suppl 4):S2–S10.

Devinsky O, Gershengorn J, Brown E, Perrine K, Vazquez B, Luciano D. (1997) Frontal functions in juvenile myoclonic epilepsy. *Neuropsychiatry, Neuropsychology, and Behavioral Neurology* 10:243–246.

Endicott J, Spitzer RL. (1978) A diagnostic interview: the schedule for affective disorders and schizophrenia. *Archives of General Psychiatry* 35:837–844.

Fiordelli E, Beghi E, Bogliun G, Crespi V. (1993) Epilepsy and psychiatric disturbance. A cross-sectional study. *British Journal of Psychiatry* 163:446–450.

First M, Gibbon M, Spitzer RL, Williams J. (1997a) *User´s guide for the structured clinical interview for DSM-IV axis II personality disorders*. American Psychiatric Press, Washington, DC.

First M, Spitzer RL, Gibbon M, Williams J. (1997b) *Structured clinical interview for DSM-IV axis I disorders (SCID-I), clinician version (administration booklet)*. American Psychiatric Press, Washington, DC.

Fydrich T, Renneberg B, Schmitz B, Wittchen HU. (1997) *Strukturiertes Klinisches Interview für DSM-IV Achse II: Persönlichkeitsstörungen Interviewheft*. Hogrefe, Göttingen.

Gelisse P, Genton P, Samuelian JC, Thomas P, Bureau M. (2001a) Psychiatric disorders in juvenile myoclonic epilepsy. *Revista De Neurologia (Paris)* 157:297–302.

Gelisse P, Genton P, Thomas P, Rey M, Samuelian JC, Dravet C. (2001b) Clinical factors of drug resistance in juvenile myoclonic epilepsy. *Journal of Neurology, Neurosurgery and Psychiatry* 70:240–243.

Genton P, Gelisse P, Thomas P. (2000) Juvenile myoclonic epilepsy today: current definitions and limits. In Schmitz B, Sander T (Eds) *Juvenile myoclonic epilepsy: the Janz syndrome*. Wrightson Biomedical Publishing, Petersfield, pp. 11–32.

Hermann BP, Seidenberg M, Bell B. (2000) Psychiatric comorbidity in chronic epilepsy: identification, consequences, and treatment of major depression. *Epilepsia* 41(suppl 2): S31–S41.

International League Against Epilepsy (ILEA). (1989) Proposal for revised classification of epilepsies and epileptic syndromes. Commission on Classification and Terminology of the International League Against Epilepsy. *Epilepsia* 30:389–399.

Jacobi F, Wittchen HU, Holting C, Hofler M, Pfister H, Muller N, Lieb R. (2004) Prevalence, co-morbidity and correlates of mental disorders in the general population: results from the German Health Interview and Examination Survey (GHS). *Psychological Medicine* 34:597–611.

Janz D. (1969) *Die Epilepsien. Spezielle Pathologie und Therapie*. Thieme, Stuttgart.

Janz D, Christian W. (1957) Impulsiv-Petit mal. *Deutsche Zeitschrift für Nervenheilkunde* 176:346–386.

Janz D, Durner M. (1997) Juvenile myoclonic epilepsy. In Engel J, Pedley TA (Eds) *Epilepsy: a comprehensive text-book*. Lippincott-Raven, Philadelphia, pp. 2389–2399.

Janz D, Neimanis G. (1966) A contribution to the clinical aspects and morphology of diffuse temporal lobe blastoma, the so-called rhinencephalic spongioblastoma. *Deutsche Zeitschrift für Nervenheilkunde* 188:93–118.

Kernberg P, Weiner A, Bardenstein K. (2000) *Personality disorders in children and adolescents*. Basic Books, New York.

Koepp MJ, Richardson MP, Brooks DJ, Cunningham VJ, Duncan JS. (1997) Central benzodiazepine/gamma-aminobutyric acid A receptors in idiopathic generalized epilepsy: an [11C]flumazenil positron emission tomography study. *Epilepsia* 38:1089–1097.

Lopez-Rodriguez F, Altshuler L, Kay J, Delarhim S, Mendez M, Engel J Jr.. (1999) Personality disorders among medically refractory epileptic patients. *Journal of Neuropsychiatry and Clinical Neurosciences* 11:464–469.

Lund M, Reintoft H, Simonsen N. (1976) A controlled sociological and psychological study on patients with juvenile myoclonus epilepsy. *Nervenarzt* 47:708–712.

Lyoo IK, Han MH, Cho DY. (1998) A brain MRI study in subjects with borderline personality disorder. *Journal of Affective Disorders* 50:235–243.

Manchanda R, Schaefer B, McLachlan RS, Blume WT, Wiebe S, Girvin JP, Parrent A, Derry PA. (1996) Psychiatric disorders in candidates for surgery for epilepsy. *Journal of Neurology, Neurosurgery and Psychiatry* 61:82–89.

Matsuura M, Oana Y, Kato M, Kawana A, Kan R, Kubota H, Nakano T, Hara T, Horikawa N. (2003) A multicenter study on the prevalence of psychiatric disorders among new referrals for epilepsy in Japan. *Epilepsia* 44:107–114.

Meencke HJ. (1985) Neuron density in the molecular layer of the frontal cortex in primary generalized epilepsy. *Epilepsia* 26:450–454.

Meencke HJ, Janz D. (1984) Neuropathological findings in primary generalized epilepsy: a study of eight cases. *Epilepsia* 25:8–21.

Panayiotopoulos CP, Obeid T, Tahan AR. (1994) Juvenile myoclonic epilepsy: a 5-year prospective study. *Epilepsia* 35:285–296.

Perini GI, Tosin C, Carraro C, Bernasconi G, Canevini MP, Canger R, Pellegrini A, Testa G. (1996) Interictal mood and personality disorders in temporal lobe epilepsy and juvenile myoclonic epilepsy. *Journal of Neurology, Neurosurgery and Psychiatry* 61:601–605.

Raine A, Lencz T, Bihrle S, LaCasse L, Colletti P. (2000) Reduced prefrontal gray matter volume and reduced autonomic activity in antisocial personality disorder. *Archives of General Psychiatry* 57:119–127.

Reintoft NM, Simonsen N, Lund M. (1976) A controlled sociological study of juvenile myoclonic epilepsy. In Janz D (Ed) *Epileptology*. Thieme, Stuttgart.

Rusch N, van Elst LT, Ludaescher P, Wilke M, Huppertz HJ, Thiel T, Schmahl C, Bohus M, Lieb K, Hesslinger B, Hennig J, Ebert D. (2003) A voxel-based morphometric MRI study in female patients with borderline personality disorder. *Neuroimage* 20: 385–392.

Savic I, Lekvall A, Greitz D, Helms G. (2000) MR spectroscopy shows reduced frontal lobe concentrations of N-acetyl aspartate in patients with juvenile myoclonic epilepsy. *Epilepsia* 41:290–296.

Schepank H. (1987) *Epidemiology of psychogenic disorders. The Mannheim Study—results of a field survey in the Federal Republic of Germany*. Springer, Heidelberg.

Shukla GD, Srivastava ON, Katiyar BC, Joshi V, Mohan PK. (1979) Psychiatric manifestations in temporal lobe epilepsy: a controlled study. *British Journal of Psychiatry* 135:411–417.

Soloff PH, Meltzer CC, Becker C, Greer PJ, Kelly TM, Constantine D. (2003) Impulsivity and prefrontal hypometabolism in borderline personality disorder. *Psychiatry Research* 123:153–163.

Soloff PH, Meltzer CC, Greer PJ, Constantine D, Kelly TM. (2000) A fenfluramine-activated FDG-PET study of borderline personality disorder. *Biological Psychiatry* 47:540–547.

Stefansson SB, Olafsson E, Hauser WA. (1998) Psychiatric morbidity in epilepsy: a case controlled study of adults receiving disability benefits. *Journal of Neurology, Neurosurgery and Psychiatry* 64:238–241.

Thomas P, Genton P, Gelisse P, Wolf P. (2002) Juvenile myoclonic epilepsy. In Roger J, Bureau M, Dravet C, Genton P, Tassinari CA, Wolf P (Eds) *Epileptic syndromes in infancy, childhood and adolescence*. 3rd ed. John Libbey & Co, London, pp. 335–355.

Torgersen S, Kringlen E, Cramer V. (2001) The prevalence of personality disorders in a community sample. *Archives of General Psychiatry* 58:590–596.

Trinka E, Baumgartner S, Unterberger I, Unterrainer J, Luef G, Haberlandt E, Bauer G. (2004) Long-term prognosis for childhood and juvenile absence epilepsy. *Journal of Neurology* 251:1235–1241.

Trinka E, Martin F, Luef G, Unterberger I, Bauer G. (2001a) Chronic epilepsy with complex partial seizures is not always medically intractable–a long-term observational study. *Acta Neurologica Scandinavica* 103:219–225.

Trinka E, Unterrainer J, Unterberger I, Luef G, Bauer G. (2001b) Juvenile myoclonic epilepsy: medical treatment response and prognostic factors for complete seizure remission (Abstract). *Epilepsia* 42(suppl 7):158.

Tsuboi T. (1977) *Primary generalized epilepsy with sporadic myoclonias of myoclonic petit mal type*. Thieme, Stuttgart.

vanElst LT, Thiel T, Hesslinger B, Lieb K, Bohus M, Hennig J, Ebert D. (2001) Subtle prefrontal neuropathology in a pilot magnetic resonance spectroscopy study in patients with borderline personality disorder. *Journal of Neuropsychiatry and Clinical Neurosciences* 13:511–514.

Victoroff J. (1994) DSM-III-R psychiatric diagnoses in candidates for epilepsy surgery: lifetime prevalence. *Neuropsychiatry, Neuropsychology, and Behavioral Neurology* 7:87–97.

Wittchen HU, Zaudig M, Fydrich T. (1997) *Strukturiertes Klinisches Interview für DSM-IV Achse I und II: Handanweisung*. Hogrefe, Göttingen.

Woermann FG, Free SL, Koepp MJ, Sisodiya SM, Duncan JS. (1999) Abnormal cerebral structure in juvenile myoclonic epilepsy demonstrated with voxel-based analysis of MRI. *Brain* 122:2101–2108.

Wolf P. (1992) Juvenile myoclonic epilepsy. In Roger J, Bureau M, Dravet C, Dreifuss FE, Perret A, Wolf P. (Eds) *Epileptic syndromes in infancy, childhood and adolescence*. 2nd ed. John Libbey, London, pp. 313–327.