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Original article

Brittle diabetes: psychopathological aspects

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Abstract. *Background.* The term "brittle" is used to described an uncommon subgroup of type I diabetics whose lives are disrupted by severe glycaemic instability with repeated and prolonged hospitalization. Psychosocial problems are the major perceived underlying causes of brittle behaviour. Aim of this study is a systematic psychopathological assessement of brittleness using specific parameters of general psychopathology and personality traits following the multiaxial format (axis I and II) of the current DSM-IV-TR diagnostic criteria for mental disorders. *Methods.* Patients comprised 21 brittle type I diabetics and a case-control group of 21 stable diabetics, matched for age, gender, years of education, and diabetes duration. General psychopathology and the DSM-IV-TR personality traits/disorders were assessed using the Syptom Checklist-90-R (SCL-90-R) and the Millon Clinical Multiaxial Inventory-III (MCMI-III). Results. The comparison for SCL-90-R parameters exclusively revealed higher scores in "Phobic Anxiety" subscale in brittle diabetics. No differences in all the other SCL-90-R primary symptom dimensions and in the three SCL-90-R global distress indices were observed between the two diabetic groups, as well as in the all MCMI-III clinical syndrome categories corresponding to DSM-IV-TR specific psychiatric disorders. However, brittle patients presented lower scores in MCMI-III compulsive personality traits and higher scores in paranoid, schizoid, schizotypal, antisocial, borderline, narcissistic, avoidant, dependent, depressive, and passive-aggressive personality traits. *Conclusions.* In this study, brittle diabetics show no differencies in terms of global severity of psychopathological distress and axis I specific DSM-IV-TR diagnoses in comparison with non-brittle subjects (except for phobic anxiety). Differently, brittle diabetics are characterized from less functional and maladaptive personality features and suffer more frequently and intensively from specific pathological personality traits of all DSM-IV-TR clusters. (www.actabiomedica.it)

Key words: Brittle diabetes, glycaemic instability, personality disorder, psychopathology.

Background

The term "brittle" is used to describe an uncommon subgroup of type 1 diabetic patients whose lives are disrupted by severe glycaemic instability (which may be hypoglycaemic, hyperglycaemic or both) with repeated (and often prolonged) hospitalization (1-4). Such patients generally defy conventional attempts at recontrol with multiple injection therapy or continuous subcutaneous insulin infusion (5,6), are enormously costly in terms of health-care resources (7,8), and place a heavy burden on their family and health-care teams (7,9). Type 1 diabetics with brittle behaviour most frequently have severe recurrent and unpredictable hypoglycaemic and/or ketoacidosis episodes which cannot only be explained by errors of physicians

(e.g. in preparation of incorrect therapeutic plans) or patients (e.g. in glycaemic self-control or in their management of the insulin treatment) (5,10,11). Their quality of life is also dramatically compromised by a precocious onset of chronic complications (such as nephropathy, retinopathy and neuropathy) (10).
In some epidemiological studies conducted on large diabetic populations, it has been noted a brittle diabetes prevalence of 1.2 per 1000 diabetic patients and 3 per 1000 insulin-treated diabetic subjects (4,8). A precise quantification of brittle patients is not easy because clear diagnostic criteria are still not well defined (11,12). In the diagnostic definition of brittle diabetes, all medical conditions interfering with glycaemia (such as adrenal or pituitary deficits, dysthyroidisms, gastroparesis, delayed gastric emptying as a result of autonomic neuropathy, malabsorption, renal failure, and other organic disorders characterized by metabolic stress) have to be excluded (4,13-15). In presence of a difficult glycaemic control, the diagnostic pathway should also include the plasmatic dosage of anti-insulin antibodies (16). However, despite these clinical considerations, there is an uncommon variant of insulin-dependent diabetes mellitus (the "brittle" subgroup) in which the severe glycaemic instability remains inexplicable (17,18). Brittle diabetes has shown significant correlations with younger age (4,8,10,19), female predominance (5,20,21), shorter diabetes duration (10), higher insulin dose ("overinsulinization") (5,7), overweight, and insulin resistance (19). More frequent "psychosocial" problems have been also broadly demonstrated (2,8,12). For Tattersall [1997] (18) and Brosig et al. [2001] (22), a certain amount of emotional changeability and anger seems to interfere significantly with the glycaemic control. Moreover, several authors have emphasized that acute psychological stress may play a role in the glycaemic instability of patients with type 1 diabetes through an increased secretion of insulin-counteracting hormones (e.g. ACTH and cortisol) (23-25).

Brittleness and psychosocial problems

Researches for hormonal and metabolic causes for the brittle syndrome have been generally unrewarding (10,11). It is usually believed that psychosocial problems (often manifested as the deliberate induction of poor glycaemic control) are the major perceived causes of brittle behaviour (9,17,19) and may lead to a self-perpetuating condition (4). The vast majority (95%) of diabetologists retrospectively consider various psychosocial disturbances as the single most important likely underlying casual factors (8). Tattersall [1985] (26) has noted that treatment may often simply be a question of sharing the patient's frustrations and anxieties. In a 12-year follow-up study, Tattersall et al. [1991] (2) have suggested that the tendency of brittle diabetes to become more stable with time was unlikely to be due to home monitoring of blood glucose concentration, better education, multiple insulin injections or the use of insulin pumps nor pens, but the main stabilising factor seemed to be removal of the stress (e.g. by leaving home or getting divorced).
However, no systematic psychopathological assessment was conducted on brittle type 1 diabetics. In all researches on brittle diabetes published in literature, data on psychosocial problems has been gathered through the administration of non-specific questionnaires to consultant diabetologists. Consultants were generically and subjectively asked to speculate as far as possible on the reason for diabetic brittleness (15) and highlight any psychosocial factors considered of possible relevance to severe glycaemic instability (10). Psychosocial problems have more often been described as anorexia or non-specific anxious-depressive syndromes, family dysfunction, marital disharmony, unsatisfactory relations with parents or spouse, bad-tempered separation or divorce, "life chaos", adolescent crises, unhappiness at school, and poor outside resources with no family support (15, 28, 29).
Other brittle diabetics seem to show clinical features belonging to unspecified personality disorders. Brittle patients with a history of manipulative behaviour, low frustration tolerance, more difficulty in verbalizing emotions, obsessional glycaemic self-control, poor impulse control, and extreme difficulties in adapting and accepting their diabetes or in taking appropriate decisions related to their diabetic management have been described (15, 23, 30). It has also been suggested that perhaps for social and cultural reasons, brittle diabet-

ics (particularly young female) may resolve psychosocial conflicts by disrupting glycaemic control to withdraw into a "disease role" (31). Certainly, a deliberate interference with therapy (to induce diabetic instability) and a deliberate ("factitious") induction of both ketoacidosis and hypoglycaemia have been well described (28,32-35).

Aim of the study is a systematic psychopathological assessment of brittle type 1 diabetics. In particular, we want to compare brittle and non-brittle type 1 diabetics on specific parameters of general psychopathology and personality traits/disorders following the multiaxial format of the current DSM-IV-TR diagnostic criteria for mental disorders (axis I and II) (36).

Methods

Sampling

The patients comprised 21 brittle type 1 diabetics recruited at the Diabetes Centre of the Guastalla Civil Hospital (Reggio Emilia Health-Care District). They were all diabetic subjects of at least 5 years duration and their age was comprised between 18 and 40 years. All patients had been intensively investigated and in order to avoid any attempt to selection, they had to fulfil the contemporary diagnostic criterion of "severe life-disrupting glycaemic instability of any kind" (based on the widely accepted description by Tattersall [1977]) (1), as well as later accepted characteristics including "recurrent and/or prolonged hospitalization" (interfering with work and leisure) (25) and "glycaemic instability despite intensive subcutaneous insulin therapy (including subcutaneous pump treatment)" (5). However, in all cases infective, endocrine and therapeutic causes of glycaemic instability had been carefully excluded (10).

To compare with "non-brittle" type 1 patients, a case-control group of "stable" diabetics was recruited. The 21 non-brittle subjects were from the same Diabetes Centre and consisted of type 1 patients who did not meet accepted definitions of "brittle diabetes". They were also matched for age, gender, years of education, and diabetes duration. One case-control was collected for each brittle subject by consecutive visual inspection of our database. Moreover, both in brittle and non-brittle groups, substance abusers, illiterate or markedly cognitively deteriorated diabetics, and patients suffering from mental retardation or organic mental disorders were excluded.

Full permission for the study was obtained from all diabetic patients, which specifically also gave their written informed consent to the psychopathological assessment. Socio-demographic and clinical information collected included age and gender, education, marital and employment status, diabetes duration, presence and type of chronic diabetic complications, most recent glycosylated haemoglobin (HbA_1c) and c-peptide levels, body mass index (BMI), history of current or past mental disorder, and familiarity for diabetes and psychiatric illness. To obtain a thorough evaluation, data were collected on the same day for each patient. The study protocol had been approved by an ethics Committee.

Psychopathological Assessment

General psychopathology and the DSM-IV-TR personality traits/disorders were assessed using the Symptom Checklist-90-R (SCL-90-R) (37) and the Millon Clinical Multiaxial Inventory-III (MCMI-III) (38). Both the instruments used for the psychopathological assessment have been validated for the Italian population (38, 39).

The *SCL-90-R* (37) is a relatively brief self-report psychometric questionnaire designed to evaluate a broad range of psychological problems and symptoms of psychopathology. It can be useful in a cross-sectional evaluation as an objective method for an overview of patient's symptoms and their intensity at a specific point in time (39). It consists of 90 items (each evaluated on a 5-point rating scale [from "0 = not at all" to "4 = extremely"]) and can be completed in just 12-15 minutes. This questionnaire yields ten scores along primary symptom dimensions (Somatisation, Obsessive-Compulsive features, Interpersonal Sensitivity [corresponding to feelings of personal inadequateness and inferiority in the relationships with the others], Depression, Anxiety, Hostility and anger,

Phobic Anxiety and agoraphobia, Paranoid Ideation, Psychoticism [corresponding only to psychotic behavioural aspects], and Sleep Disturbances) and three scores of global distress (Global Severity Index [GSI], which is the average score of the 90 items of the questionnaire and has been designed to measure overall psychological distress; Positive Symptom Distress Index [PSDI], which is the average score of the items scored above zero and has been designed to measure the intensity of symptoms]; and Positive Symptom Total [PST], which corresponds to the number of items scored above zero) (37). The GSI is suggested to be the best single indicator of the current level of the psychopathology (39). The SCL-90-R is normed on 13-year and older subjects and measures the psychiatric symptomatology suffered in the last week (37). More than one thousand of researches have been conducted demonstrating the reliability, validity, and utility of the instrument (40,41). Several recent studies using the SCL-90-R as a measure of mental status concerned mental health issues in a non-psychiatric setting (39).

The *MCMI-III* (38) is a psychological assessment tool intended to provide information on psychopathology, including specific personality disorders outlined in the DSM-IV-TR. It is intended for adults (18 years and over) and was developed and standardized specifically on clinical populations (42). However, there is a strong evidence base that it still retains validity on non-clinical populations and members of the general population (43). The MCMI-III is a self-report questionnaire composed of 175 "true-false" questions that reportedly takes 25-30 minutes to complete and contains a total of 24 clinical scales (14 personality disorder and 10 clinical syndrome scales) organized by severity (38). It differs from others personality tests in that it is based on an evolutionary theory of the personality and is organized according to a multiaxial format connecting with the DSM-IV-TR (42). In other words, MCMI-III scales are classified into specific personality and clinical syndrome categories to reflect the DSM-IV-TR distinction between Axis I and Axis II. The 14 MCMI-III personality scales (corresponding with Axis II diagnoses of the DSM-IV-TR) describe more pervasive trait conditions and are broken further into 11 basic clinical personality patterns (Schizoid, Avoidant, Depressive, Dependent, Histrionic, Narcissistic, Antisocial, Sadistic [aggressive], Compulsive, Passive-Aggressive [negativistic], Self-Defeating [masochistic]) and 3 severe personality pathology scales (Schizotypal, Borderline, and Paranoid) (38). The 10 MCMI-III clinical syndrome categories correspond with Axis I diagnoses of the DSM-IV-TR and specifically describe the following major psychiatric conditions: Anxiety, Somatoform disorder, Bipolar disorder (Manic episode), Dysthymia, Alcohol Dependence, Drug Dependence, Post-Traumatic Stress disorder (PTSD), Thought disorder, Major Depression, and Delusional disorder (42). In our statistical analysis, we have considered both raw and "base-rated" (BR) scores of the MCMI-III personality and clinical syndrome scales. Raw scores were standardized by the authors as BR scores rather than T scores (42). T scores were considered inappropriate by Millon [2008] (38) because they assumed an underlying normal population distribution, but the MCMI-III normative sample consisted of psychiatric patients. According to Millon et al. [2009] (42), BR scores better reflected the diagnoses of the individuals who made up the normative sample, allowed comparison between personality or clinical syndrome indices based on the real prevalence rates, and consented to select the optimum cut-off for a differential diagnosis. BR scores of 75 were assigned to the minimum raw scored obtained by patients who met full criteria for a particular disorder or condition (39). Therefore, for the personality scales, BR scores of 75 or above signify the presence of clinically significant personality traits (38). For the clinical syndrome scales, BR scores of 75 or above indicate the presence of a specific and clinically significant psychiatric syndrome (42). Several researches have been conducted demonstrating the psychometric properties of the MCMI-III, particularly the reliability and validity of the instrument (42,43).

Data Analysis

In the comparison between brittle and control ("non-brittle") groups on socio-demographic and clinical parameters, proportional data were compared by chi-

squared ($\chi 2$) test with Yates' correction or Fisher's exact test (where appropriated). Numerical data were compared using the Mann-Whitney's unpaired U test or the Student's unpaired t-test (where appropriated) according to the type (parametric or non-parametric) of the variable in analysis.

Results

The *socio-demographic* and *clinical data* are shown in table 1. In comparison with non-brittle diabetics, brittle subjects showed higher HbA_1c level (8.58±1.17 VS 7.46±0.86; t=3.56; p<0.001) and BMI scores (26.60±4.38 VS 22.97±3.04; t=2.87; p<0.01), and higher percentages of unemployed individuals (7 [33.3%] VS 1 [4.8%]; χ^2=3.95; p<0.05) and chronic diabetic complications (13 [61.9%] VS 3 [14.3%]; χ^2=7.60; p<0.01), particularly retinopathy (7 [33.3%] VS 2 [9.5%]; χ^2=3.86; p<0.05) and nephropathy (6 [28.6%] VS 1 [4.8%]; χ^2=3.89; p<0.05). No differences were detected in terms of gender, age, years of education, marital status, diabetes duration, c-peptide level, presence of past or current mental disorder, and familiarity for diabetes and psychiatric illness.

The comparison for *SCL-90-R* psychopathological parameters between brittle and non-brittle diabetics (table 2) exclusively revealed higher scores in "Phobic Anxiety" subscale in the former group (1.14±0.35 VS 0.12±0.18; z=2.81; p<0.01). No differences in the other SCL-90-R primary symptom dimensions and in the three SCL-90-R global distress indices were observed.

The comparison for *MCMI-III* parameters between brittle and non-brittle groups showed no differences in terms of presence (BR scores [cut-off] of 75 or above) of DSM-IV-TR clinically significant personality traits or DSM-IV-TR specific and clinically significant psychiatric syndromes (table 3). However, in comparison with non-brittle individuals, brittle subjects showed lower raw scores in MCMI-III compulsive personality traits (16.23±5.38 VS 17.95±4.31; z=-3.21; p<0.001) and higher raw scores in paranoid (6.76±4.94 VS 2.65±2.32; z=3.70; p<0.001), schizoid

Table 1. Comparison of socio-demographic and clinical data between brittle and non-brittle diabetics.

Socio-demographic and clinical variables	Brittle diabetics (n=21)	Non-brittle diabetics(n=21)	$\chi 2$/t/P
Gender (♀)	14 (66.7%)	14 (66.7%)	0.00
Age (years)	36.00±6.24	35.90±7.78	0.04
Education (years)	12.84±3.69	13.45±4.98	-0.43
Marital status (married)	12 (57.1%)	15 (71.4%)	0.99
Employment status (unemployed)	7 (33.3%)	1 (4.8%)	3.95*
Diabetes duration (years)	16.81±12.22	14.30±11.03	1.41
HbA1c (%)	8.58±1.17	7.46±0.86	3.56***
c-peptide (μU/mL)	0.12±0.34	0.36±0.52	-1.75
BMI (Kg/m^2)	26.60±4.38	22.97±3.04	2.87**
Presence of chronic diabetic complications	13 (61.9%)	3 (14.3%)	7.60**
Retinopathy	7 (33.3%)	2 (9.5%)	3.86*
Nephropathy	6 (28.6%)	1 (4.8%)	3.89*
Peripheral neuropathy	0 (0.0%)	0 (0.0%)	1.00
Autonomic neuropathy	0 (0.0%)	0 (0.0%)	1.00
Ischemic heart disease	0 (0.0%)	0 (0.0%)	1.00
Peripheral vascular disease	0 (0.0%)	0 (0.0%)	1.00
Cerebrovascular disease	0 (0.0%)	0 (0.0%)	1.00
Familiarity for diabetes	8 (38.1%)	4 (19.0%)	2.32
Presence of past or current mental disorder	4 (19.0%)	3 (14.3%)	0.61
Familiarity for mental disorder	5 (23.8%)	3 (14.3%)	1.14

**p<0.05; **p<0.01; ***p<0.001. Frequencies and percentages, mean ± standard deviation, chi-squared ($\chi 2$) test, Student's t test, and Fisher's exact P test values are reported.*

Table 2. Comparison of SCL-90-R psychopathological parameters between brittle and non-brittle diabetics.

SCL-90-R scales	Brittle diabetics (n=21)	Non-brittle diabetics (n=21)	z
Somatisation	0.81±0.63	0.44±0.26	0.41
Obsessive-compulsive	0.66±0.49	0.37±0.36	0.32
Interpersonal sensitivity	0.52±0.45	0.29±0.33	0.28
Depression	0.66±0.38	0.38±0.34	0.27
Anxiety	0.57±0.47	0.36±0.32	0.19
Hostility	0.47±0.41	0.19±0.18	0.58
Phobic anxiety	1.14±0.35	0.12±0.18	2.81*
Paranoid ideation	0.55±0.52	0.32±0.44	0.33
Psychoticism	0.28±0.22	0.15±0.11	0.27
Sleep disturbances	0.75±0.71	0.30±0.24	0.69
Global Severity Index (GSI)	0.51±0.42	0.32±0.22	0.37
Positive Symptom Distress Index (PSDI)	1.47±0.38	1.34±0.20	1.82
Positive Symptom Total (PST)	31.50±15.46	27.30±14.43	1.80

**p<0.01. Mean ± standard deviation and Mann-Whitney's z test values are reported.*

Table 3. Comparison of MCMI-III scale cut-off scores between brittle and non-brittle diabetics (BR scores of 75 or above).

MCMI-III scales	Brittle diabetics (n=21)	Non-brittle diabetics (n=21)	$\chi 2$/P
Paranoid	0 (0.0%)	0 (0.0%)	1.00
Schizoid	0 (0.0%)	0 (0.0%)	1.00
Schizotypal	0 (0.0%)	0 (0.0%)	1.00
Antisocial	0 (0.0%)	0 (0.0%)	1.00
Borderline	1 (4.8%)	0 (0.0%)	0.99
Histrionic	2 (9.5%)	4 (19.0%)	0.94
Narcissistic	5 (23.8%)	3 (14.3%)	1.15
Avoidant	0 (0.0%)	1 (4.8%)	1.00
Dependent	4 (19.0%)	2 (9.5%)	0.94
Compulsive	1 (4.8%)	2 (9.5%)	0.95
Depressive	1 (4.8%)	1 (4.8%)	1.00
Passive-aggressive	3 (14.3%)	2 (9.5%)	0.98
Self-defeated	1 (4.8%)	1 (4.8%)	1.00
Sadistic	0 (0.0%)	0 (0.0%)	1.00
Presence of at least 1 clinically significant personality traits	12 (57.1%)	8 (38.1%)	2.32
Anxiety	7 (33.3%)	5 (23.8%)	1.05
Somatoform	1 (4.8%)	0 (0.0%)	0.99
Bipolar-Manic	0 (0.0%)	0 (0.0%)	1.00
Dysthymia	0 (0.0%)	1 (4.8%)	0.99
Alcohol dependence	1 (4.8%)	0 (0.0%)	0.99
Drug dependence	1 (4.8%)	0 (0.0%)	0.99
Post-traumatic stress disorder (PTSD)	0 (0.0%)	0 (0.0%)	1.00
Thought disorder	0 (0.0%)	0 (0.0%)	1.00
Major depression	1 (4.8%)	1 (4.8%)	1.00
Delusional disorder	1 (4.8%)	0 (0.0%)	0.99

Frequencies and percentages (%), chi-squared ($\chi 2$) test and Fisher's exact P test values are reported.

(6.62±2.40 VS 5.00±2.83; z=3.58; p<0.001), schizotypal (3.52±3.43 VS 1.80±2.17; z=3.63; p<0.001), antisocial (5.76±3.94 VS 3.90±2.31; z=3.59; p<0.001), borderline (6.00±5.38 VS 3.25±3.54; z=3.79; p<0.001), narcissistic (15.62±5.27 VS 13.80±4.12; z=3.31; p<0.001), avoidant (5.43±4.21 VS 3.75±4.64; z=3.52; p<0.001), dependent (8.29±5.92 VS 6.30±4.93; z=3.49; p<0.001), depressive (5.71±5.82 VS 4.00±5.13; z=3.55; p<0.001), and passive-aggressive (negativistic) (10.48±6.43 VS 7.45±3.68; z=3.67; p<0.001) personality traits (table 4). No differences were detected in terms of histrionic, sadistic, and self-defeated (masochistic) personality traits, as well as in MCMI-III raw scores corresponding to DSM-IV-TR specific psychiatric syndromes.

Discussion

In the last decades, the crux of the diagnostic matter was whether the epithet "brittle" had to be used where the cause of the diabetic instability was unknown (44). According to Tattersall [1985] (26), insistence on excluding known causes of glycaemic instability assumed diagnostic omniscience and was unhelpful if it led to the advice that ordinarily no specific cause for true brittleness could be found. He argued that diagnostically it was more useful to reserve the term "brittle" for that small but conspicuous, exasperating, and expensive minority of patients whose lives were constantly disrupted by hypoglycaemia or hyperglycaemia whatever the cause. In our study, brittle diabetics had to fulfil the Tattersall's diagnostic criterion of "severe life-disrupting glycaemic instability of any kind" (1), as

Table 4. Comparison of MCMI-III scale raw scores between brittle and non-brittle diabetics.

MCMI-III scales	Brittle diabetics (n=21)	Non-brittle diabetics (n=21)	z
Paranoid	6.76±4.94	2.65±2.32	3.70*
Schizoid	6.62±2.40	5.00±2.83	3.58*
Schizotypal	3.52±3.43	1.80±2.17	3.63*
Antisocial	5.76±3.94	3.90±2.31	3.59*
Borderline	6.00±5.38	3.25±3.54	3.79*
Histrionic	16.25±4.39	16.55±5.47	-0.63
Narcissistic	15.62±5.27	13.80±4.12	3.31*
Avoidant	5.43±4.21	3.75±4.64	3.52*
Dependent	8.29±5.92	6.30±4.93	3.49*
Compulsive	16.23±5.38	17.95±4.31	-3.21*
Depressive	5.71±5.82	4.00±5.13	3.55*
Passive-aggressive (negativistic)	10.48±6.43	7.45±3.68	3.67*
Self-defeated (masochistic)	3.62±3.84	3.20±3.18	0.94
Sadistic	7.62±4.48	6.95±3.27	0.96
Anxiety	4.09±3.53	3.05±3.66	0.97
Somatoform	4.00±4.16	1.80±2.97	1.38
Bipolar-Manic	5.62±2.75	4.50±2.31	0.98
Dysthymia	3.81±3.87	2.80±3.76	0.96
Alcohol dependence	3.00±2.39	1.75±1.41	1.91
Drug dependence	3.38±2.92	2.10±1.48	1.83
Post-traumatic stress disorder (PTSD)	3.86±4.34	2.45±4.17	1.85
Thought disorder	3.43±3.20	3.10±4.05	0.37
Major depression	4.09±4.89	1.60±3.74	1.92
Delusional disorder	2.57±3.09	1.25±1.02	1.79

**p<0.001. Mean ± standard deviation and Mann-Whitney's z test values are reported.*

well as later accepted characteristics including "recurrent and/or prolonged hospitalization" (interfering with work and leisure) (25) and "glycaemic instability despite intensive subcutaneous insulin therapy (including subcutaneous pump treatment)" (5). Nowadays, this operative definition is the most universally accepted definition of "brittleness", but it is based on a clinical monitoring of the diabetes course and it could too much suffer from the arbitrary subjectivity (point of view) of the clinician. According to us, it could be useful to draw up more objective "brittleness" diagnostic criteria based on blood glucose specific parameters and their course over time.

Socio-demographic and clinical data

In accord with several authors (1,4,10,25), in this study brittle diabetics have shown an higher percentages of unemployed subjects in comparison with non-brittle patients (table 1). This poorer functioning could be due to both biological (primary severe glycaemic instability with repeated and prolonged hospitalization) and psychological component. In this connection, Tattersall [1985] (26) suggested that brittle diabetics were often emotionally disturbed. Moreover, brittle patients with a history of low frustration tolerance, difficulty in verbalizing emotions, and poor impulse control were described (2,10,15,23,30). This emotional disorder of brittleness could favour a poorer functioning through a bad management of the stress and relations with colleagues.

Today, opinion is sharply divided whether the emotional disturbance of brittle diabetics is the cause or effect of their glycaemic instability. Three theories are current. Firstly, the liability might be organic and a consequence of inappropriate metabolic responses, some known and others to be discovered (5,45). Secondly, emotional stress might be the primary cause with diabetic control being disrupted through psychological mechanisms (46). By this way, Dutour et al. [1996] (23) have emphasized that acute psychological stress may play a role in the glycaemic instability of patients with type 1 diabetes through an increased secretion of insulin-counteracting hormones (in particular ACTH and cortisol). Thirdly, emotional stress might be the primary cause with diabetic control being disrupted through inappropriate behaviour (such as factitious problems), usually to extricate the patient from an otherwise insoluble dilemma in his personal life (47). Supporters of the third theory can adduce anecdotal case history and small series showing that diabetic patients may sabotage their treatment for secondary gain. For example, Rosen and Lidz [1949] (48) were able to establish that in all 12 patients with recurrent ketoacidosis the condition had been deliberately induced. Similar cases were documented by Stearns [1959] (49), who emphasized that such potentially self-destructive behaviour might represent a need for self-punishment, attention seeking, or urge to punish others. However, each theory may be correct in specific cases.

Some years ago, Gill et al. [1985] (7) have put forward a unified theory which proposed that brittle diabetics begun by interfering with their treatment for emotional reason (they were normally sensitive to insulin and the eventual explanation of brittleness was some act or omission by the patient, which had been deliberately concealed from previous investigators), but that escalation of insulin dose, continued cheating, and repeated admission completed a vicious circle leading to chronic hyperglycaemia from which the patient could not escape. Certainly, extreme insulin resistance can occur and be due to organic factors (26), but it is much rarer than factitious insulin resistance. Diabetologists commonly miss factitious disease, partly because they had been led to believe in a condition called "idiopathic brittle diabetes", partly from a deep seated reluctance to believe that patient would deceive them wilfully, and finally because they have a stereotyped picture of the sort of patient they would expect to "cheat", which often excludes those considered to be "normal and nice" (26).

In accord with several authors (4,15,24,25), our brittle diabetics have shown higher HbA_1c level and percentages of chronic diabetic complications (particularly retinopathy and nephropathy) in comparison with non-brittle subjects (table 1). These findings confirm that brittle patients have a severe glycaemic instability (with diabetic ketoacidosis and/or hypoglycaemia) and a poor prognosis with lower quality of life scores because of an earlier onset of chronic diabetes-related complications (4,10).

In this study, no differences were detected between diabetic groups in terms of c-peptide level and familiarity for diabetes (table 1). On the contrary, Bertuzzi [2007] (11) has suggested that the lack of residual insulin secretion, documented by very low c-peptide levels, represented a constant characteristic in brittle patients, certainly in a position to explain some clinical features of brittleness (such as the glycaemic instability and the facility to ketosis).
In our research, brittle diabetics have also shown higher BMI scores in comparison with non-brittle individuals (table 1). In accord with Pickup [1985] (19), these findings suggest that brittleness seems to show significant correlations with overweight. The overweight of brittle diabetes could be due to both biological (e.g. insulin resistance, altered feeding secondary to hyperglycaemia) and psychological (e.g. altered feeding secondary to poor impulse control or high emotionality with anxiety or anger) factors.
Finally, in this study no differences were detected between diabetic groups in terms of presence of past or current mental disorder and familiarity for psychiatric illness (table 1). In accord with several authors (10,22,27), these findings confirm that only few brittle patients result to have been seen by psychiatrists and/or psychologists, and obtain a clear psychiatric diagnosis.

Psychopathological data

The intergroup comparison for *SCL-90-R* psychopathological parameters has exclusively shown higher scores in "Phobic Anxiety" subscale in brittle diabetics (table 2). No significant differences in the other SCL-90-R primary symptom dimensions and in the three SCL-90-R global distress indices have been observed between brittle and non-brittle subjects.
In brittle patients, higher levels of phobic anxiety (defined as a persistent fear response to a specific person, place, object, or situation which is characterized as being irrational and disproportionate to the stimulus, and leads to avoidance or escape behaviour) could be due to a real increase of state-phobic anxiety (e.g. because of fear of hypoglicaemia) and/or trait-phobic anxiety (such as a bad management of social hyperemotionality linked to pathological personality traits). The items of this psychopathological dimension are all manifestations of agoraphobia.
Differently with data published in the literature, our findings reveal no differences in term of global severity of psychopathological distress and intensity of many specific dimensions of psychiatric symptoms (such as somatisation, obsessive-compulsive features, depression, anxiety, hostility, psychoticism, and paranoid ideation) between the two diabetic groups. In other words, brittle patients have shown to suffer not more intensively and frequently from major (Axis I) psychiatric disorders compared to non-brittle subjects (except from phobic anxiety). On the contrary, Steel et al. [1987] (27), Gill [1992] (10), and Brosig et al. [2001] (22) had stated that although only few brittle individuals resulted to have been seen by psychiatrists or psychologists, they often proved to be affected by anorexia nervosa and anxious-depressive syndromes.
Although the comparison for *MCMI-III* personality parameters between brittle and non-brittle groups has shown no differences in terms of presence of DSM-IV-TR clinically significant personality traits (DSM-IV-TR personality disorder) (table 3), brittle diabetics have shown lower raw scores in MCMI-III compulsive personality traits and higher raw scores in DSM-IV-TR cluster A (paranoid, schizoid, and schizotypal), cluster B (antisocial, borderline, and narcissistic), cluster C (avoidant and dependent), depressive, and passive-aggressive (negativistic) personality traits in comparison with non-brittle subjects (table 4). These findings confirm several clinical observations depending on which brittle patients seemed to show psychopathological features belonging to maladaptive personality disorders (10). By this way, brittle individuals with a history of manipulative behaviour, low frustration tolerance, more difficulty in verbalizing emotions, obsessional glycaemic self-control, poor impulse control, and extreme difficulties in adapting and accepting their diabetes or in taking appropriate decisions related to their diabetic management have been described (2,15,23,30). It had also been suggested that particularly brittle young females resolved psychosocial conflicts by disrupting glycaemic control to withdraw into a "disease role" (7). Certainly, a de-

liberate interference with therapy (to induce diabetic instability) and a deliberate ("factitious") induction of both ketoacidosis and hypoglycaemia have been well described (2,28,32-35). In accord with Gill and Lucas [1999] (15), high levels of compulsive personality traits seems to promote a better glycaemic self-control and more healthy dietetic habits.

In this study, no differences have been detected between the two diabetic groups in terms of MCMI-III clinical syndrome categories corresponding to DSM-IV-TR specific psychiatric disorders (both row and BR cut-off scores) (table 3,4). These findings still further confirm our SCL-90-R results. In comparison with non-brittle individuals, brittle subjects have shown no differences in term of global severity of psychopathological distress and Axis I specific psychiatric diagnosis. Differently, they seem to be characterized from more dysfunctional personality features and suffer more frequently from specific pathological personality traits of all DSM-IV-TR clusters (such as cognitive-behavioural oddities, poor impulse self-control, anxiety, and inclination to frustration).

The discovery that diabetic brittleness is associated to specific maladaptive personality traits makes psychiatric/psychological assessment extremely necessary, although the diabetologist must remain the central figure since splitting the physical and emotional care tends to create confusion and offers opportunities for manipulation and playing one doctor off against another (26). More comprehensive psychiatric/psychological evaluation will frequently show that the patient has been driven to such potentially self-destructive behaviour by intolerable family or personal pressure. Moreover, psychiatric/psychological treatment (such as psychotherapy) can be very useful to obtain a good glycaemic control and often may simply be a question of sharing the patient's frustrations and anxiety (26). Everyone must be made aware that brittleness treatment is likely to be prolonged and that the responsibility for a successful outcome does not lie with the diabetologist alone. On the contrary, the patient, psychotherapist, family, and also friends must be prepared to cooperate (10).

Conclusions

The term "brittle" is used to describe an uncommon subgroup of type 1 diabetic patients whose lives are disrupted by severe glycaemic instability with repeated and often prolonged hospitalization (1-4). Researches for hormonal and metabolic causes for the brittleness have been generally unrewarding (10,11). Psychosocial problems (often manifested as the deliberate induction of poor glycaemic control) are the major perceived causes of brittle behaviour (7,9,17,19) and may lead to a self-perpetuating condition (4). According to Tattersall et al. [1991] (2) and Gill et al. [1996] (8), the vast majority (95%) of diabetologists retrospectively consider various psychosocial disturbances as the single most important likely underlying casual factors. Till today, no systematic psychopathological assessment was conducted on brittle type 1 diabetics. In all studies on brittle diabetes published in the literature, data on psychosocial problems has been gathered through the administration of non-specific questionnaires to patient's consultant diabetologist, who was generically and subjectively asked to speculate as far as possible on the reason for diabetic brittleness) (15). This study is the first systematic evaluation of brittleness using specific psychopathological parameters.

The results of our research reveal that brittle diabetics show no differences in term of global severity of psychopathological distress and Axis I specific psychiatric diagnosis in comparison with non-brittle subjects (except for SCL-90-R phobic anxiety). Differently, brittle patients seem to be characterized from less functional personality features and suffer more frequently from specific pathological personality traits of all DSM-IV-TR clusters.

At least, we should mention some *limitations* of this study. At first, our brittle subjects had to fulfil the standard definition of "brittleness" based on the Tattersall's diagnostic criterion of "severe life-disrupting glycaemic instability of any kind" (1), as well as later accepted characteristics including "recurrent and/or prolonged hospitalization" (interfering with work and leisure) (25) and "glycaemic instability despite intensive subcutaneous insulin therapy (including subcutaneous pump treatment)" (5). According to us, this op-

erative definition is fundamentally based on a clinical observation of the diabetes course and it could suffer from the arbitrary subjectivity of the clinician. We believe that it could be useful to draw up more objective "brittleness" criteria based on blood glucose parameters and their course over time. A second limitation of this study is that our brittle sample was numerically small (n = 21). Thus, further studies in a larger diabetic population are needed. Finally, in this study we only used self-report psychopathological scales, which could suffer from a too much subjective (patient) point of view. Thus, further researches with non-self-report scales are needed.

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