European Review for Medical and Pharmacological Sciences 2006; 10: 69-74

Psychological stress measure in type 2 diabetes

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Abstract. – **Psychological stress has been implicated as a cause of several psychosomatic disorders, but also as a factor that can unfavourably influence many diseases including diabetes mellitus. Measure of psychological stress in diabetes was performed by Psychological Stress Measure (PSM), a validated instrument, designed using 49 items drawn from descriptors generated by focus groups on stress. Clinical and psychological framework was assessed in a cohort of 100 type 2 diabetic patients (30 m, 70 f), aged 66.99 ± 13.68 years considering disease grade, complications and level of instruction. Three other questionnaires were administered concurrently to all patients: Sickness Impact Profile (SIP), Functional Living Index (FLI) and SF-36 QOL. ANOVA statistical testing and Spearman correlation matrix were used also vs socio-cultural and clinical profile.**

Gender, obesity, diet compliance, smoking do not affect PSM response. Hypertensive patients and those with family history of diabetes show lower PSM scores, according to a sort of moderator effect on stress of concurrent and/or previous experience with chronic disease. Neuromuscular ailments are more prevalent in women; men vs women experience severe limitations of their working capacities and relational possibilities, with severe discomfort. In the whole, higher scores of PSM (greater stress $p < 0.01$) and lower scores of FLI (fair well-being perception; $p < 0.01$) are reciprocally related inside any school instruction level.

Despite the great reciprocal association of the PSM vs FLI and SIP, no significant correlation is found between PSM vs SF-36 QOL. Socio-cultural elements interfere, and particularly instruction level quantified as school grades achieved, with the manner of living their disease. Interventions on psychological distress of type 2 diabetes mellitus patients is warranted, specially in the groups with lower levels of instruction which may need an attentive strategy for achieving a satisfactory coping with this disease.

Key Words:

Diabetes, Quality of life, QOL, Stress, PSM, SIP, FLI, Gender difference.

Introduction

Psychological stress has been implicated as a cause of several psychosomatic disorders[1] even considering that stress is a component of daily life. First introduced by Selye, the term stress is now widely used to describe a state of physical and psychological tension with special features in the modern life. In the context of primary care, a definition integrated into a conceptual model with a validated measurement instrument would help to ensure that this term is used appropriately. A general theoretic framework, based on a bio psychosocial model of stress, includes environmental parameters and individual processes of perception and coping with stressors. Developed outside the field of psychopathology, this model is ideal for assessing psychological stress in primary care and population health research. The state of stress depends on the interaction between an individual's environment and his or her representation of that environment[2].

In diabetes mellitus, as in most clinical conditions far from psychopathology, psychological stress is concerned with the state of "normal" tension, preoccupation and agitation reported by many people, ill or not.

Relationship between diabetes and stress is complex. Stress may have a role in the onset of diabetes, in metabolic control and in quality of life. Even though, nowadays, definite conclusions about the role of stress in the onset of diabetes are difficult to reach, there are important evidences regarding the relationships between stress, metabolic control and quality of life in diabetic patients[3].

In particular, stress can have an influence on glycaemic control in different ways, especially in some "stress reactive" individuals[4]. Physiological effects on the neuro-endocrine

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system induced by stress can affect directly blood glucose levels[5]. Stress can induce indirectly alterations in health care practices. This last aspect is very important because diabetes is a largely self-managed disease and stress, depression and psychological status may have a significant impact on self-management and health outcomes[6-9]. On the basis of stress effects, there are studies that demonstrate as stress management can improve long-term glycaemic control[10,11]. The potential influence of this aspect is important because of the association between chronically high blood glucose and diabetes complications.

Diabetes itself is an important cause of stress in these patients. In fact, this disease involves life style changes, diet, frequent medical examinations, drugs, serious complications. All these components affect the quality of life of diabetics.

Quality of life (QOL) is a concept increasingly appreciated as an outcome variable in bio- behavioural research. It is viewed as a multidimensional, dynamic concept related to but distinct from, well-being, health status, life satisfaction and hope[12]. The expression health related quality of life (HRQOL), refers to quality of life associated with health conditions. HRQOL is the value assigned to duration of life as modified by the impairments, functional states, perceptions and social opportunities influenced by disease, injury, treatment or policy[13].

Quality of life is diversely compromised in diabetes mellitus as in other chronic diseases[14-17] and has an important impact on patients' daily life[18-23]. QOL in diabetes is like a formalized way of talking about the personal side of diabetes, the felt burden of living with the illness[24]. Different clinical features of diabetic patients and type of complications can be critical components of the global individual perception of quality of life. However, diabetes can compromise not only physical function (e.g. decreased energy, limitations and physical suffering) but also psychological status (e.g. depression and stress[25], as above) and social relationships[26,27]. All these components affect the QOL and the illness perception of diabetics. Certainly, stress, like other patients' psychological features and conditions, is a critical component of QOL; but also personal socio-cultural components and gender, too, can interfere concurrently[28,29] and be closely associated with self-rated health[30].

In this study, a validated and appropriate instrument, Psychological Stress Measure[31] (PSM), is used to measure the psychological stress of considered diabetic population. Moreover, relationships between stress and health-related quality of life (HRQOL) are studied. For this purpose, some components that can have an influence on QOL, associated chronic illness and socio-cultural elements, are considered and related to stress.

Materials and Methods

The study was performed in the outpatient clinic (Day-Hospital) at Vittorio Emanuele Hospital, University, Catania, Italy. A sample of 100 type 2 diabetic patients (30 men, 70 women), aged 66.99 ± 13.68 years, participated in the study. Researchers met patients in the outpatient clinic while they were waiting for their treatment. Patients were told about the study and asked if they would be willing to answer questions. Four questionnaires were administered: Sickness Impact Profile (SIP)[31], Functional Living Index (FLI)[32] and SF-36[33,34], Psychological Stress Measure (PSM)[35].

The *Sickness Impact Profile* (SIP) is a generic measure used to evaluate the impact of disease on both physical and emotional functioning**.** It is one of the questionnaires most widely used for the generic evaluation of functional health status. There are several recent studies about SIP with the aim of enhancing the clinical interpretation and the practicality of the questionnaire[36,37]. The SIP has originally 136 yes/no questions regarding symptoms, feelings, functions, and problems that are asked about in reference to "today and because of health." It has been rated as acceptable to respondents and, because of the simple yes/no format, it is easy to understand. There are 12 scales (e.g., domains of eating, mobility, etc.) two dimension scores (physical and psychosocial) and a total SIP score was generated by a dedicated software[17] already described and targeted to type 2 diabetic patients. Scores are calculated by addi-

tion of predetermined item weights, dividing by the total possible score, and result in a range from 0 to 100 where larger scores representing greater impairment.

The *36-item Short-Form Health Survey* (SF-36) is used to measure sickness-related dysfunction. It has been revised and developed for clinical research over several years and has excellent validity and reliability. Subscales include physical functioning, role functioning (physical), social functioning, psychological well-being, and vitality. Physical functioning measures patients' abilities to perform simple everyday tasks such as climbing stairs, dressing and lifting objects. Role functioning (physical) measures the extent to which patients' physical health interferes with their ability to work or perform daily tasks, whereas social functioning looks at how much the illness interferes with their ability to socialise. The scale scores were transformed to a 0 to 100 scale, with a higher score indicating a better QOL, using a dedicated software specifically developed and already elsewhere described[16].

The *Functional Living Index* (FLI) derives from a scale devised for cancer patients and adapted to type 2 diabetic patients. It is constituted with 22 items regarding four dimensions: physical functioning, social functioning, psychological and emotional well-being, and somatic functioning. The choice of answer is made on a scale (like Likert) and result in a range from 1 to 7. A total FLI score was generated by a dedicated software[17] already described and targeted to type 2 diabetic patients.

The *Psychological Stress Measure* (PSM) is designed using 49 items drawn from descriptors generated by focus groups on stress. Patient checks the answer that best indicates the degree to which each statement has applied to him/her recently The choice of answer is made on a scale (like Likert) and result in a range from 1 (null) to 4 (much). A final comprehensive score was generated by a dedicated software developed jointly in our University[38].

Socio-demographic and school achievement of patients were obtained as well.

Statistics: data were processed by ANOVA and Spearman correlation analyses. For practical purpose the global score will be considered in the result section and discussion, even if each subscale were analysed separately with the aim of giving a more synthetic description and comment. Differences between patients are analysed using Students' t tests, analyses of (co)variance (ANOVAs) and Spearman correlation matrix. P values less than 0.05 are considered statistically significant.

Results

Medical, dietary intake and demographic characteristics of 100 type 2 diabetes mellitus participants are presented in Table I. Most of the patients have less than a high school education level (52%). There are significant differences between the groups with regard to specific symptoms and social functioning (Table II). Neuro-muscular ailments are more prevalent in women. Men experience severe limitations of their working capacities and relational possibilities, with severe discomfort. The subgroup of hypertensive patients and patients with family history of diabetes show lower PSM scores. Gender, obesity, diet compliance, smoking do not affect PSM response. Repeated measures ANOVAs are performed on the social and emotional variables and the PSM score (global level of stress), to identify significant differences as regards the level of education (see Table III). In the whole, higher scores of PSM (greater stress $p < 0.01$) and lower scores of FLI (fair well-being perception $r = 0.30$; $p < 0.01$) are related inside any school instruction level. In fact, variables (inability on leisure time organization, discouragement, sexual impairment,

Table I. Descriptive demographic variables.

	Number
Gender (F/M)	70/30
Diet (Yes/No)	36/64
Obesity (Yes/No)	31/69
High blood pressure (Yes/No)	76/24
Other pathologies (Yes/No)	84/16
Level of education	
Any school	25
Less than high school	52
High school	23

Table II. Comparison of patients by symptomatic and social characteristics.

	Women		Men		t	P <
	Mean	S.D.	Mean	S.D		
Headache	0.93	0.73	0.40	0.56	3.54	0.01
Respiration ailments	0.81	0.82	0.47	0.68	2.03	0.05
Well-being perception	3.79	1.32	4.37	1.19	-2.08	0.05
Satisfaction about work	2.56	1.33	3.27	1.11	-2.57	0.01
Personal troubles about illness	2.94	1.23	3.50	3.50	-2.04	0.05
Sexual impairment	1.73	1.33	2.73	1.62	-3.24	0.01

and fear about the future) show an elevated degree of relationship with any school instruction level. We compute correlations between PSM, FLI, SF-36 and SIP score; better FLI is related with global QOL higher score –SF-36– (r = 0.85, $p < 0.01$) and worse SIP (r = –0.42, $p < 0.01$). Differently from the great reciprocal association of the psychological stress measure vs FLI and SIP, no significant correlation is found between PSM vs QOL assessed by SF-36 and subset of SF-36 scales. Last, the perception of QOL is not correlated with years of diabetes.

Discussion

Chronic illnesses cause a considerable upset on patient's life. In our cohort of diabetic patients neuro-muscular ailments (headache and difficulties of respiration) are more prevalent in women. Men experience severe limitations of their working capability and relational opportunity, with severe discomfort and instability. Quality of life is modified during chronic illness, but in our population the global score assessed is not directly related with a greater severity of diabetes and its complications. Moreover, the subgroup of hypertensive patients and those with family history of diabetes show lower PSM scores. It seems that no additive effects of these factors is present regard to the level of measured stress, and perhaps a moderator effect is operating, conceivably related to a higher awareness of disease features. Socio-cultural elements interfere and particularly instruction level, quantified as school grades achieved, is involved with the manner of living diabetic disease. Moreover, personal socio-cultural components and gender can be closely associated with self-rated health[30]. At this regard, in this study, greater uneasiness of leisure time organization, discouragement, sexual disturbance and limitation and fear about the future show a strong association with higher school instruction level. In particular, "high school" group perceives a worse quality of life than "less than high school" group. Instead, stress, as measured by MSP, is linked with low level of education

Table III. Positive correlations detected for small bowel CT findings.

Variables	Any school		Less than high school		High school		ANOVAs	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	F	P
Uneasiness of leisure time organization	2.04	0.25	2.65	0.17	3.04	0.26	4.00	0.02
Discouragement	3.48	0.26	4.00	0.18	4.43	0.27	3.38	0.04
Sexual impairment	1.72	0.28	1.79	0.20	2.91	0.30	5.80	0.001
Fear about the future	3.44	0.22	3.88	0.15	4.57	0.23	6.16	0.001
PSM score	91.04	2.77	86.79	1.92	79.22	2.89	4.50	0.01

$P < 0.05$ were considered statistically significant.

more than with the high one. Relationship between stress and level of education is important. In fact, on the basis of this simple cultural stratification, physicians can identify patients that need, more than the other ones, interventions for preventing and coping with stress. Removing or minimizing the source of stress, changing the response to it and modifying the long-term effects can have a positive effect on quality of life and glycaemic control[3]. Certainly, stress, like other psychological features and conditions, is a critical component of quality of life but also can have an influence on glycaemic control in different ways, directly and indirectly[5-9]. Stress can induce alterations in health care practices. This aspect is momentous because diabetes mellitus is a largely self-managed disease and stress and psychological status may have a significant impact on self-management and health outcomes[6-9]. Several studies demonstrate that stress management can improve long-term glycaemic control[10,11]. The potential influence of this strategy is important, considering the association between chronically high blood glucose and diabetic complications.

Despite the great reciprocal association of the psychological stress measure instrument vs FLI and SIP, no significant correlation is found between PSM vs QOL assessed by SF-36. Stress is linked with specific aspects of individual quality of life: impact of disease on both physical and emotional functioning and perception of functional limitations. This can be a consequence of the fact that SF-36 is a global measure of quality of life, aimed to consider most condition that affect quality of life, extensively, more than FLI and SIP. No significant correlation between PMS score and quality of life measured by SF-36 could mean that stress is particularly related to experiential, cognitive and emotional fields considered and investigated more specifically by FLI and SIP.

Temporal relationship between stress and health is difficult to determine, not only because poor health often leads to adverse experiences and thereafter to higher levels of stress, but also because stress itself can affect adversely glycaemic metabolic control. The knowledge of daily life features related to stress is important for helping patients to cope with stress and disease.

Considering the multi-faceted importance of stress in diabetes, psychological profile of patients must be considered, both in diagnosis and during the lifelong treatment of this disease. It was reported that acute psychological stress affects glucose concentrations in patients with type 1 diabetes following food intake but not in the fasting state[39]. Also depression and other mood disturbance can have a significant impact on diabetes[40].

Interventions on psychological distress of type 2 diabetic patients is warranted, specially in the groups with lower levels of instruction which may need an attentive strategy for achieving a satisfactory coping with this disease.

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