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Original article

Emotional dysregulation, affective status and personality traits in a sample of migraine patients

Roberta Ciuffini[1,2], Paolo Stratta[3], Francesca Pacitti[4], Mauro Bologna[1], Alfonso Marrelli[2]

[1] Department of Life, Health and Environmental Sciences, University of L'Aquila, Italy; [2] Clinical Neurophysiology Unit, San Salvatore Hospital, L'Aquila, Italy; [3] Department of Mental Health, ASL 1, L'Aquila, Italy; [4] Department of Applied Clinical Sciences and Biotechnology, University of L'Aquila, Italy

SUMMARY

Background

Several studies hypothesize emotional dysregulation in subjects with migraine related to a generalized hyperexcitability both to sensory and emotional stimuli, involving the cortical-limbic system. The aim of the study was to investigate Emotional Reactivity by means of the International Affective Picture System (IAPS), in a sample of migraineurs in order to evaluate differences between the patients and a healthy reference group and the relationships with clinical evaluations: personality traits, psychopathological symptoms, empathy, affective status, coping and resilience strategy and with the severity of the headache disorder.

Methods

Twenty patients with migraine (14 females, 6 males) and fifteen healthy subjects (9 females, 6 males) matched for age and gender were recruited. Emotional Reactivity was tested using International Affective Picture System (IAPS); Clinical Global Impression evaluated behavioral disturbances. Clinical evaluation, by using the Zung Self-Rating Anxiety Scale, the Beck Depression Inventory II, the Empathy Quotient, the brief TEMPS-M temperament questionnaire, the Millon Clinical Multiaxial Inventory III, the Symptom Check List 90, the Brief Cope, the Resilience Scale 14 and the Migraine Disability Assessment, was performed.

Results

The mean arousal ratings of the clinical group were significantly higher than those of the control group for unpleasant and socially unpleasant pictures. The arousal scores of socially unpleasant pictures showed numerous significant correlations with psychometric scores, since higher arousal is associated with higher migraine disability. Valence to unpleasant images was similarly related to migraine disability, while arousal was inversely related to the Brief Cope score.

Conclusions

The association between personality traits and emotional dysregulation in migraine patients is worth of attention because it could represent the cause of an increased susceptibility to many negative stimuli, may worsen the course and prognosis of the headache disorder and may amplify the vulnerability to psychopathology.

Key words: migraine, emotional reactivity, personality, international affective picture system

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Correspondence
Roberta Ciuffini
Department of Life, Health and Environmental Sciences, University of L'Aquila, via Vetoio, 67010 Coppito (L'Aquila), Italy
Tel.: +39 0862 433319
E-mail: roberta.ciuffini@univaq.it

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Introduction

Migraine (M) is a disorder that is not only characterized by recurrent headache attacks but also showing comorbidity with psychiatric conditions [1]. This association of psychopathological symptoms with M goes beyond the chance overlapping of frequent disorders [2]; it regards mainly major depression, bipolar, anxiety and panic disorder [3].

The comorbidity between M and psychiatric disorders is a challenge for the diagnosis and the clinical approach, as well as for treatment. A psychopathological status may be prior, concomitant or subsequent to the course of the headache and can be concurrent to determine the deterioration of the quality of life of the patients.
M and psychiatric disorders can be related being each other's effect or they can share psychological and behavioral aspects. Alternatively, they can represent the phenotypes of common genetic or environmental factors. From an anatomic and functional point of view limbic system could be the substrate of this comorbidity [4].
Some hypotheses have been elaborated about the contribution of psychological factors to the M etiology. Some personality traits may work as predisposing factors and several stressful emotional stimuli may be precipitating factors [5]. Increased anxiety and somatization scores in women with M evaluated with the Minnesota Multiphasic Personality Inventory (MMPI) [6], tendency to aggression with increased hostility scores and increased emotionality in M patients without evidence of past or present significant emotional stress has been found [7]. They suggested an increased reactivity of the autonomic nervous system in M patients as a predisposing factor for headache attacks. Sanchez-Roman et al. [8], using the Temperament and Character Inventory (TCI) [9] found that personality features of people with M are avoidance, rigidity, reserve and obsessivity, suggesting a profile indicative of an avoidant personality. Avoidant subjects are hypothetically predisposed to "form conditioned signals of punishment and frustrative nonrewarding" associated with increased activity of the anterior paralimbic circuit (right amygdala, insula and orbitofrontal cortex and left medial prefrontal cortex) related to serotoninergic projections to the dorsal raphe [10].
Davis et al. [11] focused on the association between migraine and the personality trait of neuroticism although potential moderators of this relationship have yet to be clarified. Harm avoidance is the trait more consistently linked to migraine. Borderline personality disorder emerged from some researches [12,13], related to the increased impact on the quality of life, medication overuse and poor response to both pharmacological and alternative treatments [14].
On the other hand, there is a strong evidence about the relationship between headache and emotions [15]. Nociceptive information is integrated with the emotional awareness in the homeostatic interoceptive system. An altered affective status could be both the predisposing factor as well as the effect of headache.
The pain experience is made by sensorial and unpleasant emotional processes [16].
The concept of cortical hyperexcitability could be hypothesized both for sensory [16,18] and emotional aversive stimuli. Wilcox et al. [19], using fMRI findings in response to the International Affective Picture System (IAPS) [20], demonstrated an increased neural activity to negative emotional stimuli in people with M. The cerebral regions involved were the posterior cingulate, caudate, amygdala and thalamus. No differences were found in response to positive and neutral emotional stimuli. The pathophysiology of M can include widespread hypersensitivity to negative stimuli involving the cortical-limbic system responsible for both sensory and emotional processing.
We studied the emotional dysregulation using the IAPS paradigm, a widely used tool to obtain an emotion-processing evaluation in psychiatric and neurological conditions [21-23].
We measured emotional arousal (EA) and emotional valence (EV) in a sample of people with M to evaluate differences between the patients and a healthy reference group, and to estimate the association with psychological features.

Methods

Study population

Twenty outpatients (14 females, 6 males, mean age 35.2, SD 10.6) suffering from M were recruited at Clinical Neurophysiology Unit of the S. Salvatore Hospital of L'Aquila during a four months' period. According to the criteria of the International Classification of Headache Disorders [24] ten patients (7 females, 3 males mean age 36.8 SD 10.7) were affected by M without aura and ten patients (7 females, 3 males, mean age 33.6, SD 8.5) by M with aura. Patients with a history of psychiatric symptoms previous or coexisting with the onset of M and with the inability to provide an informed consent were excluded from the study.
Fifteen healthy subjects (9 females, 6 males, mean age 39.9, SD 15.7) matched for gender and age with the clinical sample were also recruited through word of mouth during a two months' period.
All patients signed a written informed consent to participate after receiving a full explanation of the study procedures and goals. The study protocol has been approved by the Local Institutional Ethic Committee.

Emotional Dysregulation assessment

Emotional Dysregulation (ED) assessment was carried out using the International Affective Picture System (IAPS) paradigm which consists of a set of static images based on a dimensional model of emotions.
Ninety color pictures were chosen from the IAPS depicting events with different kinds of affective valence, i.e., unpleasant, pleasant, and neutral events. Unpleasant and pleasant events were also distinguished in pictures involving or not involving social human conditions: for example, pictures with social involvement include depictions of mother-child or familial interactions (pleasant) and outcomes of violence (unpleasant) while pictures without

social involvement include landscape scenes or flowers (pleasant) and snakes, contamination, or pollution (unpleasant). Neutral images consisted of pictures of furniture or appliances. For each of the five categories, 18 images were shown.

Reactivity to the pictures was rated on the basis of EA and EV. The valence rating instructions were "Rate how unpleasant or pleasant the image makes you feel using a 1-9 Self-Assessment Manikin (SAM) valence scale (1 = very unpleasant, 5 = neutral, 9 = very pleasant)". The arousal rating instructions were "Rate how emotionally intense or arousing the image makes you feel using a 1-9 scale SAM arousal scale (1 = calm, 5 = somewhat aroused, 9 = excited)". The SAM valence scale consisted of a cartoon-type figure in which nine human emotional expressions, ranging from smiling and happy to frowning and unhappy, were presented. The SAM arousal scale consisted of another cartoon-type figure with nine expressions ranging from calm and relaxed to excited and wide-eyed.

Stimuli presentation and response recording were managed using custom software (Super Lab 4.0 for Windows). The subjects were tested individually in a dimly lit room. They were seated in front of a 15-inch computer monitor at a distance of 50 cm. Trials started with a 2-s full screen presentation of one picture. The presentation order of the pictures depicting neutral and pleasant and unpleasant scenes with or without social involvement was randomized for each subject. Then, after a 1-s black screen, a display containing a smaller version of the same picture (located in the upper part) and the SAM valence scale (located in the lower part) was presented. This display remained visible for 3 s or until the participant responded. After the participants' valence rating, another display was presented in which the SAM valence scale was substituted with the SAM arousal scale. Similarly, the display remained visible for 3 s or until the participant responded. If the subjects did not respond within 3 s, an omission was recorded. Those who showed more than 5% of omitted responses were excluded from the two samples and not considered in the analysis. No subjects in our study were excluded for this reason.

Clinical assessment

Clinical Global Impression (CGI) severity was used to evaluate behavioral disturbances [25] by a senior psychiatrist (PS) based on more than thirty years of clinical experience. This experience formed the basis of CGI severity of illness rating along a 7-point Likert scale where 1 is "normal, not ill" and 7 is "extremely ill" All the patients with a CGI score equal to or higher than 2 were excluded from the study.

All the patients underwent a psychological assessment comprehensive of the Zung Self-Rating Anxiety Scale (SAS), the Beck Depression Inventory II (BDI-II), the Empathy Quotient (EQ), the brief TEMPS-M temperament questionnaire (bTEMPS-M), the Millon Clinical Multiaxial Inventory III (MCMI III), the Symptom Check List 90 (SCL 90), the Brief Cope (BC), the Resilience Scale 14 (RS 14).

The SAS is a 20-item self-report rating scale built to measure anxiety levels, based on scoring in 4 groups of symptoms: cognitive, autonomic, motor and central nervous system symptoms. Each question is scored on a Likert-type scale of 1-4 (based on these replies: "a few times "sometimes" "good part of the time," "most of the time"). The total scores ranged between 20 and 80. The standardized cutoffs were: 0-20: very low anxiety level; 21-40: low anxiety level; 41-60: moderate anxiety level; 61-80: high anxiety level [26].

The BDI is a psychometric test for measuring the severity of depression. It contains 21 questions; each answer being scored on a scale value of 0 to 3. Higher total scores indicate more severe depressive symptoms. The standardized cutoffs are: 0-13: minimal depression, 14-19: mild depression, 20-28: moderate depression, 29-63: severe depression [27].

The Empathy Quotient (EQ) is a 60-item questionnaire to measure empathy in adults [28]. The test was developed by Simon Baron Cohen [29] and is suitable for use as a casual measure of temperamental empathy.

The bTEMPS-M temperament questionnaire [30] consists of 35 items to assess affective temperaments underlying the psychobiological aspect of personality (depressive, anxious, hyperthymic, cyclothymic and irritable) using a dimensional approach with a five-point Likert type scale ranging from 1 to 5 (1 = "not at all"; 2 = "a little"; 3 = "moderately"; 4 = "much"; 5 "very much").

The MCMI is a psychological assessment tool for adults to provide information on personality traits and psychopathology, including specific psychiatric disorders outlined in the DSM-5 [31].

The SCL-90-R is a self-report questionnaire to evaluate a range of psychological problems and symptoms. It consists of 90 items yielding nine scores along primary symptom dimensions and three scores among global distress indices. The primary symptom dimensions that are assessed are somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism [32].

The Brief Cope (BC) is a 28 item self-report questionnaire designed to measure effective and ineffective ways to cope with a stressful life event [33].

The RS-14 aims to evaluate the levels of resilience in the general population and correlates negatively with depression and positively with meaning in life and self-efficacy [34].

The disability caused by headache was assessed by means of the Migraine Disability Assessment (MIDAS) that measures the impact of headaches on daily life [35].

Statistical analysis

Student's t-test was used for between-group comparisons

of IAPS indexes. Pearson's correlation was also used to evaluate association between IAPS indexes found different in the between group comparisons or with effect size at least medium (Cohen's d > 0.50), psychometric scores and MIDAS evaluation.

Results

No differences on all variable scores, demographic, IAPS and clinical, were observed among M participants with or without aura. The analyses were then conducted to the entire M sample.

The between-group comparison of IAPS scores showed that mean arousal ratings of the clinical group were significantly higher than those of controls for unpleasant and socially unpleasant pictures (Tab. I). Observation of Cohen's d effect size showed a very high value for arousal to socially unpleasant images between group difference (4.31). Arousal to unpleasant and valence to unpleasant and socially unpleasant images were higher than 0.5, representing a 'medium' effect size. On the contrary, the remaining values were small.

Correlations of these IAPS indexes (arousal and valence to unpleasant and socially unpleasant images) with the clinical evaluations were therefore investigated. The arousal scores of socially unpleasant pictures showed numerous significant correlations with psychometric scores. In Table II are reported the significant correlations, being the remaining trivial ($r < 0.20$): higher arousal is associated with higher migraine disability ($r = 0.52$, $p < 0.25$); valence to unpleasant images was similarly related to migraine disability ($r = 0.051$, $p < 0.025$) while arousal inversely related to Brief Cope score ($r = -0.47$, $p < 0.05$).

Discussion

Our results confirm previous observations of ED in patients with M [19]. This study, however, takes one-step forward, adding the observation that arousal in response to unpleasant cues, is the most important issue, especially if social conditions are involved.

As a matter of fact, emotional arousal scores were higher in response to unpleasant and socially unpleasant pictures of IAPS, supporting the hypothesis of an altered cerebral processing of negative stimuli in M patients, according to several data in the literature [36,37]. The increased arousal to social negative stimuli may be sustained by the sensitization observed in migraine regarding not only the sensory but the emotional dimension too. This could account for the increased comorbidity with emotional disorders in M patients.

In our sample the ED correlates to some personality traits. Possibly, due to the small sample size, the increased arousal to social unpleasant stimuli moderately correlates with less dependent personality pattern and less inter-individual sensitivity and more with anxiety. These observations can suggest management impairment of social cues. The valence for socially unpleasant stimuli, was found to be reduced, although not significantly, in the M sample, but with a medium effect size. This is related positively with narcissistic, histrionic, thought disorders and negatively with antisocial personality patterns and depressive symptom dimension. Moreover, the inverse relationship with coping strategy score, as evaluated by BC, seems to suggest that this pattern is somewhat advantageous regarding social cues. On the other hand, this pattern is disadvantageous in terms of a trend towards depression, and anxiety, as well as grater severity of the headache disorder measured

TABLE I. *Mean (± SD) picture arousal and valence (socially pleasant, pleasant, neutral, unpleasant and socially unpleasant) ratings, as a function of group (20 individuals with migraine vs 15 gender and age matched healthy controls).*

	Neutral	Unpleasant	Pleasant	Socially unpleasant	Socially pleasant
Arousal					
Migraine sample	2.8 ± 0.2	5.5 ± 0.4	6.4 ± 0.5	6.2 ± 0.4	6.5 ± 0.4
Control group	2.8 ± 0.6	4.8 ± 1.3	6.6 ± 1.1	3.2 ± 0.9	6.2 ± 1.2
Student's t-test	0.30	2.13	0.83	5.67	0.97
P	NS	< 0.05	NS	< 0.0005	NS
Cohen's d effect size	0	0.73	0.23	4.31	0.33
Valence					
Migraine group	3.5 ± 0.5	3.9 ± 0.6	6.5 ± 0.5	2.7 ± 0.7	6.2 ± 1.1
Control group	3.4 ± 0.8	3.5 ± 0.9	6.6 ± 1.1	3.2 ± 0.9	6.2 ± 1.1
Student's t-test	0.64	1.22	0.17	1.69	0.00
P	NS	NS	NS	NS	NS
Cohen's d effect size	0.15	0.52	0.11	0.62	0

TABLE II. *Correlation coefficients (Pearson r) among reaction to IAPS socially unpleasant images, psychometric scores and MIDAS evaluation (n = 20).*

	IAPS socially unpleasant images	
	Arousal	Valence
MCMI III		
Clinical personality patterns		
Dependent	-52**	
Histrionic		0.55**
Narcissistic		0.54**
Antisocial		-0.49*
Clinical syndromes		
Anxiety	0.50**	
Thought disorders		0.74§
SCL 90 - R symptom dimensions		
Inter-individual sensitivity	-0.48*	
Depression		-0.69°
Anxiety	0.57***	
Brief Cope		-0.46**
Migraine disability Assessment (MIDAS)	0.52**	

** p < 0.05; ** p < 0.025; *** p < 0.01; ° p < 0.001; § p < 0.0005*

as impact on daily life, and greater headache severity as measured in terms of impact on daily life, being positively related to unpleasant stimuli (non-social and social).

These results do not allow to speculate on the possible subsistence of a cluster of personality traits specific for M or on the role of a cluster of personality traits that could differentiate M patients from controls or subjects suffering from other diseases. Further researches are needed to clarify this issue.

Nevertheless, the personality traits we found to be related to ED are suggestive for the possible link between ED and some account of neuroticism and even psychoticism, independently from the relationship with anxiety, depression, specific affective temperament and empathy patterns.

Although speculatively, our observation of a significant arousal increase in response to socially unpleasant images may be in agreement with recent research data. Fong et al. [38] found that the subjects with M could suffer from a condition of hyperexcitability of the visual cortex. If so, our results could imply moreover that this anomaly would be specifically amplified by social cues.

This study has some limitations. The small sample size is the first one. We aim to have a larger sample size that may improve the statistical power. This limited sample size could have obscured relationships with empathy or resiliency indexes that intuitively could be related to our IAPS results. Secondly, a longitudinal rather than a cross-sectional design can lead to make causal inferences.

Moreover, based on our results, showing only trivial relationship between Emotional Reactivity and psychopathological symptoms, as evaluate by psychiatric rating scales such as SAS and BDI-II, more in-depth investigation of personality traits rather than the search for specific symptomatology may be appropriate.

People with M could more frequently be prone to develop dysfunctional personality patterns, and this association could interfere with the clinical presentation and the course of the headache disorder, as well as affect the prognosis.

The association between personality traits and ED in M patients is worth of attention because it could represent the cause of an increased susceptibility to many negative stimuli, and might also worsen the course of the headache disorder and amplify the vulnerability to psychopathology.

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