Effects of Medication Use on Health State in Postictal Migraineurs

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We investigated whether headache-free patients with migraine report a lower health state compared with healthy controls, and whether health state is differently affected during the postattack period after using sumatriptan versus habitual nonvasoactive medication. Mood, health state, and personality questionnaires were administered once during an interictal period and twice within 30 hours after different migraine attacks treated with sumatriptan or habitual nonvasoactive medication. Twenty migraineurs without aura, 10 migraineurs with aura, and 30 matched and headache-free controls participated in this study. During an interictal period, patients with migraine reported more problems regarding social activities and pain compared with healthy controls. During the postictal period, mood (fatigue and emotional state) was negatively affected by an attack that was treated with habitual medication, whereas health state (physical pain, social activities, current pain) was similar to the migraine-free period. Sumatriptan treatment had beneficial effects on aspects of health state and mood during the postictal period.

Key words: migraine, health state, interictal, postictal, sumatriptan

Abbreviations: DPQ Dutch Personality Questionnaire, AMT Achievement Motivation Test, STAI Spielberger State-Trait Anxiety Inventory, STAI-1 state anxiety inventory of the STAI, STAI-2 trait anxiety inventory of the STAI, NHP Nottingham Health Profile, NHP1 health-related quality-of-life section of the NHP, NHP2 impairment of daily life activities section of the NHP, CW COOP-WONCA, POMS Profile of Mood States

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Migraine has a negative effect on health state,[1] which comprises physical complaints, psychological functioning and well-being, social disability, role disability, and general health perceptions.[2] Even between attacks, during normal physical health, migraineurs perceive greater emotional distress, and disturbed contentment, vitality, and sleep compared with healthy controls.[3] The lower perceived health state in migraineurs is manifested by problems with pain, sleep, energy, and social isolation,[4] and can partially be explained by a different personality structure or mood state, and partially by psychological effects of the exposure to the repeated and debilitating migraine attacks, and living in anticipation of an upcoming attack.

Migraineurs have been stereotyped as obsessional, rigid, compulsive, perfectionists, ambitious, and competitive.[5] Recent studies based on clinic and convenience samples demonstrated that patients with migraine have relatively high levels of performance-related debilitating anxiety,[6,7] achievement orientation,[7] depression, trait anxiety, and neuroticism.[8] Population-based studies have corroborated elevated levels of tension, anxiety, depression, hypochondriasis, and neuroticism.[8] It is unclear to what extent these characteristics are associated with perceived health state.

A migraine attack can also directly affect health state. This is most apparent during the attack, which

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can be accompanied by autonomic symptoms such as visual or sensorimotor disturbances; yawning; food craving; nausea; vomiting; hypersensitivity to light, sound, or smell[9]; cognitive disturbances; and negative mood.[10] Changes in health state can also be found preceding an attack. An increase in irritability, annoyance, and tenseness has been found up to 60 hours preceding a migraine attack, as well as a marked increase in fatigue immediately preceding an attack.[11] Hypersensitivity to light, sound, or smell; altered mood state; and tiredness can persist until shortly after an attack,[9] suggesting that health state can be influenced during the postattack period. The extent of this influence could be dependent on attack duration, severity, or medication use. To explore this, we examined health state during a postattack period after sumatriptan use and during a postattack period after habitual nonvasoactive medication (ie, nonsteroidal anti-inflammatory drugs). Sumatriptan is a selective vascular 5-HT_1 receptor agonist and is effective in the relief of migraine headache.[12] The present study addresses three questions: first, whether interictal and headache-free patients with migraine have a lower health state compared with healthy controls and how this is related to mood state and personality traits; second, whether the postictal period is accompanied by an impaired health and mood state; and third, whether postictal health and mood state is affected differently by the use of sumatriptan opposed to habitual medication.

METHODS

Subjects.—Thirty patients with migraine (20 without aura, 10 with aura) and 30 matched healthy controls participated in the study. All were students and were recruited by advertisements in university papers. Patients were diagnosed by a neurologist in accordance to the International Headache Society criteria for migraine,[13] physically examined, and entered into the study. Patients using prophylactic medication, monoamine oxidase inhibitors, β-blockers, serotonin reuptake inhibitors, or lithium, and patients with a known hypersensitivity, intolerance, or contraindication to the use of sumatriptan were excluded from the study. All patients had used sumatriptan at least once before participation in the laboratory sessions. Control subjects were selected from the same student population and matched to patients with migraine on the basis of gender, age, and handedness. Socioeconomic status was comparable between patients and control subjects. Controls did not suffer from migraine and did not suffer from any other type of headache more than once per 2 months (eg, due to alcohol consumption or exposure to toxic substances). Subjects were not admitted to the study if they had a history of epilepsy; possible risk of structural brain lesions or other severe medical conditions which could affect the interpretation of the results; current abuse of opiate analgesics, psychotropic drugs, ergotamine (more than 10 mg per week), or alcohol (more than 315 g per week); or a history of abuse of these substances in the previous 6 months.

Design.—After receiving verbal instructions on how and when to complete the personality questionnaires, all subjects filled out a set of personality questionnaires at home on a headache- and symptom-free day. These are self-administered questionnaires and validated as such, and all contain written instructions. We cannot exclude, however, an effect of the absence of a supervising experimenter on the test scores. Both patients and controls completed mood and health state questionnaires at the beginning of three sessions. The patients with migraine were tested following three different attacks. The first session took place on a headache- and symptom-free day, 4 or 5 days after the peak of a migraine attack. If the first session was followed by a new migraine attack within 3 days, that session was considered invalid. The second and third sessions each took place within 30 hours after a migraine attack and after 1 proper night's rest, after which the headache severity had declined to at most mild as judged on a 3-point scale (1 = mild, 2 = moderate, 3 = severe). During one of these two attacks directly followed by a postattack session, patients with migraine treated the attack with a 100-mg sumatriptan tablet. During the other attack, patients used their habitual migraine medication, which could also be no medication. The order of habitual medication use or sumatriptan use was counterbalanced over the second and third attacks.

Due to test habituation and learning effects, repeated testing in itself can give rise to session effects

that can confound interictal to postictal changes. Therefore, the inclusion of control subjects who are also repeatedly tested is necessary to identify possible postattack effects. Control subjects were tested while headache-free and without having used medication during the same period of the week (beginning, middle, weekend) and at the same time during the day (morning, afternoon, evening) as the patient they were matching. Furthermore, the intervals between the control sessions were equivalent to the test intervals of the patient they were matching.

Questionnaires.—The assessment comprises questionnaires for health state, mood state, and personality traits. A brief description of each is presented below.

Personality Traits.—The Dutch Personality Questionnaire (DPQ) is a translated and shortened version[14] of the California Psychological Inventory. The following scales were administered: (1) inadequacy (vague physical complaints but no specific headache symptoms, depressed mood, nonspecific anxiety, and feelings of insufficiency; this scale is considered a measure for neuroticism); (2) rigidity (a preference for having control over situations and having fixed habits and principles); (3) resentment (being critical and distrusting towards others); and (4) self-evaluation (positive attitude towards work, being flexible, and well adapted). The Achievement Motivation Test (AMT)[15] measures achievement motivation (the drive to excel in challenging situations), debilitating anxiety (anxiety which leads to dysfunctioning in tasks which are relatively unstructured and personally relevant), and facilitating anxiety (stress tolerance or anxiety which leads to optimal functioning in relatively unstructured personally relevant tasks). The Dutch version of the Spielberger State-Trait Anxiety Inventory (STAI)[16] was administered to measure trait anxiety (STAI-2).

Health State.—The Nottingham Health Profile (NHP)[17] and the COOP-WONCA (CW) charts[18] are generic instruments for multidimensional health state assessment that measure physical, psychological, and social functioning which are relevant for the health state of both patients and healthy controls. The NHP consists of statements regarding problems that can be encountered in daily life. The first part of the NHP (NHP1) denotes health-related quality of life and consists of 38 dichotomous items, covering the domains of energy, pain, emotional reactions, sleep, social isolation, and physical mobility. In accordance with the manual, standardized subscores were computed and analyzed. The second part (NHP2) denotes the amount of impairment that the current health state inflicts on daily life activities (employment, jobs around the house, social life, personal relationships at home, sex life, leisure time, and holidays). The NHP was translated and validated for The Netherlands.[19]

The Dutch version[20] of the CW charts is an instrument for the self-report of functional status and contains a set of functional aspects of daily life experienced in the 2 weeks prior to completion. The items are emotional problems (such as anxiety, depression, irritability, or dejection), physical fitness (most extreme exertion that could be kept up for at least 2 minutes), daily activities (difficulties during daily activities in and around the house due to physical or emotional problems), social activities (hindrance in social activities with family, friends, neighbors, or club members due to physical or emotional problems), general health, change of health (compared with 2 weeks before), and physical pain. All items cover a period of 2 weeks prior to completion, except for physical pain which covers the previous 4 weeks. The levels on the scales are illustrated with pictograms and have to be marked at a 5-point scale (1 = not at all, 2 = slightly, 3 = moderately, 4 = quite a lot, 5 = very much). The levels for general health are also rated on a 5-point scale (1 = perfect, 2 = very good, 3 = good, 4 = moderate, 5 = bad).

Mood State.—The Dutch version of the STAI[16] was administered for the assessment of situational anxiety. Twenty statements had to be marked on a 4-point scale (1 = almost never, 2 = sometimes, 3 = often, 4 = almost always). The shortened and Dutch version[21] of the Profile of Mood States (POMS)[22] contains the following scales: Depression/Dejection, Anger/Hostility, Fatigue/Inertia, Vigor/Activity, and Tension/Anxiety. Subjects marked the degree to which their mood matched 38 descriptions on a 5-point scale (0 = not at all, 1 = slightly, 2 = moderately, 3 = quite a bit, 4 = very much).

Procedure.—This study was part of a larger protocol, with a total duration of 4.5 hours, with cogni-

tive testing and electroencephalogram measurements performed after the subjects completed the questionnaires. All subjects abstained from alcohol, tobacco, and caffeine during the hours prior to testing and during the testing procedure. Each laboratory session began with completion of a visual analog scale that determined the headache severity of the preceding migraine attack on a line representing a 0 to 100 scale. The extremes of pain were "no pain" and "as bad as it could be." At the beginning of each session, the number of hours that had passed after meaningful relief from the migraine headache and after medication intake was determined, based on the diaries that were kept during the attack. Duration of a migraine attack was determined by a single question: "How many hours did your migraine attack last?"

Missing Data.—Two patients with migraine (one with aura, one without aura) left the study after the second session and consequently had a missing postattack session after usual medication use. These missing values were replaced by the scores these subjects had during the postattack session after sumatriptan. Two control subjects dropped out after the first session, while the matching patients with migraine participated in all sessions. These missing data were replaced by the session means of all control subjects. Two control subjects did not complete the personality questionnaires, and these missing values were replaced by the group means.

Data Reduction and Analyses.—The session characteristics listed in Table 1 were submitted to analysis of variance (ANOVA) for repeated measures. These analyses included the within-subjects factor *session* (postattack session after sumatriptan use, postattack session after usual medication use) and the between-subjects factor *aura* (migraineurs with aura, migraineurs without aura). Because we individually matched patients with migraine and healthy controls on a range of subject-related characteristics (sex, dominant hand, and age) as well as session-related characteristics (part of the day and weekday at which testing took place), we submitted all variables listed in Table 2 to ANOVA for paired observations. More specifically, a patient with migraine and the matched control were considered as one case and constitute the within-subjects factor *pair* (migraineurs, controls). In order to group the patients into migraineurs with aura and migraineurs without aura, each case was coded by the between-subjects factor *aura* (migraineurs with aura, migraineurs without aura). First, we compared migraineurs to controls in the baseline session and performed ANOVA with the within-subjects factor *pair* (migraineurs, controls) and the between-subjects factor *aura* (migraineurs with aura, migraineurs without aura). Second, we compared the baseline session to the postictal sessions between migraineurs and controls. For this purpose, the second within-subjects factor is *session* with three levels (baseline session, postattack session after sumatriptan use, postattack session after usual medication use). We entered all sessions into ANOVA for repeated measures with the within-subjects factor *pair* (migraineurs, controls) and *session* (baseline session, postattack session after

Table 1.—Demographics and Session Characteristics*

Characteristic	Migraineurs With Aura (n=10)	Migraineurs Without Aura (n=20)
Women/men, No.	8/2	18/2
Left-/right-handed, No.	1/9	4/16
Age, y	24.3 (4.9)	24.9 (2.8)
Migraine history, y	7.1 (3.8)	6.2 (3.7)
Attack duration, h†,‡		
Sumatriptan	7.6 (4.7)	10.7 (12.1)
Usual medication	13.4 (8.7)	17.6 (13.9)
Headache severity§		
Usually during attack‖	67 (19)	83 (11)
Sumatriptan	61 (29)	74 (17)
Usual medication	64 (21)	71 (19)
Interval medication intake and session, h		
Sumatriptan	23.1 (8.5)	21.8 (8.1)
Usual medication	26.5 (8.4)	25.8 (13.4)
Interval meaningful relief and session, h		
Sumatriptan	17.7 (9.9)	16.2 (7.7)
Usual medication	14.8 (8.1)	12.5 (7.0)

*Values are means (SD) unless otherwise indicated.
†Attack duration is determined by the number of hours between the prodromal state and meaningful relief.
‡Significant difference between sumatriptan and usual medication use ($P<.02$).
§Visual analog scale, 0 to 100.
‖Significant difference between migraineurs with aura and migraineurs without aura ($P<.01$).

sumatriptan use, postattack session after usual medication use), and the between-subjects factor *aura* (migraineurs with aura, migraineurs without aura). This implies that each case contained six observations for each variable. If no differences were detected between the migraine groups, *aura* was excluded from the model. Pearson correlations were used to describe the interrelations between mood, personality, and health state variables during the baseline session.

We hypothesized that patients with migraine have higher scores compared to controls on indicators of neuroticism, fatigue, tension, rigidity, and resentment, all scales of the AMT, and have lower scores on vigor, health state, and self-evaluation. During the postattack sessions, we expected that these group differences would be smaller after sumatriptan use than after usual medication intake. Therefore, these specific effects were tested one-tailed. If postictal effects were present in migraine patients, these would be reflected in significant *pair*×*session* or *pair*×*session*×*aura* interactions. One-tailed follow-up tests ensued the detection of these significant interactions. Univariate test results are reported after Huynh-Feldt ϵ adjustment.

We reduced type I error within families of tests by using the Holm method.[23] Before we proceeded with the actual ANOVA, we clustered the variables into families of tests. First, we considered the baseline session and the postattack-related changes as different research questions; these are reported separately for this reason. Second, we grouped all variables that we extracted from the baseline session into six clusters, as listed in Table 2. According to the Holm method, we ensured that the familywise α did not exceed .05 after multiple statistical testing within each family of tests. We constructed four clusters for the ANOVAs involving all three sessions: health state (NHP1), health state (CW), impairment of daily activities (NHP2), and mood (POMS and state anxiety [STAI-1]). We also used the Holm Method for these analyses and for the follow-up tests.

Levene tests were executed to ensure that the assumption of homogeneity of variances between groups was met, if necessary after a transformation of the dependent variable. For this purpose, a square root transformation was executed on "attack duration," and the data of two patients with migraine were removed and replaced by the group means of "attack severity." Moreover, a logarithmic transformation was executed on the NHP2 sum scores and a square root transformation on the POMS subscales.

Table 2.—Health Status, Mood, and Personality in Patients With Migraine (Interictal) and Controls*

	Migraineurs (n=30)	Controls (n=30)
Health status (NHP1)		
Pain	2.5 (7.6)	0 (0)
Energy	14.4 (27.2)	4.6 (19.0)
Sleep	12.0 (18.6)	6.9 (21.2)
Social isolation	6.7 (15.2)	4.8 (12.5)
Emotional reactions	8.1 (12.5)	4.4 (10.6)
Impairment daily activities (NHP2)	0.6 (0.7)	0.1 (0.4)
Health status (COOP-WONCA)		
Physical fitness	1.7 (0.7)	1.5 (0.7)
Daily activities	1.8 (1.0)	1.4 (0.6)
Social activities†	1.8 (1.0)	1.2 (0.5)
General health	2.6 (1.0)	2.3 (0.9)
Change in health†	2.9 (0.8)	2.5 (0.7)
Physical pain†	3.1 (1.0)	1.8 (1.0)
Dutch Personality Inventory		
Inadequacy	12.1 (8.0)	12.3 (7.2)
Rigidity†	23.3 (6.7)	17.8 (7.2)
Resentment	14.1 (7.6)	13.8 (5.0)
Self-evaluation	28.4 (6.7)	28.5 (6.4)
Achievement Motivation Test		
Achievement motivation†	22.0 (5.9)	18.2 (6.4)
Debilitating anxiety	11.6 (5.7)	12.0 (6.0)
Facilitating anxiety	11.8 (4.4)	11.8 (4.0)
Anxiety		
Trait anxiety (STAI-2)	37.2 (8.6)	36.3 (9.0)
State anxiety (STAI-1)	32.6 (6.2)	32.0 (4.8)
Profile of Mood States		
Depression	0.6 (1.1)	0.4 (0.7)
Anger	0.7 (1.0)	0.6 (0.7)
Fatigue	1.4 (1.1)	1.2 (1.1)
Vigor	2.7 (0.9)	2.9 (0.8)
Tension	1.3 (0.8)	1.3 (1.0)

*Values are means (SD). NHP1 indicates the first part of the Nottingham Health Profile (NHP); NHP2, the second part of the NHP; STAI-2, the trait anxiety section of the Spielberger State-Trait Anxiety Inventory (STAI); STAI-1, the state anxiety section of the STAI. NHP2 is a summed score.
†Significant different between patients with migraine and controls ($P<.02$). Data were collected in controls (n=30), patients with migraine without aura (n=20), and patients with migraine with aura (n=10).

Table 3.—Correlations Between Mood, Personality, and Health State in Patients With Migraine*

	NHP2	Problems Social Activities (CW)	Problems Physical Pain (CW)	Impaired General Health (CW)	Problems Energy (NHP1)	Problems Current Pain (NHP1)	History	Duration	Severity
Mood states									
Depression	.13	.41 (.02)	.15	.54 (.00)	.69 (.00)	.36 (.05)	.27	−.13	.09
Fatigue	.09	.38 (.04)	−.03	.48 (.01)	.52 (.00)	.44 (.01)	.17	−.28	−.21
Anxiety	.19	.57 (.00)	.08	.64 (.00)	.48 (.01)	.38 (.04)	.27	−.50 (.01)	−.21
Anger	−.19	.19	.04	.39 (.03)	.38 (.04)	.25	.23	−.33	−.08
Vigor	−.05	−.20	−.02	−.48 (.01)	−.21	.08	.05	.45 (.01)	.11
Tension	.11	.17	−.03	.10	.36 (.05)	.14	.34	.25	.13
Personality									
Inadequacy	.19	−.03	−.05	.23	.52 (.03)	.13	.13	−.06	−.12
Rigidity	.14	.01	.07	−.09	.26	.20	.25	.03	.18
AM	−.12	.15	−.02	−.07	−.06	.16	.08	.44 (.02)	−.17
Health state									
Current pain	.12	.56 (.00)	.12	.40 (.03)	.58 (.00)	−	.11	−.07	−.19
Attack characteristics									
History	.01	.13	−.54 (.00)	.13	.13	.11	−	.03	−.32
Duration	−.22	−.16	−.03	−.34	−.09	−.07	.03	−	.20
Severity	.06	−.02	.16	−.23	.09	−.19	−.32	.20	−

*Values are Pearson correlations ($P<.05$) between health state, mood state, personality variables, and attack characteristics in 20 migraineurs without aura, 10 migraineurs with aura. AM indicates achievement motivation; NHP1, Nottingham Health Profile: health status; NHP2, Nottingham Health Profile: impairment in daily activities; CW, COOP-WONCA charts; history, years of migraine history; duration, attack duration after habitual medication intake; severity, general headache severity.

RESULTS

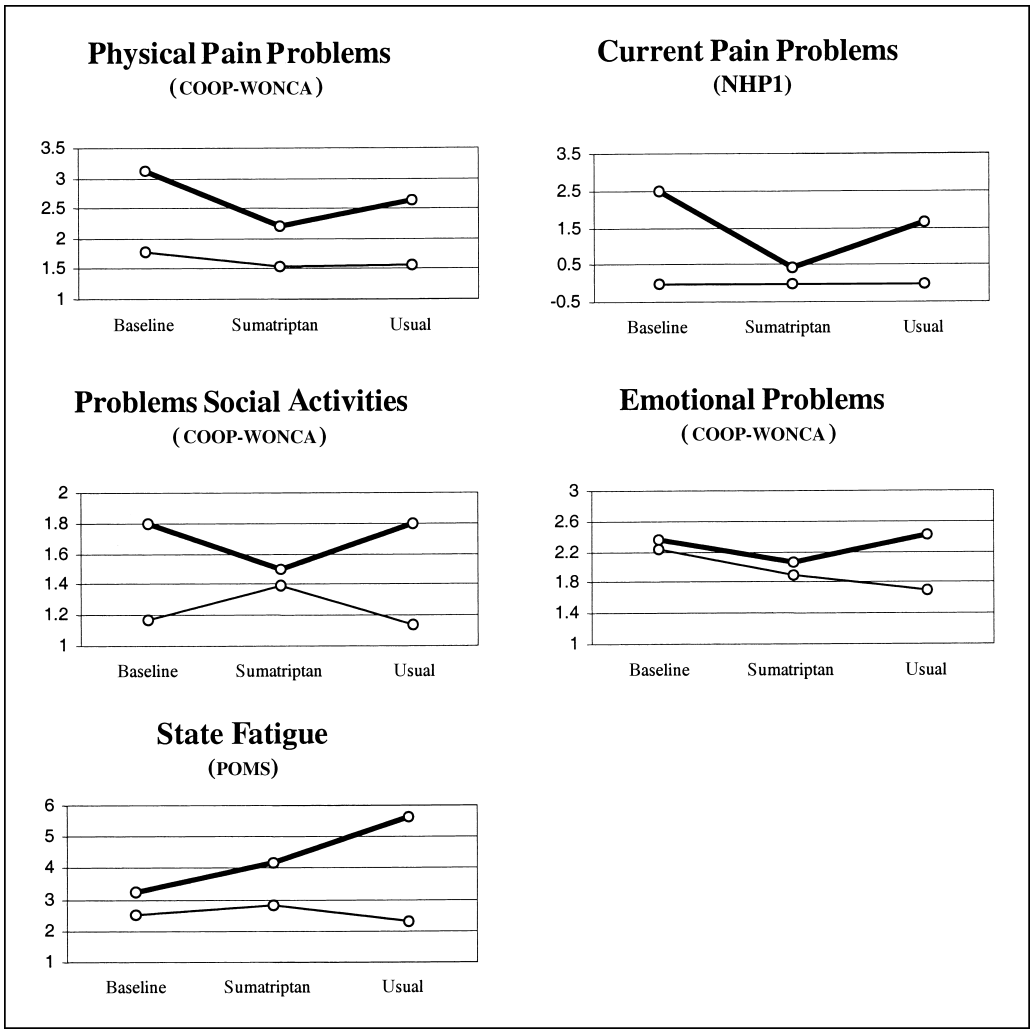
Demographics and Session Characteristics.—Table 1 depicts the demographics and session characteristics of the patients with migraine with aura and the patients with migraine without aura. Age and migraine history were comparable between the groups. The headache severity of general attacks was higher in migraineurs without aura than in migraineurs with aura ($F_{1,28}=8.4$, $P=.008$), but headache severity was not significantly different during the attack treated with sumatriptan compared with the attack treated with usual medication. Attack duration was shortened by sumatriptan use compared with usual medication use ($F_{1,28}=11.3$, $P=.002$). The time interval from medication intake to the start of the following postattack session for the two different types of medication was not significantly different; the number of hours between meaningful headache relief after both types of medication and the start of the subsequent postattack sessions was also not significantly different.

Interictal Migraineurs Versus Controls.—Table 2 lists the means of health state, mood, and personality scales in patients with migraine (interictal) and controls.

Health State.—During the interictal session, migraineurs reported a higher health-related impairment in daily activities (NHP2: $F_{1,29}=9.4$, $P=.003$) compared with controls, and more severe problems regarding physical pain (CW: $F_{1,29}=33.2$, $P=.000$) and social activities (CW: $F_{1,29}=7.8$, $P=.005$). Compared with controls, migraineurs reported worse health than 2 weeks prior (CW: $F_{1,29}=5.5$, $P=.013$).

Personality Traits.—Migraineurs (both migraineurs with aura and without aura) showed higher levels of rigidity ($F_{1,28}=5.6$, $P=.013$) and achievement motivation ($F_{1,28}=4.9$, $P<.016$) compared with control subjects.

Association Between Mood State and Health State in Patients With Migraine.—Table 3 lists the Pearson correlations between aspects of health state, mood state, personality, and migraine characteristics. In migrainous patients, mood state, rather than personality



Health status in migraineurs during interictal and postictal sessions. Mean scores of aspects of health state in patients with migraine (bold lines) and matched healthy control subjects (normal lines) during the interictal (baseline) measurement, the postattack session after sumatriptan use, and the postattack session after habitual (usual) medication use.

measures, was significantly associated with health state. High levels of depression, fatigue, and anxiety were accompanied by more problems regarding social activities, general health, energy, and current pain. Correlations for control subjects are not listed because none of these were significant, except for the correlations between achievement motivation and social activities ($R=-.43$; $P=.018$), and fatigue and energy ($R=.40$; $P=.028$).

Differences Between Migraineurs and Controls During All Sessions.—*Health State.*—Main pair effects indicated that, compared with controls, patients with migraine report more impairments in the execution of daily life activities (NHP2: $F_{1,29}=23.3$, $P=.000$) and more severe complaints regarding energy (NHP1: $F_{1,29}= 8.2$, $P=.004$), general physical pain (CW: $F_{1,29}= 44.5$, $P=.000$), social activities (CW: $F_{1,29}= 8.1$, $P=.008$), and general health (CW: $F_{1,29}= 7.9$, $P=.005$). Compared with controls, migraineurs reported worse general health than 2 weeks prior (CW: $F_{1,29}= 12.4$, $P=.001$).

Mood State.—Migrainous patients showed lower levels of vigor (POMS: $F_{1,29}=4.1$, $P<.05$) compared with controls. Migraineurs with aura showed higher levels of tension (POMS: $F_{1,28}=6.2$, $P<.025$), anger (POMS: $F_{1,28}=6.7$, $P<.025$), and anxiety (STAI-1: $F_{1,28}=8.8$, $P<.017$) than controls.

Baseline Versus Postattack Sessions.—*Health State.*—The Figure depicts the trends for *pair*×*session* inter-

action effects which were detected for current pain (NHP1: $F_{2,58}=2.5$, $P=.046$), general physical pain (CW: $F_{2,58}=3.5$, $P=.018$), social activities (CW: $F_{2,49}=3.8$, $P=.018$), and general emotional problems (CW: $F_{2,58}=2.2$, $P=.034$). Follow-up tests showed that the baseline disadvantages in migraineurs compared with controls, are unaltered during the postattack period after usual medication use and significantly reduced during the postattack period after sumatriptan use (current pain NHP1: $F_{1,29}=3.9$, $P=.029$; general physical pain CW: $F_{1,29}=7.4$, $P=.006$; and social activities CW: $F_{1,29}=3.8$, $P=.030$). Furthermore, the relatively worse emotional state in interictal migraineurs was unaltered during the postattack period after sumatriptan use, but worsened after usual medication use (CW: $F_{1,29}=5.0$, $P=.017$).

Mood State.—A significant *pair*×*session* interaction was found for fatigue (POMS: $F_{2,58}=3.4$, $P=.020$). Follow-up testing showed that the baseline difference, with higher levels of fatigue in migraineurs than controls, was unaltered in the postictal period after sumatriptan use and significantly more enhanced when usual medication had been used ($F_{1,29}=6.9$, $P=.007$).

COMMENTS

Headache-free patients with migraine reported a lower health state compared with healthy control subjects, which has also been found in other studies.[1,3,24] Mood and health state are interrelated concepts that can both be a source of hindrance in daily functioning. This confounds the determination of what causes the perceived lower health state in migraineurs. In the following, we refer to mood state as "internalizing" aspects of health state and to the participation in daily and social activities as "externalizing" aspects of health state. We demonstrated that migraineurs report higher levels of impairment in the externalizing aspects of health state. They reported more problems in the execution of daily activities, more severe problems regarding physical pain and participating in social activities, and worse general health compared with controls. It was only in patients with migraine that aspects of mood state were strongly associated with externalizing health state. More problems concerning current pain, energy, general health, and participation in social activities were strongly associated with higher levels of state fatigue, depression, and anxiety. A longer migraine history, a higher general headache severity, and attack duration were not accompanied by negative effects on internalizing or externalizing aspects of health state. This suggests that being a migraineur per se or living in anticipation of an upcoming attack is probably related to an impaired health state in headache-free migraineurs.

This impaired health state could be associated with certain personality factors that are associated with migraine. In the present study, migraineurs showed higher levels of rigidity and achievement motivation compared with their healthy controls, which has also been found in other studies.[6,7] As shown in Table 3, these personality traits did not play a decisive role in the perception of an impaired health state, but the causal relationship between migraine, rigidity, and achievement motivation remains unclear. These personality factors might predispose or increase the risk of the development of migraine, or could mirror a psychological reaction to the repeated and unpredictable exposure to migraine and its incapacitation. We suggest that the longer a migraine attack lasts, the more achievement-oriented one is in a migraine-free period to make up for this lost time. Unlike achievement motivation, rigidity was not associated with attack duration, severity, or length of migraine history. Increased levels of rigidity might, therefore, be part of a certain predisposition to migraine or a consequence of living in constant anticipation of an attack.

During the migraine-free period, mood state is similar in migraineurs and healthy controls. Averaged over the sessions, we demonstrated that migraineurs with aura show higher levels of tension, anger, and anxiety. This result supports the study of Merikangas et al[25] who found higher levels of neuroticism, predominantly in migraineurs with aura. The present study could not confirm the high levels of depression that have been demonstrated in migraineurs,[8] which could be due to the relatively young sample of patients with migraine recruited in a student population. The fact that higher levels of tension, anger, and anxiety in migraineurs with aura were only found if interictal and postictal sessions were averaged, stresses the importance of controlling for the time interval between a preceding attack and an interictal measurement.

The postattack session after an untreated attack or an attack treated with habitual medication was accompanied by pronounced levels of fatigue and emotional problems, whereas this was not the case after sumatriptan use. Problems regarding current pain, general physical pain, and engaging in social activities that are already present in interictal migraineurs, are unaltered during the postattack period after habitual medication use but significantly reduced after sumatriptan use, which seems paradoxical. These results were indicated by the CW charts, an instrument for the measurement of general functional state, and the items address the 2 weeks prior to completion. The patients may base their judgment of health state on their experiences during their latest attack rather than the addressed period. The attacks that preceded the baseline session and the postattack session after habitual medication were both treated with the same medication, and, hence, the perceived health state in these conditions was equivalent. Sumatriptan induces a shorter attack duration; patients are probably debilitated for a shorter period, and can resume social interactions and normal functioning sooner. Solomon and colleagues[26] found an improved health state after 6 months of sumatriptan use, especially in physical aspects of role functioning, bodily pain, and social functioning in very severe and difficult-to-treat patients with migraine. The present study suggests similar improvements in health state during the postattack period after sumatriptan use. Because it does not reduce attack frequency, and did not reduce headache severity in the present study, the reduced attack duration is probably a key factor in the beneficial effects on postictal health state.

In short, headache-free patients with migraine reported a lower health state compared with healthy controls. In migraineurs, mood state (depression, anxiety, and fatigue) rather than personality traits was associated with externalizing aspects of health state. Internalizing aspects of health state (fatigue and emotional problems) were negatively affected by an attack when untreated or treated with analgesics, whereas externalizing aspects of health state (physical pain, social activities, and current pain) were similar to the migraine-free period. In contrast, treatment with sumatriptan had beneficial effects on both internalizing and externalizing aspects of health state during the postictal period. The present results suggest that effects induced by a preceding attack as well as those of medication use should be considered in future studies on health and mood state in interictal migrainous patients.

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