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The relationship between fatigue, coping behavior, and inflammation in patients with rheumatoid arthritis

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Abstract This research investigated the relationships among the severity of inflammation, the extent of fatigue, and fatigue symptoms, and the relationship between fatigue and coping behavior in patients with rheumatoid arthritis (RA). Our study group consisted of 177 female patients with RA (105 women with CRP $>$ 0.5 mg/dl and ESR $>$ 30 mm/h (inflammatory group) and 72 women with CRP $\leqq$ 0.5 and ESR $\leqq$ 30 (noninflammatory group)) and 81 age-matched healthy women (control group) who were given self-assessment questionnaires. The extent of fatigue was higher in the inflammatory group than in the noninflammatory and control groups. The characteristics of fatigue symptoms in the inflammatory group were "decline in the strength to carry on the activities of daily life" and "difficulty in performing daily activity." The patients in the inflammatory group adopted a technique of "reducing the burden on the body" as a pattern of coping behavior for reducing fatigue. The extent of fatigue and fatigue symptoms perceived by RA patients is strongly related to the severity of inflammation, and these patients adopt a coping behavior in response to the extent of fatigue and subjective symptoms.

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Introduction

Rheumatoid arthritis (RA) is a chronic inflammatory disease characterized by multiple osteoclastic arthritis. Fatigue, as well as pain, is one of the most common distressing symptoms, among others, in patients with RA,[1,2] and is related to the disease activity, with 88% of patients in the active stage and 40% in the remission stage complaining of this symptom.[3] Fatigue related to RA has a very strong influence on the quality of life (QOL) of the patient, and affects the patient's participation in treatment and rehabilitation therapy, thus requiring management in the patient's daily life.[4,5]

Although fatigue is an important symptom experienced by many RA patients, it has been assessed only as a hallmark of the disease activity, and not as a symptom requiring adequate self-management by the patients in their daily life.

In performing self-management of the symptoms of RA, which has a chronic course through repeated remission and aggravation, it is important to understand the difference in the mode of manifestation of fatigue according to the grade of inflammation. It is also necessary for the patient to acquire the ability to cope with varying manifestation of fatigue in order to improve their QOL. However, there are hardly any data available on the differences in the mode of manifestation of fatigue in relation to inflammation, or on how to cope with it.

In this study, to facilitate effective self-management for reducing fatigue in RA patients, we investigated the following issues: (1) the relationship among the extent of inflammation, the extent of fatigue, and fatigue symptoms; (2) the relationship between fatigue and coping behavior. We defined fatigue as "perception of persistent tiredness of the whole body not able to be restored by rest."

Patients and methods

Subjects

From RA outpatients at the Institute of Rheumatology of Tokyo Women's Medical University, 200 patients who met the following requirements were selected and enrolled in the study: (1) women aged 20–65 years; (2) no hepatic hypofunction and no surgery in the preceding year; (3) no history of psychiatric disease; (4) able to talk. These patients fulfilled the ACR (American College of Rheumatology) criteria for RA. The period of the survey was from June 24 to September 1, 1997.

To compare the extent of fatigue and fatigue symptoms in RA patients with those of healthy people, 81 women who met the same inclusion criteria were selected as controls from among the women who visited the Community Health Care Center in an urban area for a health check-up. The survey of the controls was carried out between September 8 and 12, 1997.

Contents of the survey

For RA patients, demographic data, disease-related information, fatigue, and coping behavior were investigated.

The demographic data included age, marital status, occupational status, and social support. The social support status of each RA patient was assessed according to the social support scale of the Japanese version of Arthritis Impact Measurement Scales (Japanese-AIMS).[6,7]

The disease-related information, including the duration of disease, complications, medication, clinical laboratory data, functional status, and Steinbrocker radiographic stage,[8] was obtained through interview with the patient's physician and a review of medical records.

To assess fatigue and coping behavior, three scales were used: "the extent of fatigue scale"; "the fatigue symptoms scale"; "the fatigue coping behavior scale." They were developed by the author, and the reliability and validity of these scales have previously been demonstrated.[9]

The "extent of fatigue scale" is a constructed scale to measure fatigue during the past month. It is composed of four items ("severity," "frequency," "duration," and "effect on activities"), and has a 5-grade rating for the first three items and a 6-grade rating for the last one. A numerical rating is assigned to each response according to a logical ranking, and the range of scores are 4–21 points.

The "fatigue symptoms scale" is intended to measure subjective symptoms associated with fatigue. It is composed of 5 subscales: "depressive mood"; "decline in the strength to carry on the activities of daily life"; "difficulty in performing daily activities"; "drowsiness"; "tendency to make mistakes." Each subscale expresses characteristics of fatigue symptoms. Table 1 presents the items for each subscale. A numerical rating is assigned to each item by using a 5-grade rating from 1 = not at all to 5 = a great deal. Because the number of items varies for each subscale, the points assigned to each subscale were divided by the number of items and expressed in the range 1–5.

Table 1. Fatigue symptoms scale

Subscale	Items
Depressive mood	I don't want to do anything
	I feel depressed
	I don't have any energy
	I don't care about my personal appearance
	I can't do anything to change/divert my mind
	I just think about my problems
	I become melancholic
	I feel powerless
	I get irritated easily
	I can't concentrate
Decline in the strength to carry on the activities of daily life	I lack physical strength
	I soon lie down
	I cannot walk for a long time
	I have difficulty walking up and down stairs
	It is hard for me to keep standing
	I have no endurance
	It takes time for me to start moving
	It is hard for me to go out
Difficulty in performing daily activities	It is difficult to hold and squeeze things
	It is difficult to get dressed
	Housekeeping and work are difficult
	The pain becomes more intense
Drowsiness	I always feel sleepy
	I can't get up in the morning
Tendency to make mistakes	I make many mistakes
	I tend to forget things

The "fatigue coping behavior scale" is intended to examine the patterns adopted to deal with fatigue. It is composed of 7 subscales: "prevention of fatigue"; "managing the procedure of activities"; "regulation of energy expenditure"; "reducing the burden on the body"; "management of therapeutic regimen"; "actively seeking social contact"; "taking a nap." Each subscale represents a behavior pattern to deal with fatigue. Table 2 presents the items for each subscale. A "yes" or "no" response is required. If "yes," one point is given. The points for each subscale are divided by the number of items, and the product is used as the points for that subscale. The points were expressed in the range 0–1.

Survey procedure

Before or after a regular medical examination, each patient was informed about the questionnaire, and asked to fill in the form of the self-assessment section. If the patient could not complete the questionnaire by herself, the investigator listened to her answers and filled in the form for her. The time required for the answers to the questionnaire survey was about 25–40 min per patient.

The control subjects were examined for demographic data and fatigue. The extent of fatigue scale and the fatigue symptoms scale were used to assess fatigue. The questionnaire was filled in by each control subject before a check-up. The time required for the survey was about 5 min per person.

Table 2. Fatigue coping behavior scale

Subscale	Items
Prevention of fatigue	I eat food that has a high iron content I avoid colds I take rests to prevent it I investigate the cause of the fatigue I know the limits of my physical strength I pay attention to the warning signs of fatigue I pay attention to the pain cycles
Managing the procedure of activities	I consider the order of my priorities I set up a weekly schedule I make plans and preparations in advance I always allow myself extra time I engage in pastimes
Regulation of energy expenditure	I avoid overwork I adhere to a regular schedule I balance rest and work I get adequate sleep I adjust my activity time I adjust my level of activity I choose social activities
Reducing the burden on the body	I use tools I use less burdensome movements I sit while working I ask other people for help I arrange my home to make movements easier I arrange objects so that they are easy to reach
Management of therapeutic regimen	I take the medication prescribed I manage the pain I eat nutritious meals I exercise my joints I perform exercises that maintain and increase muscle strength
Actively seeking social contact	I get together with a friend I don't brood about things I don't find fault with myself
Taking a nap	I take naps

A copy of the prospectus, including a description of the contents of the study and protection of the participant's rights, was handed out to each subject before the study, and the consent of the subject was obtained.

Statistical analysis

The level of C-reactive protein (CRP) and the erythrocyte sedimentation rate (ESR) were used as a parameter of the degree of inflammation. In this study, the normal value for CRP was set below 0.5 mg/dl, and the criteria used to evaluate inflammation were ESR values of $\leqq$30 mm/h, which is the clinical remission criterion for RA in women.[3] The RA patients were divided into two groups: patients with CRP $>$ 0.5 and ESR $>$ 30 were assigned to the inflammatory group, and those with CRP $\leqq$ 0.5 and ESR $\leqq$ 30 were assigned to the noninflammatory group. Accepted subjects had to show an increase or decrease in CRP and ESR at least twice in a row. Because it was impossible to obtain an accurate evaluation of whether inflammation was present in the 23 patients whose values were CRP $\leqq$ 0.5 but ESR $>$ 30, or CRP $>$ 0.5 and ESR $\leqq$ 30, they were excluded, and the remaining 177 patients were the subjects of the analysis.

Comparisons were made with a control group in order to assess whether the fatigue in the noninflammatory group differed from the fatigue in healthy subjects.

Data were analyzed for significant differences by the Student's t test, χ^2 test, one-way analysis of variance (ANOVA), or Mann–Whitney U test. The correlation between fatigue and coping behavior was analyzed by the correlation coefficient (Pearson's r).

Results

Demographic and clinical characteristics of the subjects

The mean age of the 177 RA patients was 48.3 $\pm$ 10.1 years (mean $\pm$ SD), and the mean duration of disease was 6.24 $\pm$ 6.18 (range 0.5–40.0) years. The number of complicating diseases was 0 in 126 patients (71.2%), 1 in 43 patients (24.3%), and 2 or more in 8 patients (4.5%), with Sjögren's syndrome being most frequent (16 cases), followed by

hypertension (13 cases). Oral medication consisted of steroids in 70 cases (39.5%), nonsteroidal anti-inflammatory drugs (NSAIDs) in 123 cases (69.5%), and disease-modifying antirheumatic drugs (DMARDs) in 166 cases (93.8%).

According to the classification of global functional status in rheumatoid arthritis by the American College of Rheumatology,[10] class I was found in 72 patients (40.7%), class II in 86 (48.6%), class III in 18 (10.2%), and class IV in 1 (0.5%). The subjects in whom the Steinbrocker stage was confirmed by bone radiography within 1 year of the time of the survey were 54.2% ($n = 96$) of the total. Of these 96 subjects, 26 (27.1%) were stage I, 28 (29.2%) were stage II, 17 (17.7%) were stage III, and 25 (26.0%) were stage IV.

The CRP levels ranged from 0 to 10.1 mg/dl, and the ESR levels ranged from 3.5 to 103.7 mm/h. There were 105 patients (59.3%) with a CRP $>$ 0.5 mg/dl and an ESR $>$ 30 mm/h (inflammatory group), and 72 patients (40.7%) with a CRP $\leqq$ 0.5 mg/dl and an ESR $\leqq$ 30 mm/h (noninflammatory group).

One hundred and twenty-six patients (72.0%) were married, and the mean number of cohabiting persons was 2.3 (range 0–8). The mean score of social support (defined by AIMS2) was 1.7 (range 0–8.8; the greater the score, the more acutely the patient felt lack of support). In occupational status, 78.9% of patients were employed, and 22.5% were full-time workers. The mean age of the 81 controls was 45.42 $\pm$ 7.62 years.

Comparison of demographic and clinical characteristics

As shown in Table 3, a comparison of the inflammatory, noninflammatory, and control groups revealed no significant intergroup difference in age, and there was no significant difference in the duration of disease and the scores for social support (defined by the social support scale of the Japanese-AIMS) between the two groups of RA patients. On the other hand, steroid therapy was significantly more frequent in the inflammatory group than in the noninflammatory group ($\chi^2 = 7.03$, df = 1, $P < 0.01$). Functional status class II was most frequent (60.0%) in the inflammatory group, whereas class I was most frequent (65.3%) in the noninflammatory group, showing a significant intergroup difference ($\chi^2 = 32.18$, df = 3, $P < 0.001$). There were no significant differences between the Steinbrocker's stage distribution in the two groups. Married individuals were significantly fewer in the inflammatory and

Table 3. Comparison of demographic data and clinical characteristics among the inflammatory group ($n = 105$), the noninflammatory group ($n = 72$), and the control group ($n = 81$)

	Inflammatory group		Noninflammatory group		Control group		Statistical value[a]	*P*
	Mean	SD	Mean	SD	Mean	SD		
Age	48.28	10.69	48.32	9.07	45.42	7.62	$F = 2.59$	ns
Duration of disease	6.49	6.39	5.88	5.83	–	–	$t = 0.64$	ns
Score of social support[b]	1.49	1.82	1.92	2.11	–	–	$t = 1.43$	ns
	Cases (%)		Cases (%)		Cases (%)			
Medication								
Steroid	50 (47.6)		20 (27.8)		–		$\chi^2 = 7.03(1)$	**
DMARDs	100 (95.2)		66 (91.7)		–		$\chi^2 = 0.94(1)$	ns
NSAIDs	77 (73.3)		46 (63.9)		–		$\chi^2 = 1.80(1)$	ns
Functional status[c]							$\chi^2 = 32.18(3)$	***
Class I	25 (23.8)		47 (65.3)		–			
Class II	63 (60.0)		23 (31.9)		–			
Class III	16 (15.2)		2 (2.8)		–			
Class IV	1 (1.0)		0 (0.0)		–			
Steinbrocker stage[d]							$\chi^2 = 1.33(3)$	ns
Stage I	14 (24.1)		12 (31.6)		–			
Stage II	16 (27.6)		12 (31.6)		–			
Stage III	11 (19.0)		6 (15.8)		–			
Stage IV	17 (29.3)		8 (21.0)		–			
Marital status							$\chi^2 = 6.46(2)$	*
Married	75 (71.4)		51 (72.9)		70 (86.4)			
Divorced or separated	30 (28.6)		19 (27.1)		11 (13.6)			
Occupational status							$\chi^2 = 23.24(8)$	**
Full time	24 (22.9)		16 (22.5)		35 (43.2)			
Part time	11 (10.5)		15 (21.1)		18 (22.2)			
Self-employed	10 (9.5)		7 (9.9)		5 (6.2)			
Other	1 (1.0)		2 (2.8)		1 (1.2)			
No occupation	59 (56.1)		31 (43.7)		22 (27.2)			

[a] Data were analyzed for significant differences by Student's *t*-test, χ^2 test, or one-way ANOVA. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; ns = not significant. [b] Social support was assessed according to the social support scale of the Japanese version of the Arthritis Impact Measurement Scales (Japanese-AIMS).[6,7] [c] Functional status was classified according to the criteria of the American College of Rheumatology 1991.[10] [d] The data of Steinbrocker stage within 1 year was gained from 96 subjects

the noninflammatory groups than in the control group ($\chi^2 = 6.46$, df = 2, $P < 0.05$). People without occupation were significantly more frequent in the inflammatory group than in the other two groups ($\chi^2 = 23.24$, df = 8, $P < 0.01$).

Relationship between degree of inflammation and fatigue

Difference in the extent of fatigue in relation to inflammation severity

To examine the extent of fatigue in relation to the severity of inflammation, the scores for extent of fatigue in the three groups were compared. As shown in Fig. 1, there were significant differences among the scores for these groups ($F = 6.88$, $P < 0.01$), with the highest score in the inflammatory group. In the intergroup comparisons, there were significant differences between the inflammatory and noninflammatory groups ($t = 3.34$, $P < 0.01$) and between the inflammatory and control groups ($t = 2.90$, $P < 0.05$). In order to confirm whether oral steroids had any effect on their extent of fatigue, the patients who did not use steroids ($n = 107$) were divided into an inflammatory group ($n = 55$) and a noninflammatory group ($n = 52$), and the scores for extent of fatigue in the two groups were compared. The results showed that the scores were higher in the inflammatory group, and the difference was significant ($t = 2.48$, $P < 0.05$).

Difference in fatigue symptoms in relation to inflammation severity

To see whether or not the manifestation of fatigue differs depending on inflammation severity, the scores given to fatigue symptoms in the three groups were compared. As shown in Fig. 2, among the five characteristics of fatigue symptoms, significant differences were noted among the three groups on "decline in the strength to carry on the activities of daily life" ($F = 33.0$, $P < 0.001$), "difficulty in performing daily activities" ($F = 56.1$, $P < 0.001$), and "tendency to make mistakes" ($F = 7.14$, $P < 0.001$).

In a comparison of the differences in the scores assigned to these three characteristics for these groups, the inflammatory group received the highest score on "decline in the strength to carry on the activities of daily life," followed by the noninflammatory group, and then the control group. There was a significant difference between the inflammatory group in comparison with the noninflammatory or the control group ($t = 5.89$, $P < 0.001$; $t = 7.56$, $P < 0.001$, respectively). There was no difference between the noninflammatory and control groups. Similarly, the inflammatory

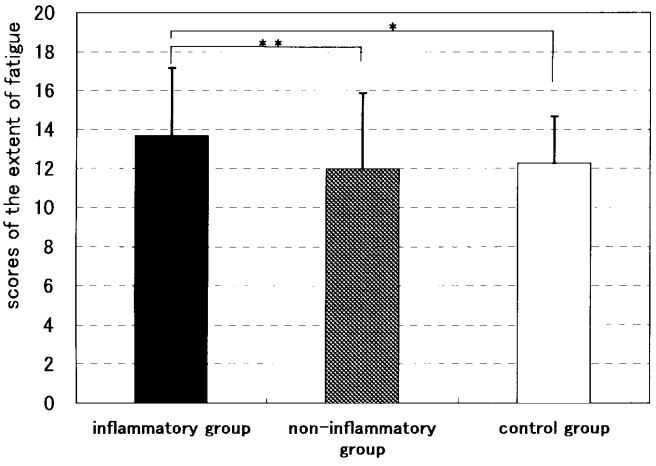

Fig. 1. Comparison of the score for extent of fatigue among the inflammatory group ($n = 105$), the noninflammatory group ($n = 72$), and the control group ($n = 81$). The vertical axis denotes scores for the extent of fatigue. One-way ANOVA was used for among-groups comparison, and the *t*-test was used for within-groups comparison. Data are presented as mean + SD (*$P < 0.05$; **$P < 0.01$)

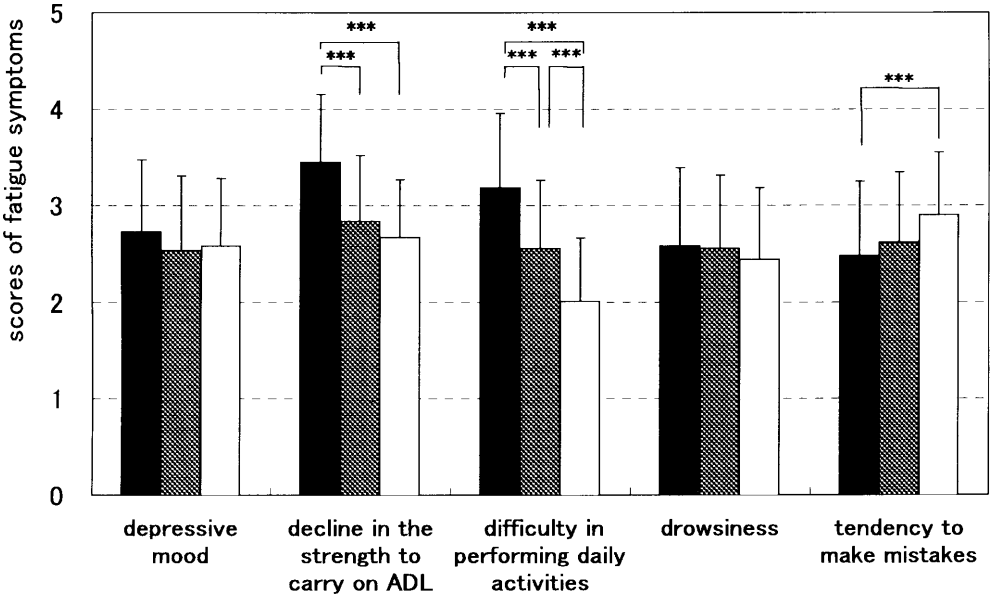

Fig. 2. Comparison of the score for fatigue symptoms among the inflammatory group ($n = 105$), the noninflammatory group ($n = 72$), and the control group ($n = 81$). *Black boxes*, inflammatory group; *gray boxes*, noninflammatory group; *white boxes*, control group. The vertical axis denotes scores for fatigue symptoms. One-way ANOVA was used for among-groups comparison, and the *t*-test was used for within-groups comparison. Data are presented as mean + SD (***$P < 0.001$)

group received the highest score for "difficulty in performing daily activities," and a significant difference was noted between the groups ($P < 0.001$). On the other hand, the control group received the highest score for "tendency to make mistakes," with significant differences in comparison with the inflammatory group ($t = 3.77$, $P < 0.001$).

Relationship between extent of fatigue and fatigue symptoms

The extent of fatigue showed a significant positive correlation with all five characteristics of fatigue symptoms. In particular, "decline in the strength to carry on the activities of daily life" ($r = 0.63$, $P < 0.001$), "depressive mood" ($r = 0.62$, $P < 0.001$), and "difficulty in performing daily activities" ($r = 0.52$, $P < 0.001$) showed strongly positive correlations.

Relationship between fatigue and coping behavior

Coping behavior to deal with fatigue in patients with RA

More than half of the RA patients used each of the seven coping behavior patterns, according to the scores given for coping behavior for fatigue. There was a significant difference among the scores for the seven coping behavior patterns ($F = 22.3$, $P < 0.001$), indicating that coping behavior patterns differ in their frequency. Among them, the scores for "actively seeking social contact" and "regulation of energy expenditure" were particularly high (scores for these patterns of coping behavior, 0.80 and 0.72, respectively), showing that these two patterns were the most frequently adopted coping responses for fatigue.

Relationship between severity of inflammation and patterns of coping behavior

We examined whether the patterns of coping behavior differ for varying degrees of inflammation in the RA groups. As shown in Fig. 3, a significant difference was noted between the inflammatory and noninflammatory groups in the behavior of "reducing the burden on the body" ($P < 0.01$). No significant difference was noted between these two groups in the other coping behavior patterns.

Relationship among extent of fatigue, fatigue symptoms, and patterns of coping behavior

As shown in Table 4, whether the patterns of coping behavior vary according to the extent of fatigue and fatigue symptoms was investigated. In examining the correlation between the extent of fatigue and coping behavior patterns, positive correlations were found between the scores for the severity of the fatigue sensation and "reducing the burden on the body" ($r = 0.28$, $P < 0.001$). It was shown that RA patients used this coping behavior for increasing degrees of fatigue.

When the correlation between the patterns of coping behavior and the characteristics of fatigue symptoms were examined, "reducing the burden on the body" was found to be related to all characteristics of fatigue symptoms, showing a particularly strong correlation with "decline in the strength to carry on the activities of daily life" ($r = 0.43$, $P < 0.001$), "depressive mood" ($r = 0.32$, $P < 0.001$), and "difficulty in performing daily activity" ($r = 0.32$, $P < 0.001$). "Regulation of energy expenditure" was positively related to the characteristics of the fatigue symptom

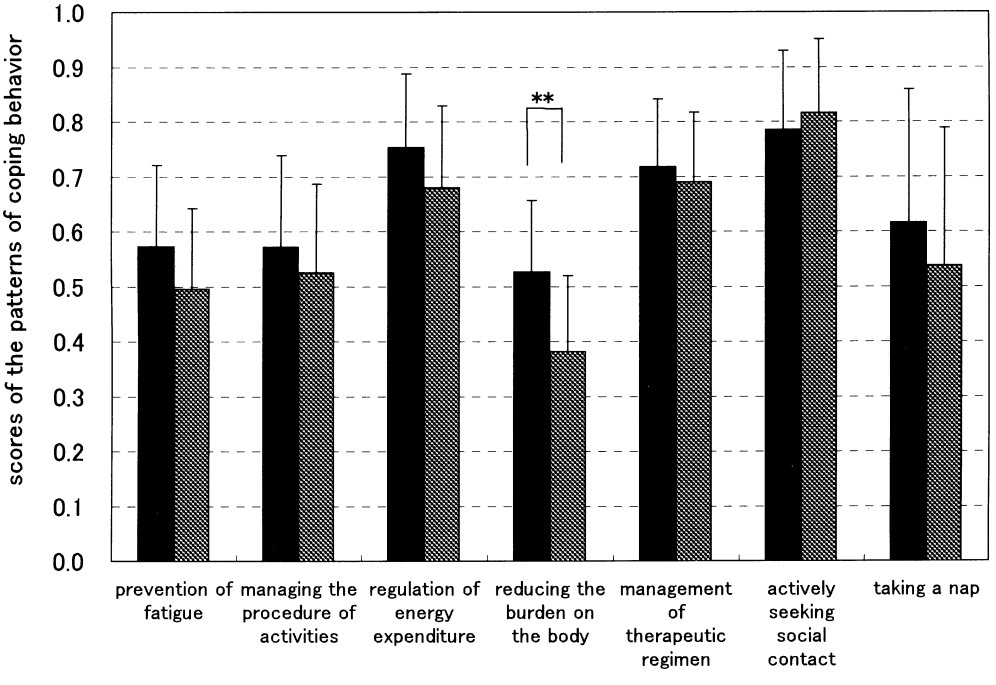

Fig. 3. Comparison of the scores for patterns of coping behavior between the inflammatory group ($n = 105$) and the noninflammatory group ($n = 72$). *Black boxes*, inflammatory group; *gray boxes*, noninflammatory group. The vertical axis denote scores for the patterns of coping behavior. Statistical analysis was performed using the Mann–Whitney *U* test. Data are presented as mean + SD (**$P < 0.01$)

Table 4. Relationship among scores for degree of fatigue, fatigue symptoms, and patterns of coping behavior in patients with rheumatoid arthritis ($n = 177$)

Patterns of coping behavior	Prevention of fatigue	Managing the procedure of activities	Regulation of energy expenditure	Reducing the burden on the body	Management of therapeutic regimen	Actively seeking social content	Taking a nap
Extent of fatigue	0.03	−0.04	0.11	0.28***	−0.02	−0.07	0.14
Fatigue symptoms							
1. Depressive mood	0.07	−0.12	0.15	0.32***	0.04	−0.06	0.18*
2. Decline in the strength to carry on ADL	0.12	−0.03	0.23**	0.43***	−0.02	−0.04	0.17*
3. Difficulty in performing daily activities	0.12	0.11	0.15	0.32***	−0.11	0.01	0.06
4. Drowsiness	−0.01	−0.03	0.01	0.23**	−0.07	0.06	0.07
5. Tendency to make mistakes	0.01	−0.10	−0.01	0.20**	−0.04	−0.01	−0.02

ADL, activities of daily life. The correlation between fatigue and coping behavior was analyzed by correlation coefficient (Pearson's r). * $P < 0.05$; ** $P < 0.01$; *** $P < 0.00$

"decline in the strength to carry on the activities of daily life" ($r = 0.23$, $P < 0.01$).

Discussion

The results of the study indicated that the extent of fatigue experienced by RA patients is strongly related to the severity of inflammation, subjective symptoms of fatigue perceived in relation to the severity of inflammation vary, and these patients adopt various types of coping behavior in response to the extent of fatigue and subjective symptoms.

When the extent of fatigue is examined in relation to inflammation severity, the scores given to the fatigue experienced by the inflammatory group were notably high, while there was no difference between the extent of fatigue felt by the noninflammatory group and the control group. This indicates that the presence (or absence) of inflammation is a significant factor affecting the extent of fatigue sensations in RA. This finding was in agreement with the results of earlier studies in which a significant relationship between the extent of fatigue and inflammation was described. It can thus be readily inferred that systemic inflammation, such as seen in RA, raises the body temperature, and a large quantity of energy derived from nutritional intake is wasted in inflammatory responses. Thus, fatigue felt due to an insufficient supply of energy is unavoidable in the inflammatory group. Furthermore, it is known that in association with inflammation in RA, the production of inflammatory cytokines such as interleukin-1beta (IL-1β) and tumor necrosis factor-alpha (TNFα) is augmented, affecting energy and protein metabolism.[11–13] This is considered to be one of the important factors dictating the extent of fatigue.

The characteristics of fatigue symptoms reported by the RA patients were dominated by "difficulty in performing daily activities," which indicates hardship in conducting the personal chores of daily life, and "decline in the strength to carry on the activities of daily life," which describes a condition where a lack of energy interferes with keeping up with daily activities. These were the physical characteristics of subjective fatigue symptoms. These trends were understandably more pronounced in the inflammatory group. As stated earlier, the patients belonging to this group experience more severe fatigue, and the extent of fatigue is positively correlated with the subjective symptoms of "decline in the strength to carry on the activities of daily life" and "difficulty in performing daily activities." The fact that, in contrast to 34.7% for the noninflammatory group, 76.2% of the RA patients in the inflammatory group are rated class II or have a more severe functional status also attests to the difficulty that these patients with exaggerated inflammation face in daily life. It has been recognized that RA patients often exhibit reduced muscular functions (e.g., muscular strength and endurance), atrophy due to disuse (a result of a decline in physical activities) and factors such as the actions of steroids and other medicaments,[14] and reflex extensor atrophy due to inflammation. Among patients with dysfunctions rated above class II, in particular, this deterioration of muscular functions is notable.[15] Based on these findings, it was concluded that the physical characteristics of subjective fatigue symptoms are more acutely experienced in the inflammatory group.

The presence (or absence) of inflammation did not affect the patient's experience of "depressive mood" or "drowsiness." This finding suggests that these two characteristics of subjective fatigue symptoms are commonly perceived in association with fatigue regardless of the presence of inflammation. The "tendency to make mistakes" was a unique psychological characteristic of subjective fatigue symptom among the healthy control group. Perhaps this can be explained by the fact that, in contrast to the RA groups, many belonging to the control group were employed on a full-time basis, and they are more frequently reminded that errors are likely to occur during the performance of work over an extended period.

Corresponding with the differing extent of fatigue and fatigue symptoms due to inflammation, the resultant coping behavior patterns were also found to be dissimilar between the two patient groups. "Reducing the burden on the body" was a unique coping behavior pattern among the inflam-

matory group. This finding shows an effort by the patients to perform work while expending less energy by altering their behavior patterns or their environment, or relying on tools or human resources. This coping behavior pattern was adopted more frequently in proportion to the severity of fatigue, and was positively related to all five characteristics of the fatigue symptoms. It was concluded that "reducing the burden on the body" is an effective coping behavior for rapidly ameliorating the sensation of fatigue.

On the other hand, a psychological response, "actively seeking social contact," is the most commonly employed coping reaction adopted by RA patients. Like the prophylactic coping behaviors "regulation of energy expenditure," "prevention of fatigue," and "management of therapeutic regimens," the frequency of reliance on this approach is unrelated to the severity of inflammation. It may be presumed that these coping behavior patterns represent a way to adapt to life while suffering from RA, and patients turn to these methods daily regardless of the presence of inflammation.

For RA patients who undergo a chronic course characterized by periods of remission and aggravation, the fatigue, together with pain, is an important warning alerting the patient to an approaching change in the disease course. The fatigue also necessitates readjusting one's life and easing the difficulty in daily living that accompanies the symptom changes.

For patients to develop their own strategies to manage the symptoms, it is essential that they receive adequate and specific education on symptoms and coping approaches. The relationship between inflammation and the extent of fatigue and diverse subjective fatigue symptoms caused by inflammation serve as useful information in self-monitoring symptoms by patients. The coping behavior (corresponding to the extent of fatigue) and the necessary prophylactic behavior (unrelated to the presence of inflammation) offer specific behavioral indices that are important for patients in learning strategies to manage their symptoms. In particular, self-monitoring of fatigue, which varies depending on the disease activity of RA, and developing the prophylactic coping behavior before becoming completely exhausted are most effective in conserving energy.[16,17]

Confidence, fortified by an experience in which the symptoms were successfully controlled or reduced by patients themselves, is an important psychological factor in continuing efforts to keep to a therapeutic regimen and determining their quality of life.[18,19] Patient education to show specific coping methods to suit individual symptoms will aid patients in succeeding in combating the disease and gaining confidence in doing so. It is anticipated that the results of this study will serve as valuable data in assisting RA patients in their self-management of fatigue.

In future, it is necessary that factors other than inflammation which affect fatigue and coping behavior are examined, and that an effective logical basis for supporting patients in their efforts at self-management are investigated.

Conclusion

The extent of fatigue and the fatigue symptoms perceived by RA patients are strongly related to the severity of inflammation. The extent of fatigue was higher in the inflammatory group than in the noninflammatory and control groups. The characteristics of fatigue symptoms in the inflammatory group were "decline in the strength to carry on the activities of daily life" and "difficulty in performing daily activities." RA patients use various coping behaviors in response to the extent of fatigue and subjective symptoms. "Reducing the burden on the body" is an effective coping behavior for patients in the inflammatory group.

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