Pain Perception and Personality Measures as Discriminators in the Classification of Fibrositis

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Abstract. **Twenty patients with fibrositis were compared to age and sex matched groups of patients with rheumatoid arthritis (RA) and normal controls regarding personality variables measured by the Basic Personality Inventory (BPI) and responsiveness to experimentally induced pain. The group with fibrositis scored significantly higher than the normal group on 4 of the BPI scales and had lower pain threshold and tolerance than the normal group. The group with RA was found to be significantly different from the normal group on hypochondriasis and pain tolerance. Using only pain and personality measures, a statistical discriminant function that was developed resulted in a 72% classification accuracy for the 3 groups studied and 85% accuracy when only the 2 clinical groups were considered. (*J Rheumatol 1987;* 14:563–569)**

Key Indexing Terms:
FIBROSITIS FIBROMYOSITIS FIBROMYALGIA RHEUMATOID ARTHRITIS
PERSONALITY ASSESSMENT PAIN THRESHOLD PAIN TOLERANCE

The terms fibrositis, fibromyalgia and fibromyositis have been used to describe a clinical syndrome that is characterized by a chronic and diffuse muscular aching accompanied by areas of exquisite sensitivity in specific "tender points" in the absence of laboratory, radiographic and examination evidence of inflammatory disease[1-3]. The syndrome is also often associated with sleep disturbance[4] and is most frequently found in women in early middle age[5].

Although fibrositis has been thought of as a disorder of pain perception[1], few studies have published data on responsiveness to noxious stimulation in these patients. Campbell, *et al*[6], using the dolorimeter, found that a group of 22 patients with fibrositis did not have significantly different pain thresholds and tolerances at control points than a group of age, sex and clinic matched controls. However, a recent paper reported that patients with fibrositis had decreased thresholds to a painful sound stimulus as compared to normal controls[7].

Several studies have examined psychological variables that may be associated with fibrositis. Payne, *et al*[5] found that a group of hospitalized patients with fibrositis scored generally higher on some Minnesota Multiphasic Personality Inventory (MMPI) scales than a matched group of hospitalized patients with rheumatoid arthritis (RA). They also noted a large variability of scores within the group with fibrositis. It was suggested that fibrositis might not be solely a somatic disorder, but one in which psychological factors play a large part.

Ahles, *et al*[8] reported that ambulatory patients with primary fibromyalgia had 8 significantly elevated scales on the MMPI when compared with normal controls, and 4 when compared with a group of patients with RA. It was further shown that the group with fibromyalgia was not homogeneous, but consisted of 3 subgroups which differed from each other on MMPI scales. Wolfe, *et al*[9] examined MMPI and Arthritis Impact Measurement Scale (AIMS) scores for patients with primary fibrositis and those with RA and fibrositis. Both groups had elevations on the "neurotic" scales of the MMPI; the group with primary fibrositis showed elevations on an additional 3 scales. As well, the primary fibrositis, but not the RA and fibrositis group, showed statistically significant elevations on the anxiety and depression scales of the AIMS. Wolfe, Cathey and Kleinheksel[10] also noted significant elevations in depression and anxiety, as well as pain, among patients with RA and fibrositis compared with those suffering only RA. In contrast, Clark, *et al*[11] using the Beck Depression Inventory, the Spielberger State-Trait Anxiety Inventory, and the SCL-90, found no significant differences in personality variables between patients with fibrositis symptoms attending a general medical clinic and clinic patients without fibrositis but with a high incidence of musculoskeletal pain.

Consequently, there is still some uncertainly in the literature as to whether patients with fibrositis do, indeed, have alterations in particular personality dimensions. Moreover, the nature of pain perception in patients with fibrositis has not been conclusively demonstrated. Our study examined both pain responsiveness and personality variables in a group of patients with fibrositis as well as matched patients with

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RA and normal controls. The data were then used to develop a mathematical function that sought to discriminate among subjects in the 3 diagnostic groups based on differences in pain perception and personality measures alone.

MATERIALS AND METHODS

Subjects. Sixty subjects participated in our study, with 20 individuals/group. All clinical subjects were drawn from the outpatient population of the Rheumatic Disease Unit of University Hospital, London, ON. The protocol was approved by the Health Sciences Ethics Committee and informed consent was obtained before a session began.

Group 1 consisted of the first 20 consecutive consenting patients with the diagnosis of fibrositis according to the criteria of Smythe and Moldofsky[12]. They displayed (a) a chronic widespread muscular aching of at least 3 months' duration, (b) a nonrestorative sleep pattern, (c) morning stiffness and fatigue, (d) localized tenderness at 12 or more of 14 specific sites, and (e) normal erythrocyte sedimentation rates, TSH levels and roentgenograms, although age related degenerative changes were permitted. This group had a female:male ratio of 4:1 and a mean age of 43.7 years with a standard deviation of 11.3 years. The other 2 groups were age and sex matched to the subjects in Group 1 (Table 1). Group 2 consisted of 20 ambulatory subjects with the diagnosis of classical or definite RA[13]. These subjects were free of the signs of fibrositis. The 20 subjects in Group 3 were normal healthy volunteers from the community. Participants were requested not to take any analgesics or nonsteroidal antiinflammatory drugs for a minimum of 12 h before testing. No subjects were taking antidepressant medication at the time of the study. Further, all subjects in the study were Caucasian with a good command of English.

Materials. Pain threshold and tolerance were determined for 3 stressors widely used in experimental studies of pain responsiveness[14,15]. These were selected because they differ in transduction processes, time dependent vs intensity dependent changes in discomfort, and degree of anxiety and other psychological characteristics associated with their presentation[16]. As well, measures of ongoing pain and personality characteristics were obtained.

Electrical stimulation. A Fredrick Haer and Company (Brunswick, ME) constant current stimulator delivered trains of 35 one-msec monophasic square wave pulses, separated by 10 msecs, to the skin over the first dorsal interosseous muscle. Current was applied through Grass silver electrodes filled with conductive cream and was increased gradually from 0 to a maximum of 7.5 mA or to that point when the subject verbally indicated that he or she was unwilling to allow a further increase.

Constant pressure. A modified Forgione-Barber constant pressure algometer[17] was used to apply a pressure of 3000 g through a lucite wedge to a point on the lateral surface of the radius at the junction of the middle and the lower 3rds. The experimenter placed the weight on the subject's arm and removed it immediately when tolerance was verbally indicated or the upper limit of 3 min was reached.

Dolorimeter. A variable pressure dolorimeter (John Chatillon & Sons, Kew Gardens, NY) was used, with a range of 0 to 9 kg and a contact head whose surface area was equal to 1.54 cm^2. Pressure was applied to a point midway between the styloid process of the radius and the lateral epicondyle of the humerus with the arm pronated and supported. This point was not spontaneouly tender to mild pressure before testing began. Pressure was increased gradually by the experimenter and was removed as soon as tolerance was indicated verbally by the subject or the upper limit of 9 kg was reached.

Table 1. *Subject characteristics*

		RA	Fibrositis	Normal
Male:Female ratio		1:4	1:4	1:4
N/group		20	20	20
Age (years)	Mean	45.3	43.7	41.3
	SD	11.0	11.3	12.0
Duration of pain problem (years)	Mean	5.8	6.7	0.7
	SD	6.9	4.4	1.7

Visual analogue scale. A 15 cm line with word delimiters at either end (no pain, the most intense pain imaginable) was employed to obtain a measure of the endogenous present pain intensity (PPI) of each subject[18].

Basic Personality Inventory (BPI). This is a 240-item questionnaire consisting of 11 clinical scales and one critical item scale[19,20]. Each scale has 20 items, 10 true keyed and 10 false keyed, except for the deviation scale which has 20 true keyed items. Items on this test are self-descriptions of activities, interests, or characteristic behaviors. Unlike the MMPI, which is empirically derived, the BPI is based upon a construct oriented approach to test development which emphasizes (1) the role of psychological theory in selecting potential items; (2) convergent and discriminant validity in item selection procedures; and (3) scale homogeneity and generalizability[20]. Consequently, each scale is independent of the others. Psychometric properties of the BPI have been established in recent studies[21,22], as has its utility in medical settings[23-25].

Procedure. After completion of the BPI, each subject's PPI was assessed using a visual analogue scale. Determination of responsiveness to experimentally induced discomfort followed, with each of the 3 stressors delivered in random order, allowing for one of 6 possible sequences.

Subjects were asked to indicate when the stimulus became painful (pain threshold) and then to say at what point they wished the stimulus to cease (pain tolerance). Before each stressor was presented, the subject was asked to tolerate the stimulus to the greatest extent possible, but was also told that the presentation would cease immediately when he or she indicated that tolerance had been reached. In this manner, 3 measures of pain threshold and 3 of pain tolerance were obtained. None of the points chosen for stimulation was tender to light pressure by palpation before testing.

RESULTS

Subject characteristics. The groups were matched equally for age and sex (Table 1). The mean age was in the early forties. Only 3 subjects in the normal group reported having pain at the time of testing (a 65-year-old male with 4 years of hip pain, a 39-year-old female with 5 years of head and neck pain, and a 40-year-old female who had been suffering from recurrent headache for 5 years). This is consistent with previous findings of pain in the general population[26]. Univariate analysis of variance (ANOVA) was performed on the data for duration of pain problem and present pain intensity. These revealed a significant difference in the length of symptoms between the 3 groups ($F = 7.86$, $p < .001$). This was due to the inclusion of the normal group data. However, there was no significant difference in the length of time from onset of symptoms in the 2 clinical groups (Duncan's multiple range test (MRT), $p > .05$)[27]. As shown in Figure 1, there was a large significant difference in present pain intensity between the 3 groups ($F = 16.07$, $p < .0001$). Duncan's MRT also revealed a significant difference in PPI between the groups with RA and fibrositis and the normal and the fibrositic groups ($p < .05$), but not between the normal and RA groups.

Physical measures. Figures 2, 3, and 4 illustrate threshold and tolerance data for each of the 3 stressors. For trains of electrical pulses, there were generally substantial mean differ-

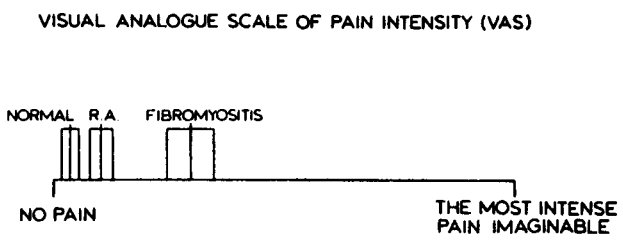

Fig. 1. Scores of present pain intensity for normal controls, patients with fibrositis and patients with RA on a visual analogue scale. The line in the center of each rectangle represents the mean value for that group; the right and left borders indicate plus and minus 1 standard error of the mean, respectively.

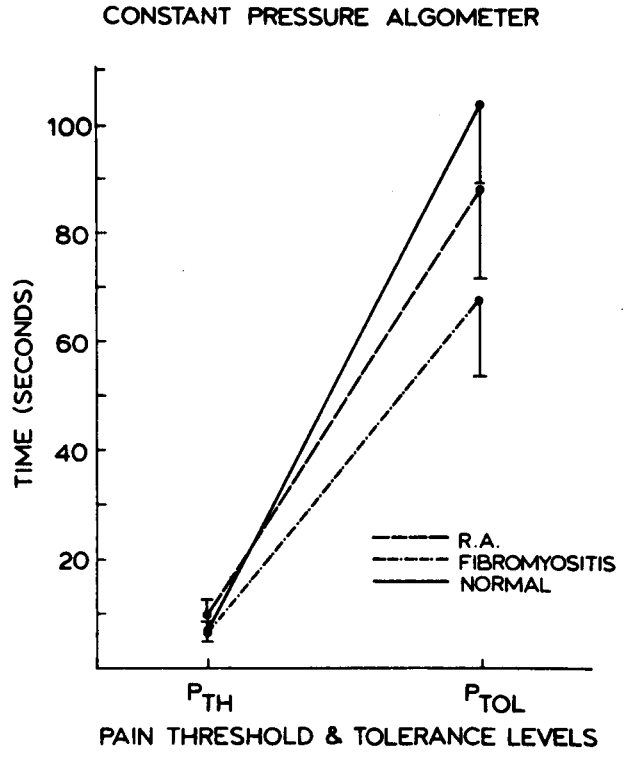

Fig. 2. Pain threshold and tolerance for the 3 groups when using trains of electrical pulses. The data points represent the mean values and the bars represent 1 standard error of the mean. All F scores are not significant.

ences between the groups on both threshold and tolerance measures (Figure 2), but there were also large within group variances. Although the group with fibrositis was lower than the normal group on both electrical threshold and tolerance and lower than the group with RA on tolerance, these measures did not demonstrate statistically significant differences.

With the constant pressure algometer measures, a similar trend was evident (Figure 3). Again, there were sizable mean differences between the groups on tolerance, with the group with fibrositis showing the lowest value, but there were also large within group variances for each measure with no statistically significant differences found between the groups.

For the dolorimeter, the group with fibrositis was lower than the 2 other groups on both threshold and tolerance

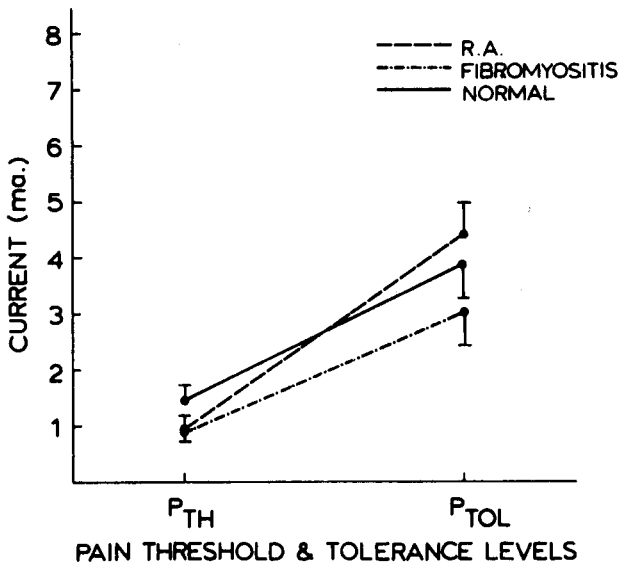

Fig. 3. Pain threshold and tolerance for the 3 groups when using a constant pressure algometer. The data points represent mean values and the bars represent 1 standard error of the mean. All F scores are not significant.

(Figure 4). Here, however, the within group variance was much less for each measure. ANOVA indicated a significant group difference for threshold ($F = 3.83$, $p < .03$) and for tolerance ($F = 7.54$, $p < .001$). For pain threshold, the significant difference lay between the normal group and the group with fibrositis (Duncan's MRT, $p < .05$). For pain tolerance, there were 2 significant differences. The first lay between the normal group and the group with fibrositis; the 2nd was between the normal group and the group with RA (Duncan's MRT, $p < .05$). In each case the group with fibrositis had the lowest values and the normal group the highest.

BPI scores. Of the 12 scales of the BPI (Table 2), 4 showed a significant difference between the 3 groups (by univariate ANOVA). These were hypochondriasis, depression, anxiety

Table 2. *Analysis of variance of Basic Personality Inventory scores*

Scale	F Ratio	Probability
1. Hypochondriasis	18.96	< .00001
2. Depression	5.13	< .0089
3. Denial	1.31	< .275
4. Interpersonal problems	1.95	< .151
5. Social deviation	0.41	< .662
6. Persecutory ideas	0.27	< .761
7. Anxiety	4.02	< .023
8. Thinking disorder	2.75	< .072
9. Impulse expression	1.54	< .222
10. Social introversion	3.19	< .048
11. Self deprecation	0.47	< .662
12. Deviation	0.60	< .552

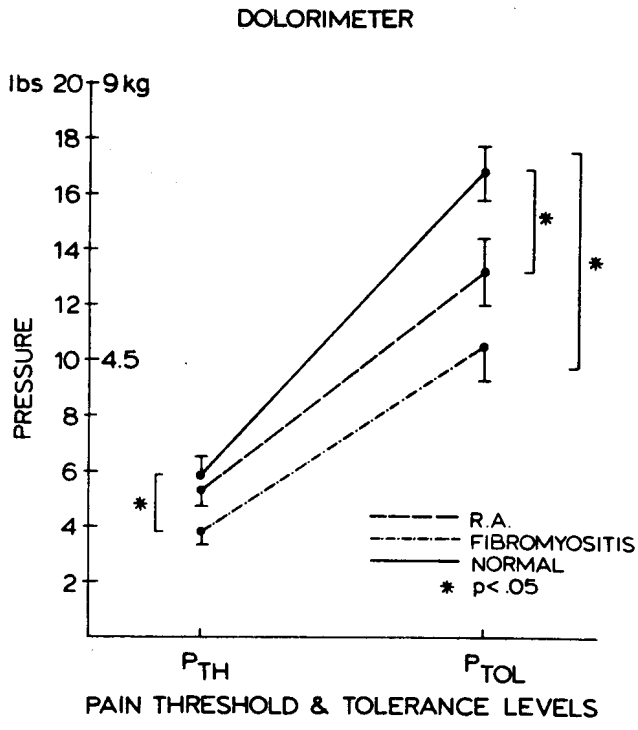

Fig. 4. Pain threshold and tolerance for the 3 groups when using a variable pressure dolorimeter. The data points represent mean values and the bars represent 1 standard error of the mean. The asterisks indicate those differences which are statistically significant.

and social introversion. Table 3 presents the scores on these scales. For hypochondriasis, a significant difference was found betweeen each of the groups (Duncan's MRT, $p < .05$), with the group with fibrositis having the most elevated score and the normal group the lowest. For each of depression, anxiety and social introversion, a significant difference (Duncan's MRT, $p < .05$) lay between the normal group and group with fibrositis only, with the latter group having higher scores than the normal group.

Discriminant function analysis. An *a priori* expectation was that significant differences would be found between the groups on 3 pain measures: pain threshold, tolerance and PPI, and on the personality measures of hypochondriasis, depression and anxiety. Using these 6 variables, a series of discriminant functions[28] were developed which substituted, in turn, the threshold and tolerance measures for each of the 3 stressors along with the other 4 variables. The purpose of the discriminant functions, in this context, was to separate the groups maximally on a weighted series of variables and to classify the subjects as correctly as possible into their respective groups. Each variable was entered directly into the analysis because no *a priori* assumption had been made regarding their relative importance.

A highly significant separation into 3 groups was achieved using the dolorimeter threshold and tolerance measures, the PPI, and the 3 personality variables ($\chi^2 = 59.75$, $p < .00001$). Table 4 presents the actual group membership as well as the group membership assigned by the discriminant function. Of all cases, 71.67% were correctly classified, compared to a chance distribution of 33.33%. The group with fibrositis was the least ambiguous, with 80% accurate assignment. The members of the group with RA were classified with 60% accuracy; those that were wrongly assigned resembled the normal group (25%) more than they did the group with fibrositis (15%). None of the normal subjects was misclassified into the fibrositic group, but 25% were assigned to the group with RA.

Table 4. *Discriminant function classification*

A. For 3 groups

Actual Group	N	Predicted Group Membership		
		RA	Fibrositis	Normal
RA	20	12	3	5
Fibrositis	20	3	16	1
Normal	20	5	0	15

Discriminant Function	% of Variance	Wilk's Lambda	χ^2	p
1.	96.09	.334	59.75	$p < .00001$
2.	3.91	.932	3.83	$p < .573$

Percent of grouped cases correctly classified 71.67%

B. For 2 groups.

Actual Group	N	Predicted Group Membership	
		RA	Fibrositis
RA	20	17	3
Fibrositis	20	3	17

Discriminant Function	% of Variance	Wilk's Lambda	χ^2	p
1.	100	0.499	24.31	$p < .0005$

Percent of grouped cases correctly classified 85%.

Table 3. *Characteristics of the significant personality measures*

Scale	RA		Fibrositis		Normal		Duncan's ($p < .05$)
	Mean	SD	Mean	SD	Mean	SD	Between
Hypochondriasis	6.9	2.9	10.3	3.6	4.1	2.8	Fib > RA > Normal
Depression	4.0	3.6	5.6	4.0	2.2	2.0	Fib > Normal
Anxiety	7.0	2.5	8.0	3.1	5.7	2.1	Fib > Normal
Social introversion	4.4	3.2	5.8	4.1	3.3	1.7	Fib > Normal

In a similar manner, and perhaps more clinically meaningful, a discriminant function based on personality variables, present pain, and pain responsiveness significantly separated the 2 patient groups. Here, the maximally correct classification to groups was found using constant pressure threshold and tolerance and the other 4 variables ($\chi^2 = 24.31$, $p < .0005$) (Table 4). Only 3 cases in each group were misclassified, resulting in a correct classification rate of 85% compared to a chance level of 50%.

A graphic representation of the ability of this statistical procedure to separate the clinical groups, using only pain and personality measures, is shown in Figure 5. The weighted scores for present pain, personality variables and threshold and tolerance were combined to obtain values for each individual along a discriminant function continuum. The great majority of patients with fibrositis are easily distinguishable from those patients with RA. The normal group appears separated from the 2 patient samples, a finding that is even more readily apparent from a complex 2-dimensional representation which emerges from the 3 group discriminant analysis described above.

Confirmatory stepwise discriminant analysis of these data revealed that the greatest weight is given to PPI and hypochondriasis scores. The addition of threshold and tolerance data is particularly useful in improving the discrimination capacity when the 3 groups are considered.

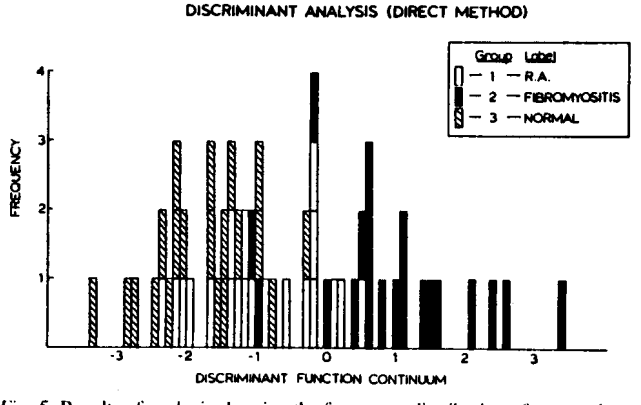

Fig. 5. Results of analysis showing the frequency distribution of scores along a discriminant function continuum for each of the 60 individuals comprising the 3 groups.

DISCUSSION

The population studied was largely women in early middle age and female to male ratio of 4:1, agreeing with demographic data from earlier studies with patients with fibrositis[2,5]. The patient groups had been experiencing pain from their conditions for an average of about 6 years.

The group with RA was not found to be significantly different from the normal group on any of the threshold measures, but was significantly lower on dolorimeter pain tolerance. Huskisson and Hart[29] also failed to find a difference between the thresholds of patients with RA and normals using pressure pain.

The patients with fibrositis had a significantly reduced pain threshold and tolerance to the dolorimeter when compared to the normal group, but no significant difference was demonstrated on these between the groups with fibrositis and RA. Thresholds and tolerances of patients with fibrositis were also lower than those of the comparison groups on the other 2 stressors, but these differences were not statistically significant. These data are in agreement with those of Campbell, *et al*[6] who also did not find a significant difference in dolorimeter pain threshold and tolerance, at nontender points, between their sample of patients with fibrositis and matched clinic patients.

There were large individual differences, and thus large within group variances, for the other 2 stressors (constant pressure and trains of electrical pulses), in agreement with previous research[16,30,31]. These data suggest that between subject differences are smallest for the dolorimeter, which induces a rapidly rising (phasic) pain, and that methods employing this stressor are most sensitive in discriminating between patient and control groups. Further, the dolorimeter is relatively nonthreatening to the patient and is easily portable. Repeated measures of pain threshold and tolerance over time are readily obtainable and may be a useful indicator of patient reaction to treatment.

Previous research[32,33] has indicated that pain perception may alter in reaction to disease processes and may return towards normal values after amelioration of the symptoms. It would be instructive to follow a series of patients with fibrositis over time and match their symptomatology and response to treatment with changes in pain perception. Such a study is currently nearing completion at this center.

Earlier studies of personality characteristics associated with chronic pain in general[34], and with RA and fibrositis in particular[35,36], have often used the MMPI as their assessment tool. Considerable elevation has been reported on those scales which emphasize mood and personal emotional adjustment, such as hypochondriasis, depression, and anxiety. Consequently, it was an *a priori* expectation that the corresponding scales of the construct oriented BPI would also show the largest differences between patient and normal groups. This expectation was confirmed. The whole BPI was administered to replicate the usual testing session and to avoid drawing undue attention to a limited sample of questions. However, only the scales mentioned above were intended for inclusion in the discriminant function analysis. In our study, the group with fibrositis scored significantly higher than the normal control group on each of hypochondriasis, depression and anxiety plus social introversion. The group with RA showed a mild, but statistically significant, elevation on the hypochondriasis scale when compared to the normal group; the value for the group with RA was, however, significantly lower than that of those with fibrositis.

Some studies on the relationship between pain and personality profiles, particularly those obtained using the MMPI, have been the subject of recent criticism because the MMPI was not designed to detect psychopathology in pain patients[37-40]. In fact, as Smythe[39] has pointed out, the wording of the questions is such that a patient suffering from a painful disorder will almost invariably tend to score high on the scales of the "neurotic triad" of hypochondriasis, depression and hysteria. Furthermore, since a reply to one question may contribute to the score on more than one scale, the MMPI test construction methods fail to give rise to independent dimensions[41]. The personality inventory used in our study, the BPI, was designed to avoid this pitfall.

Of the 20 items which contribute to the hypochondriasis scale of the BPI, it seems that 6 might be included among the symptomatic features for fibrositis (for example, difficulty in keeping fit, presence of aches and pains, bodily discomfort). One is questionable (trouble arising from joints). On average, patients with fibrositis endorse 10.3 items. Seven items might be symptomatic features of RA; 6.9 are endorsed on average. Consequently, although the BPI hypochondriasis scale is subject to some of the same concerns which have been expressed about the MMPI, patients with fibrositis do appear to endorse some additional items. Normals, however, do so as well. The hypochondriasis scale, therefore, must be interpreted with caution, since portions of it could be considered a symptom checklist.

Similar analyses can be applied to the depression and anxiety scales. On the former, only one or 2 items are closely linked to physical disorders. Therefore, the mean fibrositic score of 5.6 out of 20 represents a marked elevation compared to 2.2 for the normal controls. Likewise, examination of the items contributing to the anxiety scale reveals that only one or 2 are closely linked to physical disorders. Here, patients with fibrositis scored 8.0 out of 20, a value significantly greater than the 5.7 obtained for the normal group.

In view of this analysis, the elevated score of the group with fibrositis on the hypochondriasis scale of the BPI may simply indicate the presence of a disease process. The significant elevations on depression and anxiety, however, deserve further examination. The moderately high depression scores are possibly secondary to the physical disability, as similar scores on the BPI are obtained by a group of patients suffering from renal failure and treated by continuous ambulatory peritoneal dialysis[23]. Less certain is the interpretation of the elevated anxiety scores. Fear of minor matters, even an idea, and apprehension about a wide range of daily events point to the possibility of some psychogenic factors accompanying the fibrositis syndrome.

The group with RA had only one significantly raised personality test score, and that could be entirely attributed to symptomatology. Our study did not find significant elevations for the group with RA on the denial and depression scales as might have been expected from the previous literature[42]. This may have been due, in part, to the experimental design. Emphasis was placed on matching the demographic characteristics of the patients with RA to those of the group with fibrositis. It is possible that the use of a larger sample size differing in age, sex ratio, functional disability and present pain, may have revealed significant alterations on other personality measures and the response to experimentally induced pain. However, extension of these results to a larger sample of almost 70 patients with RA indicates considerable support for each of the findings reported here[43].

Chapman[44] theorized that patients with long lasting pain would become more reactive to a stimulus which previously had not been perceived as being painful. Such "hypervigilance" may be part of a general pattern in which increased reactivity to noxious stimuli is related to anxiety, depression and high levels of disease activity. Malow, *et al*[45] reported that patients with myofascial pain dysfunction syndrome conformed to a hypervigilance paradigm, with lower pain thresholds for constant pressure than normal controls. Myofascial pain dysfunction syndrome has also been associated with anxiety and depression in the past[46,47]. To this extent, and to the extent that the etiology of the condition is still subject to some debate, the patients with myofascial pain dysfunction resemble those in the group with fibrositis. Severe and unremitting discomfort may sensitize patients in both groups to pain and cause a reactive elevation on selected personality measures. This may be one explanation for the hypervigilant and hyperreactive pattern found in the patients with fibrositis in our study, when compared to the normal subjects. However, patients suffering from some other painful disorders show an increased threshold and tolerance[48]. Clearly, the relationship between disease, pain responsiveness and personality characteristics is a complex one that has not yet been fully eluciated.

The discriminant functions which were developed to separate the groups maximally on the basis of hypochondriasis, anxiety, depression and the 3 pain measures of PPI, dolorimeter threshold and dolorimeter tolerance, demonstrate that the members of the group with fibrositis are readily identifiable. They are not only different from normal subjects but also different from those with RA. The group with RA of this sample is more difficult to distinguish from normal subjects on the basis of psychophysical and psychological variables.

Present research is attempting to define more accurately the constellation of symptoms that make up the descriptive label of fibrositis. The present confirmation and extension of earlier studies[5,6,8,29], and, in particular, the demonstration of significant differences between patients with fibrositis and normal controls in both perceptual performance and scores on selected personality scales, suggests that a process which combines subjective pain reports, personality measures and psychophysical indices may complement the conventional diagnostic procedures.

REFERENCES

1. Smythe HA: "Fibrositis" as a disorder of pain modulation. *Clin Rheum Dis 1979;*5:823-832.
2. McCain GA: Fibromyositis. *Mod Med Can 1983;*38:197-207.
3. Yunus MB: Fibromyalgia syndrome: a need for uniform classification. *J Rheumatol 1983;*10:841-844.
4. Moldofsky H, Scarisbrick P, England R, *et al:* Musculoskeletal symptoms and non-REM sleep disturbance in patients with "fibrositis syndrome" and healthy subjects. *Psychosom Med 1975;*4:341-351.
5. Payne TC, Leavitt F, Garron DC, *et al:* Fibrositis and psychologic disturbance. *Arthritis Rheum 1982;*25:213-217.
6. Campbell SM, Clark S, Tindall EA, *et al:* Clinical characteristics of fibrositis. I. A "blinded," controlled study of symptoms and tender points. *Arthritis Rheum 1983;*26:817-823.
7. Gerster J-C, Hadj-Djilani A: Hearing and vestibular abnormalities in primary fibrositis syndrome. *J Rheumatol 1984;*11:678-680.
8. Ahles TA, Yunus MB, Riley SD: Psychological factors associated with primary fibromyalgia syndrome. *Arthritis Rheum 1984;*27:1101-1105.
9. Wolfe F, Cathey MA, Kleinheksel SM, *et al:* Psychological status in primary fibrositis and fibrositis associated with rheumatoid arthritis. *J Rheumatol 1984;*11:500-506.
10. Wolfe F, Cathey MA, Kleinheksel SM: Fibrositis (fibromyalgia) in rheumatoid arthritis. *J Rheumatol 1984;*11:814-818.
11. Clark S, Campbell SM, Forehand ME, *et al:* Clinical characteristics of fibrositis. II. A "blinded," controlled study using standard psychological tests. *Arthritis Rheum 1985;*28:132-137.
12. Smythe HA, Moldofsky H: Two contributions to the understanding of "fibrositis" syndrome. *Bull Rheum Dis 1977;*28:928-931.
13. Ropes MW, Bennett GA, Cobb S, *et al:* 1958 Revision of diagnostic criteria for rheumatoid arthritis. *Bull Rheum Dis 1958;*4:175-176.
14. Scudds RA: Pain assessment. *Aust J Phys Ther 1983;*29:96-102.
15. Rollman GB: Multiple subjective representations of experimental pain. In: Bonica JJ, Liebeskind JC, Albe-Fessard DG, eds. *Advances in Pain Research and Therapy,* New York: Raven Press, 1983;3:865-869.
16. Harris G, Rollman GB: The validity of experimental pain measures. *Pain 1983;*17:369-376.
17. Forgione A, Barber TX: A strain gauge stimulator. *Psychophysiol 1971;*8:102-106.
18. Scott J, Huskisson EC: Graphic representation of pain. *Pain 1976;*2:175-185.
19. Reddon JR, Holden RR, Jackson DN: Desirability and frequency of endorsement scale values and endorsement proportions for items of the Basic Personality Inventory. *Psychol Rep 1983;*52:619-633.
20. Holden RR, Reddon JR, Jackson DN, *et al:* The construct heuristic applied to the measurement of psychopathology. *Multivariate Behav Res 1983;*18:37-46.
21. Kilduff RA, Velicer WF: Reliability and faking susceptibility of the Basic Personality Inventory. *J Clin Psychol 1987;* in press.
22. Hill TD, Jackson DN: *Parallel Forms for the Basic Personality Inventory.* Research Bulletin 616, Department of Psychology, University of Western Ontario, 1984.
23. Burton HJ, Canzona L, Wai L, *et al:* Life without the machine: A look at psychological determinants for successful adaptation of patients on CAPD. In: Leung NB, ed. *Psychonephrology II: Psychological Problems in Kidney Failure and Their Treatment,* New York: Plenum, 1983:159-174.
24. Burton HJ, Kline SA, Lindsay RM, *et al:* The relationship of depression to survival in chronic renal failure. *Psychosom Med 1986;*48:261-269.
25. Wai L, Richmond J, Burton H, *et al:* The influence of psychosocial factors upon the survival of home dialysis patients. *Lancet 1981;*2:1155-1156.
26. Crook J, Rideout E, Brown G: The prevalence of pain complaints in a general population. *Pain 1984;*18:299-315.
27. Duncan DB: Multiple range and multiple F tests. *Biometrics 1957;*11:1-42.
28. Cooley WW, Lohnes PR: *Multivariate Data Analysis,* New York: Wiley, 1971.
29. Huskisson EC, Hart FD: Pain threshold and arthritis. *Br Med J 1972;*28:193-195.
30. Clark JW, Bindra D: Individual differences in pain thresholds. *Can J Psychol 1956;*10:69-76.
31. Brown RA, Fader K, Barber TX: Responsiveness to pain: stimulus specificity versus generality. *Psychol Rec 1973;*23:1-7.
32. Nyquist JK, Eriksson MBE: Effect of pain treatment procedures on thermal sensibility in chronic pain patients. *Pain 1981;*(suppl 591):1.
33. Francini F, Maresca M, Procacci P, *et al:* The effects of nonpainful transcutaneous electrical nerve stimulation on cutaneous pain threshold and muscular reflexes in normal men and in subjects with chronic pain. *Pain 1981;*11:49-63.
34. Prokop CK, Bradley LA, Margolis R, *et al:* Multivariate analysis of the MMPI profiles of patients with multiple pain complaints. *J Pers Assess 1980;*44:246-253.
35. Spergel S, Ehrlich GE, Glass A: The rheumatoid personality: a psychodiagnostic myth. *Psychosom 1978;*19:79-86.
36. Weinberger LM: Fibrositis. *West J Med 1981;*135:425-426.
37. Rook JC, Pesch RN, Keeler EC: Chronic pain and the questionable use of the Minnesota Multiphasic Personality Inventory. *Arch Phys Med Rehabil 1981;*62:373-376.
38. Main CJ, Waddell G: Chronic pain, distress and illness behaviour. In: Main CJ, Lindsay WR, eds. *Clinical Medicine and Psychology — A Behavioral Perspective,* New York: Plenum Press, 1982:1-52.
39. Smythe HA: Problems with the MMPI. *J Rheumatol 1984;*11:417-418.
40. Merskey H, Brown J, Brown A, *et al:* Psychological abnormality in persistent headache patients. *Pain 1985;*23:35-48.
41. Jackson DN: The dynamics of structured personality tests. *Psychol Rev 1972;*78:229-248.
42. Cassileth BR, Lusk EJ, Strouse TB, *et al:* Psychosocial status in chronic illness. *N Engl J Med 1984;*8:506-511.
43. Scudds RA, Harth M, Rollman GB: Perception of pain in rheumatoid arthritis. *Proceedings of the Joint International Meeting on Pain,* Halifax: Canadian Pain Society and Intractable Pain Society of Great Britain and Northern Ireland, August, 1985.
44. Chapman CR: Pain: The perception of noxious events. In: Sternbach RA, ed. *The Psychology of Pain,* New York: Raven Press, 1978:169-203.
45. Malow RM, Grim L, Olson RE: Differences in pain perception between myofascial pain dysfunction syndrome patients and normal subjects: a signal detection analysis. *J Psychosom Res 1980;*24:303-309.
46. Lupton DE: Psychological aspects of temporomandibular joint dysfunction. *J Am Dent Assoc 1969;*79:131-137.
47. Speculand B, Goss AN, Hughes A, *et al:* Temporo-mandibular joint dysfunction: pain and illness behaviour. *Pain 1983;*17:139-150.
48. Rollman GB: Measurement of experimental pain in chronic pain patients: methodological and individual factors. In: Melzack R, ed. *Pain Measurement and Assessment,* New York: Raven Press, 1983:265-272.