

## NEUROMODULATION SECTION

### Original Research Article

# Comparison of Pain, Functioning, Coping, and Psychological Distress in Patients with Chronic Low Back Pain Evaluated for Spinal Cord Stimulator Implant or Behavioral Pain Management

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#### Abstract

**Objective.** Subgroups of patients with chronic low back pain may exhibit differences in self-reported measures of pain, functioning, coping, and psychological distress. The present study compared subgroups of patients with chronic low back pain referred either for pre-spinal cord stimulator (SCS) psychological evaluations or for behavioral pain management (BPM).

**Design.** Measures from comprehensive pain, functioning, and psychological assessments were compared using multivariate ANCOVA.

**Setting.** Tertiary care medical outpatient pain management center.

**Subjects.** One hundred and two patients (64% female, mean age = 53.7, standard deviation = 14.3) with chronic low back pain diagnoses were evaluated either as possible candidates for SCS (N = 73) or as part of treatment planning for BPM (N = 29).

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**Methods.** These groups were compared on measures of pain, interference, disability, pain-related anxiety, pain coping, pain catastrophizing, depression, post-traumatic stress symptoms, affective distress, and interpersonal distress assessed using standardized scales. It was hypothesized that the two groups would report similar levels of pain, functioning, and coping, but pre-SCS patients would report fewer psychological symptoms of psychological distress compared with BPM patients in order to gain approval for SCS.

**Results.** Consistent with hypotheses, BPM and pre-SCS patients reported similar pain, functioning, and coping, but pre-SCS patients reported fewer psychological symptoms.

**Conclusions.** Pre-SCS patients possibly under-report psychological symptoms perhaps to gain SCS approval for SCS. Separate norms and cutoffs for pre-SCS psychological evaluations may be needed to better identify risks of unsuccessful outcomes. Validity scales for measures of psychological distress also could be developed to detect biased reporting. Alternatively, referring clinicians may have referred patients for BPM who were more psychologically distressed and perceived as more in need of psychosocial intervention than those referred for pre-SCS evaluations. Further investigation of clinical referral decisions and assessment bias is warranted to clarify the meaning of these differences and how they apply to patient outcomes.

**Key Words.** Assessment; Back Pain; Behavior Therapy; Catastrophizing; Chronic Pain; Coping; Depression; Low Back Pain; Psychology; Spinal Cord Stimulation

## Introduction

Chronic low back pain is a common and costly problem and a public health concern [1]. Psychosocial factors, such as exposure to stress, somatization, depression, anxiety, and poor coping, are associated with poor outcomes in patients with low back pain [2,3]. Psychological distress and poor coping also have been specifically predictive of poor outcomes for patients with chronic low back pain having back surgery or implantation of a spinal cord stimulator (SCS) [4–12]. As such, psychological assessment of risk factors and psychological interventions are included in American College of Physicians and the American Pain Society joint clinical practice guidelines [13].

A number of medical and psychosocial factors are considered when referring patients with chronic low back pain for psychological evaluation, including the perceived level of psychological distress and coping, the complex history of the pain condition and its treatment, and the viability of various treatment options [13,14]. As such, patients may be referred for psychological evaluation for treatment planning for behavioral pain management (BPM), or they may be referred for a psychological screening of psychological risk factors prior to the consideration of SCS implantation.

Although systematic study of referral patterns for psychological evaluation has been limited, patients with pain who demonstrate psychological distress during physician evaluations, or who have histories of psychiatric disorders, may be more likely to be referred for psychological assessment and BPM [15]. Alternatively, patients being considered for surgery, including SCS, often are referred for psychological assessment because it is assumed that poor surgical candidates will be screened out during evaluation, and many third-party payers frequently require psychological assessments prior to approval for surgery [6,9,10]. Recommendations for presurgical psychological evaluations, including pre-SCS psychological assessments, have been made, although the systematic evaluation of SCS outcomes based on these recommendations has been limited and there has been no standardization [9]. A recent review concluded that although the data were limited and further investigation is needed, 92% of studies found positive relationships between psychological factors and poor SCS treatment outcomes, and in particular, somatization, depression, anxiety, and poor coping were most predictive [9]. Especially in the case of SCS, the use of psychological assessment data in subsequent clinical decision making (i.e., proceeding to SCS trial and implant) remains unclear, and the relationship of psychological risk factors to SCS outcomes also needs further study, as recommended in previous work [9,10,12].

While the psychological evaluation of patients with pain is important, patients may bias their reports depending on circumstances and motivation. Specifically, they may deny, minimize, or even exaggerate psychological disturbance in order to meet their own needs, and without validity scales or adjusted norms, this may be undetected

[16]. For instance, patients may underreport psychological disturbance in order to appear “healthy” or “normal” to avoid having to address emotionally painful psychological issues, to resist nonmedical interpretations, to have their pain or other physical complaints taken seriously, or to improve their chances of being selected as a suitable candidate for surgery or SCS implant. Alternatively, patients may exaggerate psychological disturbance as a cry for help or in situations when compensation or disability benefits are pending and the patient perceives that showing greater levels of psychological distress improves their chances of receiving compensation or disability benefits, or avoiding some unwanted responsibility, such as return to work or financial obligations [17]. Detecting these response biases, especially with face valid, self-report measures has been difficult, although some use of symptom validity tests and validity scales have been shown to improve assessment accuracy in patients with pain and possible malingering [18,19]. No previous reports could be found examining whether there may be differences in pain, disability, and psychological functioning between patients referred for pain coping and behavioral treatment compared with those referred for a different reason, such as surgery or SCS.

Comparing subgroups of patients could be useful in characterizing subgroups, detecting biases in responding, and in establishing subgroup norms and cutoff scores to use in more accurately detecting psychological distress and risks to positive outcomes. To that end, in the current study, it was hypothesized that two groups of patients with chronic back pain referred for psychological assessment prior to psychological treatment and in consideration of their candidacy for SCS would report similar levels of pain, functioning, and coping. However, it was expected that pre-SCS patients would report fewer psychological symptoms compared with BPM patients in order to gain approval for SCS.

## Methods

### Subjects

#### Patients

One hundred and two patients (64% female, mean age = 53.7, standard deviation = 14.3) with chronic low back pain were evaluated either as possible candidates for an SCS (N = 73, 45 F/28 M) or as part of treatment planning for BPM (N = 29, 20 F/9 M) in a multidisciplinary, tertiary care medical outpatient pain management center. The demographic characteristics of the sample and comparisons between groups are shown in Table 1. There were no differences in age, sex ratio, race, education, and body mass index between candidates for SCS and BPM patients. The candidates for SCS were more likely to be married. The East Carolina University Medical Institutional Review Board and the Vidant Health Research Committee approved the review of patient charts and collection of relevant research data for the conduct of the current

## Comparison of Patients with Chronic Low Back Pain

**Table 1** Comparison of BPM and pre-SCS groups on demographics and BMI

Group Variable	BPM N = 29 Mean (SD)	Pre-SCS N = 73 Mean (SD)	P Value*
Age	52.41 (15.6)	54.2 (13.9)	0.562
Sex	20 female/9 male	45 female/28 male	0.488
Race			0.836
White	25	60	
Black	4	11	
Other	0	2	
Education	12.5 (2.2)	13.5 (2.2)	0.078
Marital			0.002
M	13	58	
D	4	6	
S	7	3	
Other	3	6	
BMI	29.5 (8.2)	31.3 (6.9)	0.263

\* Two-tailed independent samples *t*-tests or chi-squared tests.

BMI = body mass index; BPM = behavioral pain management; D = divorced; M = married; S = single; SCS = spinal cord stimulator; SD = standard deviation.

study. The data were collected from psychological evaluations done over a period of 1.8 years from consecutive patients with the specific diagnoses of lumbar postlaminectomy/failed back surgery syndrome, lumbar radiculopathy/radiculitis, and lumbar spinal stenosis. Patients completed all written assessments immediately prior to an appointment with a psychologist in which a comprehensive clinical interview including pain, mental health, substance, and social history was conducted. Patients completed the questionnaires in 30–60 minutes and the clinical interview in 90 minutes. Patients were given a packet of questionnaires to complete, ordered with the pain questionnaires first and followed by the psychological and coping scales; however, they could complete the packet in any order they desired. Missed items or discrepancies were resolved during the interview. All patients were adults, age 18 years and older, and all were diagnosed with chronic, predominantly low back pain. Data were collected from patient health records on measures of pain, pain coping, disability, depression, post-traumatic stress symptoms, pain-related anxiety, pain catastrophizing, and affective and interpersonal distress.

### BPM

Patients were referred by physicians and other medical providers for BPM to address psychological distress (e.g., anxiety, depression) to improve pain coping, learn relaxation strategies, improve stress management, improve social support, assess the potential for narcotic abuse, address poor treatment compliance, and address contributing lifestyle factors.

### Spinal Cord Stimulation

Patients were referred for a psychological screening when SCS implantation was being considered because other

options, including surgery, had failed or were not recommended. To be referred for SCS, patients have to have a clear pathology meeting the diagnostic categories we described; to have failed conservative treatments such as epidural injections, physical therapy, and medications; and to not have any litigation pending. The particulars of the use of SCS have previously been extensively reviewed [10]. All patients included in the present study referred to the Pain Management Center for SCS consideration were required to have a pre-SCS psychological evaluation by a PhD-level psychologist with a specialization in pain to screen for psychological risks to success with SCS.

### Measures

#### Pain Ratings and Scales

Pain ratings were done on paper using 0–10 Numerical Graphical Rating Scales, 10 cm long, to rate current pain and, in the last week, maximum pain, minimum pain, average pain, pain unpleasantness, and interference from pain.

The McGill Pain Questionnaire (MPQ) Short Form was used to rate sensory and affective dimensions of pain. The MPQ includes 0–3 ratings of 11 sensory terms (throbbing, shooting, stabbing, etc) and four affective terms (tiring-exhausting, sickening, fearful, and punishing-cruel) [20]. Scores range from 0 to 33 for the sensory dimension and 0 to 12 for the affective dimension.

The Multidimensional Pain Inventory (MPI) version 3 is a 48-item comprehensive pain assessment normed on 6,545 pain patients yielding nine primary scales and two composite scales. The MPI pain severity and pain interference scales were used. The *pain severity scale* assesses pain severity in past week and suffering due to

pain. The *pain interference scale* assesses the ability to participate in, and satisfaction from, social activities, work, daily activities, chores, friendships, family activities, and marital and family relationships [21]. Scores are reported as *T*-scores with a mean of 50 and standard deviation of 10.

### Functioning Measures

The general activity, dysfunctional, and life control scales from the MPI were used as measures of functioning. The content of these scales is as follows: *general activity*, frequency of household chores, outdoor work, activities away from home, and social activities; *dysfunctional*, composite score, weighted combination of primary scales related to functioning; and *life control*, control over life in past week and ability to deal with problems.

### Psychological Distress and Coping Measures

The affective distress and interpersonal distress scales from the MPI were used as two of the indicators of psychological distress. The content of these scales is as follows: *affective distress-mood*, anxiety, tension, and irritability; and *interpersonal distress-composite score*, weighted combination of primary scales related to relationships.

The Pain Catastrophizing Scale (PCS) is a 13-item scale using 0–4 ratings. The PCS contains three factors which have been validated in clinical samples: *ruminations* on pain-related thoughts, *pain magnification*, and *helplessness* in coping with pain [22]. Scores on the total range from 0 to 52, and a score of 30 (75th percentile) is said to represent a clinically relevant level of catastrophizing [23].

The Coping Strategies Questionnaire (CSQ) is a 27-item questionnaire assessing coping strategies and pain catastrophizing, which has shown to be reliable and predictive of behavioral and emotional adjustment to chronic pain [24]. Coping strategies assessed with the CSQ include *distraction*, *ignoring*, *distancing*, *self-talk*, and *prayer* [25]. Average scores on the subscales range from 0 to 6, and those scores above 4.0 are generally indicative of good coping [24].

The Pain Anxiety Symptoms Scale-20 is a short form version of the original inventory measuring fear- and anxiety-specific responses to pain [26]. The inventory has shown a good consistency, reliability, and validity in the original development and later psychometric evaluation [26,27]. Scores range from 0 to 100, and patients with chronic pain had a mean score of 38.6 and standard deviation of 20.38 in previous work [26].

The Center for Epidemiological Studies Depression Scale is a 20-item scale for ratings of depressive symptoms in the past week. Scores range from 0 to 60, with scores above 16 indicating possible clinically significant depressive symptoms [28]. It has been shown to have good

consistency, reliability, and validity in general population and psychiatric settings [28].

The Post-Traumatic Disorder Checklist-Civilian Version (PCL-C) is 17-item scale of Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV-TR) for post-traumatic stress disorder (PTSD) symptoms [29]. Scores above 50 suggest a PTSD diagnosis. The psychometric properties of the PCL-C have been evaluated [30].

### Statistical Analysis

Demographic variables were compared between the two groups with two-tailed independent samples *t*-tests and chi-squared goodness of fit tests. A general linear model multivariate ANCOVA, with age and BMI as covariates, was used to compare groups on measures of pain, interference, disability, pain-related anxiety, pain coping, pain catastrophizing, depression, PTSD symptoms, affective distress, and interpersonal distress. Age and BMI were included as covariates because they showed significant interactions with some of the measures. Unadjusted and adjusted *P* values were calculated. Adjusted *P* values were calculated using the Bonferroni-Holm method used to control for family-wise type I error. An alpha level of 0.05 was used as a cutoff for an adjusted *P* value that was deemed to indicate a statistically significant difference supportive of hypotheses, and an adjusted *P* value between 0.05 and 0.10 was deemed to be a marginally significant difference.

### Results

A comparison of the BPM and SCS groups on pain measures is shown in Table 2. From the table, it can be observed that pain and pain duration were generally not different between groups. Only the affective scale of the MPQ was marginally significantly different (*P* = 0.055, adjusted), with the BPM group having marginally higher mean affective MPQ ratings than the SCS group.

A comparison of BPM and SCS, on scales from the MPI and the CSQ measuring functioning and coping, is shown in Table 3. Generally, measures of functioning and coping were not different between groups. The MPI life control scale was only marginally higher in the SCS group compared with the BPM group (*P* = 0.056, adjusted). None of the CSQ scales measuring different ways of coping with pain (distraction, ignoring, distancing, self-talk, and prayer) were significantly different between BPM and SCS groups (adjusted *P* values ranging from 0.852 to 1.000).

Table 4 shows a comparison of BPM and SCS groups on symptoms of psychological distress. In general, the BPM group reported higher mean levels of psychological symptoms than the SCS group. The BPM groups were higher on pain-related anxiety (*P* = 0.033), marginally higher on pain catastrophizing (*P* = 0.097), higher on depression (*P* < 0.005), higher on PTSD symptoms (*P* < 0.005), marginally higher on affective distress (*P* = 0.068), and higher on interpersonal distress (*P* < 0.028) than the SCS group.

## Comparison of Patients with Chronic Low Back Pain

**Table 2** Comparison<sup>†</sup> of BPM and pre-SCS groups on pain measures

Variable	BPM N = 29 Mean <sup>‡</sup> (SD)	Pre-SCS N = 73 Mean <sup>‡</sup> (SD)	P Value	P Value <sup>‡</sup>
Pain duration (months)	139.2 (130.6)	109.4 (102.2)	0.337	1.000
Pain (0–10)* Current	6.9 (2.6)	6.5 (2.1)	0.087	0.696
Max (0–10)*	9.0 (1.1)	8.8 (1.4)	0.012	0.120
Min (0–10)*	5.1 (2.1)	5.0 (2.4)	0.517	0.517
Ave (0–10)*	6.8 (1.8)	6.7 (1.8)	0.443	0.886
Unpleasantness (0–10)*	7.4 (1.9)	7.0 (2.0)	0.241	1.000
Interference (0–10)*	7.6 (1.9)	7.0 (2.0)	0.220	1.000
MPQ total	26.7 (9.2)	22.5 (8.1)	0.020	0.180
MPQ affective	7.1 (2.8)	4.9 (3.0)	0.005	0.055
MPI severity	74.2 (14.2)	71.0 (18.3)	0.165	1.000
MPI interference	74.8 (17.3)	71.0 (15.9)	0.388	1.000

\* Numerical graphical rating scale.

† ANCOVA with age and BMI as covariates.

‡ Bonferroni–Holm-adjusted P values for controlling family-wise type I error.

ANCOVA = analysis of covariance; BPM = behavioral pain management; Mean<sup>‡</sup> = uncorrected (original) means; MPI = Multidimensional Pain Inventory; MPQ = McGill Pain Questionnaire; SCS = spinal cord stimulator; SD = standard deviation.

### Discussion

As hypothesized, BPM and pre-SCS patients reported similar pain, functioning, and coping, but pre-SCS patients reported fewer symptoms of psychological distress. Comparison of groups also revealed that demographic characteristics of the two groups were similar. Interactions between age, BMI, and some of the variables of interest were significant, so the group comparisons were corrected for age and BMI so that these variables would not explain differences between groups. Thus, although the patients were not randomly assigned to groups, controlling for demographic differences between groups in this way suggests any such differences do not explain group differences on other variables of interest. Previous research also has demonstrated differences in

referrals and treatment recommendations by sex and race; however, the sex and race of patients were distributed equally across both groups in the present study, so these variables did not explain the differences observed between groups [31].

Remarkably, ratings of pain, duration, interference, pain coping, and functioning were not significantly different between groups, while most ratings of psychological distress were different in the present study. Previous work has related pain variables, coping, and disability to psychological distress [32,33]. It generally has been recognized that with increased pain and chronicity, psychological distress increases [2]. There is also much literature on the association between pain coping and psychological distress, showing when coping improves,

**Table 3** Comparison\* of BPM and pre-SCS groups on functioning and coping

Variable	BPM N = 29 Mean <sup>‡</sup> (SD)	Pre-SCS N = 73 Mean <sup>‡</sup> (SD)	P Value	P Value <sup>†</sup>
MPI general activity	45.4 (6.5)	47.2 (7.7)	0.365	1.000
MPI dysfunctional	60.5 (8.2)	56.4 (10.6)	0.055	0.385
MPI life control	50.4 (13.4)	59.2 (19.3)	0.007	0.056
CSQ distraction	3.0 (1.7)	3.2 (1.6)	0.817	1.000
CSQ ignoring	1.9 (1.4)	1.8 (1.4)	0.866	0.866
CSQ distancing	1.2 (1.6)	1.0 (1.5)	0.229	1.000
CSQ self-talk	4.0 (1.3)	3.7 (1.5)	0.142	0.852
CSQ prayer	4.9 (1.3)	4.4 (2.0)	0.435	1.000

\* ANCOVA with age and BMI as covariates.

† Bonferroni–Holm-adjusted P values for controlling family-wise type I error.

ANCOVA = analysis of covariance; BPM = behavioral pain management; CSQ = Coping Strategies Questionnaire (Revised); Mean<sup>‡</sup> = uncorrected (original) means; MPI = Multidimensional Pain Inventory; SCS = spinal cord stimulator; SD = standard deviation.

**Table 4** Comparison\* of BPM and pre-SCS groups on symptoms of psychological distress

Variable	BPM N = 29 Mean <sup>T</sup> (SD)	Pre-SCS N = 73 Mean <sup>T</sup> (SD)	P Value	P Value <sup>†</sup>
PASS-20	59.5 (18.8)	45.3 (21.6)	0.011	0.033
PCS	32.4 (11.7)	26.2 (13.0)	0.097	0.097
CES-D	24.9 (10.7)	14.5 (10.6)	<0.001	<0.005
PTSD PCL-C	38.9 (18.5)	27.7 (12.4)	0.001	0.005
MPI affective distress	54.2 (9.0)	50.1 (13.7)	0.034	0.068
MPI interpersonal distress	39.3 (11.5)	32.6 (10.9)	0.007	0.028

\* ANCOVA with age and BMI as covariates.

† Bonferroni–Holm-adjusted *P* values for controlling family-wise type I error.

ANCOVA = analysis of covariance; BPM = behavioral pain management; CES-D = Center for Epidemiological Studies Depression Scale; Mean<sup>T</sup> = Uncorrected (original) means; MPI = Multidimensional Pain Inventory; PASS-20 = Pain-Related Anxiety from Pain Anxiety Symptoms Scale-20; PCL-C = Post-Traumatic Disorder Checklist-Civilian Version; PCS = Pain Catastrophizing Scale; PTSD = post-traumatic stress disorder; SCS = spinal cord stimulator; SD = standard deviation.

pain and disability are consequently reduced [3,24,34]. Specifically, in a review of studies of patients with back and neck pain, pain coping and psychological distress have been related to pain and disability [2]. Thus, it would be reasonable to presume that patients with similar pain, chronicity, and pain coping would have similar levels of psychological distress. However, in the present study, the SCS patients reported significantly lower levels of psychological distress than the patients referred for BPM. We had hypothesized that the pre-SCS group would report lower levels of psychological distress than the BPM group in order to win approval for SCS. It is also plausible that clinicians referred patients who were more psychologically distressed and perceived as more in need of psychological treatment for BPM than the patients referred for SCS. Accordingly, referring clinicians may have presumed that patients who showed lower levels of psychological distress also would be better candidates for SCS. Either way, referring clinicians may have been influenced in their selection of patients for either BPM or SCS, by the perceived or reported level of psychological distress during clinical evaluations. In any case, the groups are similar in all respects except for measures of psychological distress, which is likely biased, and this bias should be considered in these evaluations and treatment. Further work could be done to better understand the reasons for this possible bias and to evaluate the clinical decision making and referral process to better understand the exact meaning of the observed differences between groups.

Additionally, the current findings may underscore a possible need to develop separate norms or validity indications for patients referred for pre-SCS psychological evaluations to more accurately identify patients at risk for poor outcomes with SCS. Further, data examining SCS outcomes and their relation to baseline psychological assessments would be valuable in establishing cutoffs for accurate risk prediction. However, while previous work has been done evaluating SCS outcomes for pain, functioning, and complications, only limited data have shown psychological risk factors, such as somatization, depres-

sion, and anxiety, and poor coping relate to poor SCS outcomes [9]. Further, many of the patients who do show a high degree of psychological risk for poor outcomes with SCS may not be approved for SCS trial and implant or may drop out of further consideration when challenged to address psychosocial and behavioral issues, such as depression, family stressors, and smoking, before being allowed to proceed, making outcome data unavailable.

## Conclusions

The present study shows that there are differences in reported psychological distress between patients referred for pre-SCS and BPM, but only future research can fully explain these differences and how they actually relate to outcomes with SCS and treatment using BPM and other modalities. Further work could be useful to examine differences in those who proceed to trial and implant vs those who do not proceed to determine which psychological predictors are most useful in predicting outcomes. Comparisons of SCS outcomes with patients who received other treatments, such as BPM, could also be informative. In the future, including only the most important psychological predictors could further reduce patient burden by shortening the sometimes lengthy psychological screening evaluations that have been used before [9]. Our research points out the need for this difference in referral reason to be taken into account during evaluations for presurgical or other treatment purposes, possibly through the use of different norms or development of validity scales.

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