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Biomedical and psychosocial factors associated with disability after peripheral nerve injury

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Background: The purpose of this study was to evaluate the biomedical and psychosocial factors associated with disability at a minimum of six months following upper-extremity nerve injury.

Methods: This cross-sectional study included patients who were assessed between six months and fifteen years following an upper-extremity nerve injury. Assessment measures included patient self-report questionnaires (the Disabilities of the Arm, Shoulder and Hand Questionnaire [DASH]; pain questionnaires; and general health and mental health questionnaires). DASH scores were compared by using unpaired t tests (sex, Workers' Compensation/litigation, affected limb, marital status, education, and geographic location), analysis of variance (nerve injured, work status, and income), or correlations (age and time since injury). Multivariable linear regression analysis was used to evaluate the predictors of the DASH scores.

Results: The sample included 158 patients with a mean age (and standard deviation) of 41 ± 16 years. The median time from injury was fourteen months (range, six to 167 months). The DASH scores were significantly higher for patients receiving Workers' Compensation or involved in litigation ($p = 0.02$), had a brachial plexus injury ($p = 0.001$), or were unemployed ($p < 0.001$). There was a significant positive correlation between the DASH scores and pain intensity ($r = 0.51$, $p < 0.001$). In the multivariable regression analysis of the predictors of the DASH scores, the following predictors explained 52.7% of the variance in the final model: pain intensity (Beta = 0.230, p = 0.006), brachial plexus injury (Beta = −0.220, p = 0.000), time since injury (Beta = −0.198, p = 0.002), pain catastrophizing score (Beta = 0.192, p = 0.025), age (Beta = 0.187, p = 0.002), work status (Beta = 0.179, p = 0.008), cold sensitivity (Beta = 0.171, p = 0.015), depression score (Beta = 0.133, p = 0.066), Workers' Compensation/litigation (Beta = 0.116, p = 0.049), and female sex (Beta = −0.104, p = 0.090).

Conclusions: Patients with a peripheral nerve injury report substantial disability, pain, and cold sensitivity. Disability as measured with the DASH was predicted by brachial plexus injury, older age, pain intensity, work status, time since injury, cold sensitivity, and pain catastrophizing.

Level of Evidence: Prognostic Level II. See Instructions to Authors for a complete description of Levels of Evidence.

Recovery following upper-extremity peripheral nerve injury is variable and may result in substantial morbidity. Studies of outcomes following upper-extremity peripheral nerve injury frequently include assessment of physical impairment[1-12]. Evaluations of the impact of the physical impairment on the patient and validated measures of disability are not commonly included in the surgical literature.

Although few investigators have evaluated disability after peripheral nerve injury, the evidence points to high levels of disability after such injuries[13-15]. Disability following peripheral nerve injury may be related to biomedical factors, including motor or sensory dysfunction and pain. However, psychosocial factors may also be associated with disability. An association between psychosocial factors and pain, patient satisfaction, and disability has been reported in previous studies of patients with various abnormalities of the hand[16-19]. Identification of the factors that are associated with disability will allow the development of comprehensive treatment strategies after peripheral nerve injury.

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The main objective of this cross-sectional study was to evaluate the biomedical and psychosocial factors associated with patient disability following upper-extremity peripheral nerve injury. On the basis of our specific research questions, we hypothesized that (1) patients with peripheral nerve injury would have high levels of disability, (2) pain would be significantly associated with disability, (3) patients with a brachial plexus lesion would report higher levels of pain and disability than those with a more distal nerve injury, (4) cold sensitivity would be associated with increased pain and greater disability, and (5) higher levels of psychosocial distress would be associated with greater disability.

Materials and Methods

This cross-sectional study was approved by our institutional and university research ethics boards.

Subjects

Adults who had sustained a traumatic upper-extremity peripheral nerve injury six months to fifteen years before the time of recruitment were included in the study. The minimum duration of follow-up of six months was chosen to include patients who would be classified as having chronic pain following a peripheral nerve injury, and the maximum duration of fifteen years was chosen to prevent inclusion of participants who had sustained an obstetrical peripheral nerve injury and were now presenting for assessment. All patients were adults (older than eighteen years of age) at the time of injury. Patients with a previous upper motor neuron lesion, amputation, or self-inflicted injury or who were unable to understand the questionnaires were excluded. Between September 2007 and August 2009, patients were recruited when our study coordinator was present at one of two clinics (the University of Toronto Hand Program, Toronto, Ontario, and the Division of Plastic and Reconstructive Surgery, Washington University School of Medicine, St. Louis, Missouri). One hundred and sixty-four patients were invited to participate in the study. Six patients declined, and seventy-seven patients from Toronto and eighty-one from St. Louis agreed.

Testing Protocol

After the subjects provided signed informed consent, all testing was completed at one clinic appointment. The assessment was performed with the following questionnaires: Cold Intolerance Symptom Severity Questionnaire (CISS); Short-Form McGill Pain Questionnaire (SF-MPQ); Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH); Hospital Anxiety and Depression Scale (HADS); Posttraumatic Stress Disorder Checklist-Civilian (PCL-C); Pain Catastrophizing Scale (PCS); and comorbidity index. The order of questionnaires was randomly determined for each patient. The questionnaires were numbered, and computer software was used to generate a randomization schedule for the administration order of the questionnaires.

Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH)

The DASH was designed to assess disability experienced by patients with upper-extremity musculoskeletal disorders[20,21]. There are thirty items related to symptoms and physical function, which are ranked on a 5-point Likert scale. The score is calculated from the responses; higher scores indicate greater disability. As recommended by the questionnaire developers, missing items are replaced with the mean value for all subjects for that item and if more than three items are missing the total score should not be calculated[20]. In the present study, no patient had more than two missing responses. Good validity and reliability have been reported for the DASH[20-23].

Short-Form McGill Pain Questionnaire (SF-MPQ)

The McGill Pain Questionnaire (MPQ) was developed to assess the qualities of pain[24]. The SF-MPQ has fifteen adjectives from the sensory (n = 11) and affective (n = 4) categories of the original MPQ[25]. Each descriptor is rated on a 4-point scale and a Pain Rating Index is calculated. Pain intensity is assessed on a 10-cm visual analog scale (VAS) with the anchors "no pain" and "worst possible pain." Good validity and reliability have been shown for the SF-MPQ[25,26].

Cold Intolerance Symptom Severity (CISS) Questionnaire

The CISS was designed to evaluate the patient's sensitivity to exposure to cold[27,28]. The item scores are summed for a total score ranging from 0 to 100; higher scores indicate greater cold sensitivity. Good validity and reliability have been shown for the CISS[27-29]. The CISS includes questions regarding physical tasks, and some patients did not answer those questions because they were unable to perform those tasks. A validated method to impute missing CISS data has not been published. We performed a sensitivity analysis using different methods to replace the missing values (mean, median, linear trend, and linear interpolation). We found no statistical differences between the mean values calculated with each method, and we found strong correlations ($r = 0.99$, $p < 0.001$) between all methods. Therefore, we chose to impute missing CISS data by using linear trend regression analysis for each item[30].

Hospital Anxiety and Depression Scale (HADS)

The HADS was used to measure symptoms of anxiety and depression[31]. There are fourteen items in the HADS: seven for anxiety and seven for depression. Each item is ranked from 0 to 3, and the sum score is calculated for each subscale; higher scores indicate a higher degree of anxiety or depressive symptoms. The validity and reliability of the HADS have been established[32-37].

Posttraumatic Stress Disorder Checklist-Civilian Version (PCL-C)

The PCL-C is a seventeen-item questionnaire designed to evaluate posttraumatic stress symptoms. The patient indicates how much they are bothered by each item on a scale of 1 (not at all) to 5 (extremely). A higher score indicates more symptoms of posttraumatic stress. Validity, internal consistency, and reliability have been shown for the PCL-C[38-40].

Pain Catastrophizing Scale (PCS)

The PCS was designed to measure the degree of exaggerated negative thinking relative to the pain experience[41]. It includes thirteen items, and patients use a scale ranging from 0 (not at all) to 4 (all of the time) to indicate the degree to which they have each thought or feeling when they experience pain[42]. Three subscale scores (rumination, magnification, and helplessness) and a total score may be calculated; higher scores indicate a higher degree of pain catastrophizing. Validity and reliability have been established for this scale[43-47].

Comorbidity Index

The comorbidity index is a patient-reported questionnaire that is used to assess medical comorbidities, and the validity of this index has been established[48]. The patient is asked to indicate if a medical condition is present, is being treated, and limits activities. Each condition may score up to 3 points, with the total score ranging from 0 to 45 points; higher scores indicate more medical comorbidities.

Statistical Methods

Means and standard deviations or medians and ranges were calculated for continuous data, and frequency counts were calculated for categorical data. Continuous data were tested for normality and collinearity before analysis. Unpaired t tests were used to assess the association between the DASH scores and the following independent variables: sex, Workers' Compensation/litigation, dominant limb affected, marital status, education, and geographic location (Toronto versus St. Louis). Correlation coefficients were used to evaluate the association between DASH scores and age and time since injury. A one-way analysis of variance (ANOVA) was used to assess the association between the DASH scores and nerve(s) injured (brachial plexus nerve; single shoulder nerve, defined as a single nerve in the shoulder region; or distal nerve, defined as the median, ulnar, radial, or digital nerve or a combination of these nerves), work status (working; unemployed; or homemaker, student, or retired), and income groups. A significant ($p < 0.05$) F test (main effect) was followed by a Tukey post hoc analysis.

Multivariable linear regression with manual backward elimination was used to evaluate the variables that were associated with the DASH score (dependent variable)[49]. The preliminary regression model included the predictor variables that had been found to have a p value of ≤0.2 in the bivariate analysis[50]. Collinearity between the predictors was assessed, and if correlations were found to be >0.8, one of the pair was eliminated from the model. Regression models were derived by manual backward elimination with use of a Beta coefficient criterion p value of ≥0.1 to remove a variable. The subsequent regression models were fitted, and the final model included only those predictors with a Beta coefficient p value of <0.1.

The regression analysis indicated that a total of 158 patients provided sufficient power (0.8) for this study. This analysis was based on one main dependent outcome variable (the DASH score) and ten patients per predictor variable[30].

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This study was supported by a Doctoral Fellowship Award (C.B.N.) and a Canada Research Chair (J.K.) from the Canadian Institutes of Health Research and by a Research Award from the American Association for Hand Surgery.

Results

Patient demographics are presented in Table I. There were 158 patients (fifty-three women and 105 men). The mean age (and standard deviation) was 41 ± 16 years. The time from injury to recruitment was positively skewed (median, fourteen months; range, six to 167 months). The dominant hand was involved in ninety-five cases (60%). The level of injury in the upper extremity was the brachial plexus in sixty-one cases, a single shoulder-region nerve in fourteen (axillary in six, suprascapular in three, and long thoracic in five), and a distal nerve or nerves in eighty-three (median in seventeen, ulnar in nineteen, radial in twenty-eight, digital in eight, median and ulnar in ten, and median and radial in one). Fifty patients were receiving Workers' Compensation or involved in litigation, and there was no difference according to the nerve that was injured ($p = 0.875$). At the time of the study, eighty-one patients were working full or part-time; twenty-one were retired, students, or homemakers; and fifty-six were unemployed. Ninety-four patients were married or living with a partner, and 106 had a college or university education. The annual household income was reported as being less than $20,000 by thirty patients (Table I).

The mean score and standard deviation for each questionnaire are presented in Table II. The mean DASH score was 44 ± 22, indicating substantial disability, and eighty-seven patients (55%) scored higher than 39.46 on the DASH (two standard deviations above the mean normative value[51]). A significant positive association was found between brachial plexus injury and a high DASH score ($p = 0.001$). The mean pain intensity as indicated on the VAS was 4.2 ± 3.0, and the mean total SF-MPQ Pain Rating Index was 13.0 ± 10.8 (10.5 ± 8.3 for sensory and 2.5 ± 3.1 for affective). The mean CISS score was 33 ± 26, indicating substantial cold sensitivity. Eighty-one patients (51%) were classified as having abnormal cold sensitivity (a CISS score of >30[28]). In this study of patients with upper-extremity peripheral nerve injury, excellent internal consistency was found for the DASH (Cronbach alpha = 0.96), PCS (Cronbach alpha = 0.96), PCL-C (Cronbach alpha = 0.93), and CISS (standardized item alpha = 0.95), and good internal consistency was found for the HADS anxiety and depression subscales (Cronbach alpha = 0.83 and 0.82, respectively).

TABLE I Patient Demographics

	No. of Patients	Percentage of Patients
Sex		
Male	105	66.5
Female	53	33.5
Dominant hand affected	95	60.1
Nerve(s) injured		
Brachial plexus	61	38.6
Single shoulder nerve	14	8.9
Distal nerve(s)	83	52.5
Work status		
Working (full or part-time)	81	51.3
Unemployed	56	35.4
Homemaker, student, or retired	21	13.3
Workers' Compensation/litigation	50	31.6
Marital status		
Married or living with partner	94	59.5
Single, separated, divorced, or widowed	64	40.5
Education		
Some college/university or higher*	106	67.1
Income		
$19,999 or less	30	19.0
$20,000 to $49,999	27	17.1
$50,000 to $79,999	50	31.6
$80,000 or greater	33	20.9
Missing data	18	11.4

*One patient did not answer this question.

Bivariate Analyses

Patients receiving Workers' Compensation or involved in litigation had significantly higher DASH scores ($p = 0.02$) (see Appendix). Significant differences in the DASH scores were not found among the other independent variables. The ANOVA showed a significant association between the DASH score and the nerve that was injured ($p < 0.05$). Post hoc analysis revealed that DASH scores for patients with a brachial plexus injury were significantly higher than those for the patients with a distal nerve injury ($p = 0.001$). The ANOVA comparing DASH scores between work status groups also showed a significant difference ($p < 0.05$). Post hoc analysis revealed that the DASH scores for patients who were unemployed were significantly higher than those for patients who were working ($p < 0.001$). There was no

TABLE II Summary of Questionnaire Scores

	Mean Score ± Standard Deviation	Scale Range	Cronbach Alpha
DASH	44 ± 22	0-100	0.96
Work module	60 ± 35		0.97
Sports/arts module	70 ± 32		0.94
HADS			
Anxiety subscale	7 ± 4	0-21	0.83
Depression subscale	5 ± 4	0-21	0.82
PCS			
Total score	16 ± 15	0-52	0.96
Rumination subscale	6 ± 5		
Magnification subscale	3 ± 3		
Helplessness subscale	7 ± 7		
PCL-C			
Total score	33 ± 14	17-85	0.93
Reexperiencing subscale	10 ± 5		
Avoidance subscale	4 ± 2		
Emotional numbing subscale	10 ± 5		
Hyperarousal subscale	11 ± 5		
CISS	33 ± 26	0-100	0.95*
SF-MPQ			
Pain Rating Index	13 ± 11	0-45	
VAS for pain intensity	4 ± 3	0-10	
Comorbidity index			
Total no. of comorbidities indicated	1 ± 1	0-15	
Total score	2.8 ± 3.1	0-45	

*Standardized item alpha.

significant difference in DASH scores as a function of income ($p = 0.284$).

DASH scores were positively correlated with pain intensity as indicated on the VAS ($r = 0.51$, $p < 0.001$) and had a weak positive correlation with age ($r = 0.16$, $p = 0.02$). VAS pain intensity had a strong positive correlation with the CISS ($r = 0.50$, $p = 0.00$) and the PCS total score ($r = 0.66$, $p < 0.001$) (see Appendix). There was a moderate positive correlation between VAS pain intensity and the PCL-C total score ($r = 0.47$, $p < 0.001$), HADS anxiety score ($r = 0.32$, $p < 0.001$), and HADS depression score ($r = 0.41$, $p = 0.00$).

Multivariable Regression Analysis

Multivariable linear regression was used to evaluate the factors that statistically predicted disability as measured with the DASH. Our criterion for multicollinearity was $r = 0.8$, and the correlation between the HADS anxiety score and the PCL-C score was $r = 0.76$. Both the HADS anxiety subscale and the PCL-C assess anxiety-related symptoms, and this likely accounts for the strong correlation. Because we were assessing patients who had sustained a traumatic injury and the PCL-C was designed to assess symptoms of posttraumatic stress, we chose to include the PCL-C in the regression model and not the HADS anxiety score. The correlation coefficients between the variables in the regression analysis are presented in a table in the Appendix. The distribution of time from injury was positively skewed (skewness = 2.8). The non-normality was corrected with use of a log10 transformation, and these transformed data were used in the regression analysis[30]. On the basis of the bivariate analyses, the preliminary regression model included the following independent variables: sex, age, education, work status, time since injury, Workers' Compensation/litigation, nerve(s) injured, comorbidity index, HADS depression score, PCL-C score, VAS pain intensity score, CISS score, and PCS total score. With use of manual backward elimination and a 0.1 level of significance for removal (see Appendix), the final model explained 52.7% of the variance and contained ten predictor variables (Table III): pain intensity (Beta = 0.230, $p = 0.006$), nerve(s) injured (Beta = −0.220, $p = 0.000$), time since injury (Beta = −0.198, $p = 0.002$), pain catastrophizing score (Beta = 0.192, $p = 0.025$), older age (Beta = 0.187, $p = 0.002$), work status (Beta = 0.179, $p = 0.008$), cold sensitivity (Beta = 0.171, $p = 0.015$), depression score (Beta = 0.133, $p = 0.066$), Workers' Compensation claim/litigation (Beta = 0.116, $p = 0.049$), and female sex (Beta = −0.104, $p = 0.090$). The standardized Beta coefficients in the final model showed that higher pain

TABLE III Final Multivariable Regression Model with Use of Manual Backward Elimination (Dependent Variable: DASH Score)

Model	R^2	Predictor Variables	Unstandardized Coefficients Beta	Standardized Coefficients Beta	T Value	Level of Significance
Final	0.527	(Constant)			4.543	0.000
		Pain intensity	1.652	0.230	2.772	0.006
		Nerve(s) injured	−9.505	−0.220	−3.668	0.000
		Time since injury	−12.205	−0.198	−3.195	0.002
		Pain catastrophizing	0.284	0.192	2.258	0.025
		Age	0.259	0.187	3.138	0.002
		Work status	8.035	0.179	2.676	0.008
		Cold sensitivity	0.145	0.171	2.467	0.015
		HADS depression score	0.735	0.133	1.849	0.066
		Workers' Compensation/litigation	5.375	0.116	1.984	0.049
		Sex	−4.728	−0.104	−1.709	0.090

intensity, brachial plexus injury, time since injury, and pain catastrophizing resulted in higher DASH scores.

Discussion

The results of the present study indicate that patients with a peripheral nerve injury report substantial disability, which is predicted by a combination of biomedical and psychosocial factors. Authors of previous studies of outcomes following peripheral nerve injury have emphasized measures of motor and sensory recovery, data that reflect nerve regeneration and reinnervation of the motor fibers and/or sensory end organs but not the impact on the patient. More recently, investigators have recognized the importance of patient self-report questionnaires, disability, and health-related quality of life[13-15,19,52].

Disability is defined as a limitation in the ability to perform tasks, activities of daily living, or other activities[53-56]. The DASH was designed to assess disability experienced by patients with upper-extremity musculoskeletal disorders[20-23]. Few investigators have reported disability as measured with the DASH in a study of patients with peripheral nerve injury[13,15,57]. In a previous retrospective study of patients with peripheral nerve injury, we found high DASH scores, which were associated with pain, older age, and brachial plexus injury[15]. Other studies have shown that patients with a brachial plexus injury have high levels of disability[13,58]. The results of the present study confirm previous reports that patients with upper-extremity peripheral nerve injury experience high levels of disability and that a significant predictor of higher disability is brachial plexus injury.

Pain following traumatic nerve injuries has been reported to be associated with poor outcomes[5,15,59-61]. Brachial plexus injury is often associated with more severe pain and is a significant predictor of disability. Choi et al. reported that patients who had undergone brachial plexus reconstruction had a moderately high quality of life and that 75% had substantial pain[52]. In a study of patients with a brachial plexus avulsion injury, Htut et al. found the greatest pain to be in patients who had not had reconstructive surgery[5]. Kato et al. reported positive correlations between pain intensity and the number of nerve root avulsions and a longer interval between the injury and surgery[59]. In the present study, we did not examine root avulsions specifically, but we did find that patients with a brachial plexus injury had more pain and disability than did those with a distal nerve injury and that pain intensity was a significant predictor of disability.

Pain has also been associated with disability in patients with other musculoskeletal disorders. Greater pain was associated with higher DASH scores in a study of patients who had sustained a distal radial fracture[18]. In a study of patients with an intra-articular elbow fracture, it was found that higher DASH scores were associated with increased pain and that decreased motion and pain were the strongest predictors of disability[62]. A study of patients following elbow trauma showed pain to be the strongest predictor of disability[63]. The results of the present study of patients with a peripheral nerve injury are consistent with these findings as they also showed pain to be a significant predictor of disability (Beta = 0.230, $p = 0.006$). These data highlight the importance of the relationship between pain intensity and disability and emphasize the need for good long-term pain management and a comprehensive treatment approach.

Pain may also be associated with cold sensitivity[15,27,28,64-78]. The present study showed that patients with peripheral nerve injury had high levels of cold sensitivity and disability and that disability was predicted by pain and cold sensitivity. Many studies have demonstrated persistent cold sensitivity and substantial pain following hand trauma[65,66,68,71,76,79]. Cold sensitivity remains a challenge following peripheral nerve injury, particularly for patients who reside in cold environments.

Historically, in the surgical literature, biomedical factors associated with outcome have been emphasized over other potentially important variables. More recently, the influence of psychosocial factors on outcome has been recognized. In our sample of patients with peripheral nerve injury, depression scores were positively correlated with DASH scores and pain catastrophizing was a positive predictor of disability (Beta = 0.192, p = 0.025). Previous studies have evaluated the relationship between psychosocial factors and outcomes in patients with various pathological conditions of the hand[16,17,80]. In a study of patients who had undergone a carpal tunnel release, a significant negative correlation was found between the DASH scores and patient satisfaction, and pain catastrophizing and depressive symptoms were associated with disability[16]. Pain catastrophizing and depression symptoms were associated with higher DASH scores in a study of patients with various pathological conditions of the hand[80]. However, in that study, it was unclear if the patients had had the catastrophizing and depression symptoms prior to the injury or had developed them following the injury and associated disability.

Pain catastrophizing is a maladaptive cognitive-affective response to pain that involves negative thinking regarding the pain experience[41,42]. In a study of patients with chronic pain, those who catastrophized had more pain, disability, and psychological distress[81]. In the present study, patients with a traumatic peripheral nerve injury exhibited substantial disability and pain catastrophizing. Disability is a multidimensional construct, which is influenced by physical impairment, activity, participation in life roles, and environmental and personal factors and requires a multidisciplinary treatment approach[55,56].

The limitations of this study include the unique patient sample, cross-sectional study design, and possibility of low statistical power for detecting certain relationships. In addition, we only evaluated patients who had sustained the injury at least six months previously and who had attended clinics during the study period. This may represent a biased sample of patients who continue to seek assessment and treatment and may not be representative of all patients following peripheral nerve injury. There are patients who have satisfactory or complete recovery following peripheral nerve injury and no apparent morbidity. However, patients with physical impairments, pain, and disability often are the most difficult to treat, overwhelm the available resources, and have diminished health-related quality of life. Also, our inclusion of patients with a peripheral nerve injury who have not obtained full recovery or maximal medical improvement may have biased the results in the direction of finding more pain and greater disability. The primary aim of this study was to evaluate the predictors of DASH scores with use of a multivariable regression model, and a sample size of 158 was sufficient to support the regression model. Our study was the first to address the relationships between these factors and disability in patients with an upper-extremity peripheral nerve injury; therefore, we included factors that we hypothesized were important. It was not feasible to include all possible factors and interactions in the preliminary regression model, and investigation of the possible interaction effects was not part of our initial hypotheses. The presence of interaction effects such as between compensation status and the nerve injured is an important issue that merits future investigation. The t tests assessing the association between the DASH scores and the independent variables were performed, in part, to select the factors for the regression model and may not have had sufficient power to detect significance in all cases. Finally, with a cross-sectional design, conclusions about the causal direction cannot be made. The present study provides the preliminary data for a comprehensive longitudinal study to evaluate the specific risk factors for persistent pain and disability following peripheral nerve injury. Although the nature and efficacy of treatment were not evaluated in the present study, they are crucial factors to be assessed in future studies regarding the relationship among psychosocial measures, physical impairment, and disability. This important question can only be determined by a prospective, longitudinal study that measures baseline pretreatment biomedical and psychosocial characteristics; documents the nature, duration, and cost of treatment; and follows patients post-treatment to evaluate the extent to which baseline characteristics and/or treatment-related variables predict outcome.

In summary, our patients with a peripheral nerve injury reported substantial disability and pain. Disability was predicted by a combination of biomedical and psychosocial factors, including pain intensity, brachial plexus injury, pain catastrophizing, older age, work status, time since the injury, and cold sensitivity.

Appendix

eA Tables showing the results of bivariate analyses of the associations between DASH, pain intensity, and cold sensitivity scores and independent variables; correlational relationships between the DASH scores and scores on other questionnaires; and correlation coefficients between variables in the regression analysis are available with the online version of this article at jbjs.org. ■

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