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Relationships of Clinical, Psychologic, and Individual Factors with the Functional Status of Neck Pain Patients

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ABSTRACT

Objective: The objective of this study was to use both generic and disease-specific functional measures examining relationships of clinical, psychologic, and individual factors with the functional status of neck pain patients.

Methods: Patients who visited a university-based spine clinic and reported neck pain were included in this study. A comprehensive computerized survey questionnaire was used to collect the information related to this study. The questionnaire also contained a generic measure, short form 12-item survey (SF-12), and a disease-specific measure, neck disability index (NDI). Correlation and multiple regression analysis were conducted to examine the relationships.

Results: A range of clinical, psychologic, and individual factors emerged to be significant predictors of the NDI or physical component of the SF-12 (PCS). The predictors of higher NDI included higher levels of neck pain, higher levels of back pain, higher levels of pain in arm or shoulder areas, not working, lower education, higher stress, the presence of depression or anxiety, and smoking. The predictors of lower PCS included not working, higher levels of back pain, higher levels of neck pain, lower education, female sex, the presence of cardiovascular disorders, the absence of cervical disk disorders, and older age.

Conclusions: The predictors of the NDI or PCS appear to be multidimensional. Interventions designed to maximally improve the functional status of neck pain patients should be multifaceted and involve multidisciplinary teams. Selection of the most appropriate functional measures for an intervention study should consider differences between the generic and disease-specific measures in terms of their respective relationships with targeted factors. Prospective studies are needed to confirm the relationships observed in this study.

Keywords: neck pain, functional status, clinical factors, individual factors.

Introduction

Neck pain is a common condition in western countries. According to a study conducted in Canada, approximately 67% of adults reported neck pain some time during their lifetime [1]. In a study from Finland, the lifetime prevalence of neck and shoulder pain reached 71% [2]. The point prevalence of neck pain has also been reported, ranging from 11.5% in a Finnish study [2] and 13.4% in a study from the Netherlands [3] to 22.2% in a study from Canada [1]. Neck pain influences both physical and psychologic functioning. It can negatively affect the execution of activities of daily living and is associated with other functional limitations and disabilities [1]. Because death is rarely a consequence of neck pain, improvement in the functional status is often a major goal of interventions.

To consistently improve the functional status of neck pain patients, clinicians should accurately assess the functional status. They should understand which clinical factors could impact patients' functional status and consequently design appropriate interventions to target these factors. Clinical factors refer to data parameters that come from medical histories, physical examinations, pathology reports, and results of laboratory tests [4]. They include factors such as patient-reported symptoms, measures of biologic and physiologic functions, and diagnoses [4]. In addition to the clinical factors, clinicians should also have good knowledge about relationships of psychologic and individual factors such as demographic and socioeconomic characteristics with patients' functional

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status. Such information will allow them to identify what kind of patients are at risk for future functional decline and consequently apply more aggressive treatments or develop appropriate prevention strategies for these patients. Accurate assessment of the functional status of neck pain patients is no longer a problem because a number of reliable and valid instruments have been developed [5]. Nevertheless, it is still unclear how to consistently improve the functional status of neck pain patients. One of the reasons may be that the impacts of the clinical, psychologic, and individual factors on the functional status of neck pain patients have not been well established.

Cross-sectional studies are usually the first step toward understanding causal relationships between explanatory factors and outcomes. Several studies have been conducted to examine the cross-sectional relationships between various factors and the functional status of neck pain patients [6,7]. It was found that increasing degeneration was associated with increasing functional limitations among female patients with chronic neck pain [6] and the involvement of financial compensation was associated with poor functional outcomes among patients with cervicobrachial pain [7]. Although these studies provided valuable information about the associated factors of the functional status among neck pain patients, they only explored a limited number of factors. The relationships of the clinical, psychologic, and individual factors with the functional status of neck pain patients have not been adequately studied.

An integrated range of factors may impact the functional status of neck pain patients. It is a common observation that patients with neck pain of similar intensity and frequency can demonstrate markedly different levels of functional limitation. Some of these patients may experience severe disability, whereas others may continue working or conducting daily activities. It is obvious that factors beyond neck pain have impacts on the functioning of neck pain patients. Wilson and Cleary [4] have developed a conceptual model about the relationships among five levels of health outcomes: biologic and physiologic variables, symptoms, functioning, general health perception, and overall quality of life. In their model, an integrated range of factors influences functional status. One of them is symptom severity. The other factors that may also have influences are biologic and physiologic variables including clinical diagnoses, laboratory tests, measures of physiologic function, and physical examination findings. Their impacts are usually mediated by the symptoms. Psychologic factors and individual characteristics can also affect functional status, either directly or through the effects of the symptoms [4]. The model by Wilson and Cleary [8] that has been supported by a subsequent empirical analysis is so far the most comprehensive framework about the determinants of functioning and health-related quality of life. Nevertheless, no studies have followed this model and concurrently investigated such an integrated range of factors about their relationships with the functional status of neck pain patients.

There are two different types of instruments to measure the functional status of neck pain patients: generic and disease-specific [9,10]. The generic instruments are designed to be applicable to the general population or patients across different types of conditions. In contrast, the disease-specific instruments assess neck pain and its affects on patients' functioning. Such instruments are only valid with patients who have neck pain, and as a consequence, these instruments are more responsive to clinically important changes in health caused by interventions [9,10]. Previous studies have found that different types of outcomes measures may have different relationships with investigated factors [11]. Given this observation and given the fact that they were developed for different purposes, the generic and disease-specific measures may be very different in terms of their respective relationships with specific factors among neck pain patients. Understanding such difference may help making choice of the most appropriate measures for interventions designed to target the specific factors. A previous study has compared among neck pain patients the generic and disease-specific functional measures in aspects including construct validity and sensitivity to changes [12]. But no studies have compared these two types of instruments in terms of their respective relationships with an integrated range of factors.

The purpose of this study was to use both the generic and the disease-specific instruments to examine the relationships of the clinical, psychologic, and individual factors with the functional status of neck pain patients. We hoped that the results from this cross-sectional study would guide future prospective studies to identify factors that could influence the functional status of neck pain patients and ultimately prompt optimal design of intervention strategies to improve the functional status of this patient population.

Methods

Study subjects

All patients who consulted a university-based spine clinic in the southeastern United States were approached to answer a comprehensive computerized survey questionnaire. There was no selection process. In this survey, patients were asked approximately 60 questions regarding their health and ability to perform activities of daily living. One of these questions was aimed at identifying whether a patient was having neck pain. Responses included yes and no. Patients who answered yes were prompted to complete the questions from neck disability index (NDI) [13]. From January 2000 to January 2001, a total of 1348 patients completed the survey and the participation rate was about 70%. Of the 1348 patients, 571 of them reported in the survey that they were having neck pain and were eligible for this study. Twenty-four were excluded owing to missing demographic data or information about whether they had psychologic disorders. An additional 10 were excluded because they were students and their information about employment status and completed education was not applicable. In total about 6% of the eligible subjects were excluded. For patients who have been included in this study and have been surveyed multiple times during the study period, the first survey responses were used.

Study variables

Functional status. The functional status of neck pain patients was assessed by both the generic and the disease-specific functional measures. For the disease-specific measures, five neck pain-specific functional measures have been developed so far. This study used the NDI, the most widely used functional outcomes measure for neck pain patients [5]. The NDI was designed to assess degree of functional limitations caused by neck pain. The reliability and validity of this instrument in neck pain patients have been well documented [13,14]. The NDI contains 10 questions and produces a disability percentage. A higher percentage corresponds to higher levels of functional limitation [13].

Ranges of generic measures of health status are currently available [15,16] and this study used short-form 12-item survey (SF-12) [17], which was derived from short-form 36-item survey (SF-36) [18]. The SF-12 has demonstrated good reliability and validity in both general and specific patient populations. It can be summarized into two summary scales: physical component summary (PCS) measuring physical health and mental component summary (MCS) measuring mental health [17]. Because this study focused on the physical functioning of neck pain patients, only the PCS was examined. In the general population, the PCS has a mean of 50 with a standard deviation of 10. Higher scores indicate better physical functioning [17].

Explanatory variables

Following the model of Wilson and Cleary [4], integrated ranges of factors were investigated about their relationships with the functional status of neck pain patients. These factors were grouped into the following four domains: biologic and physiologic variables, symptoms, individual characteristics, and psychologic factors. Biologic and physiologic variables as well as symptoms were all considered to be clinical factors. Detailed information for each domain of variables was described as following and how each variable was coded is summarized in Table 1.

Table 1 Coding of explanatory variables

Variables	Coding
Biologic and physiologic variables	
Neck disorders	Yes = 1, no = 0
Disk disorders	Yes = 1, no = 0
Neck injuries	Yes = 1, no = 0
Cardiovascular disorders	Yes = 1, no or maybe = 0
Osteoarthritis	Yes = 1, no or maybe = 0
Ulcer	Yes = 1, no or maybe = 0
Symptoms	
Neck pain	No pain at the moment = 0, very mild at the moment = 1, moderate at the moment = 2, fairly severe at the moment = 3, very severe at the moment = 4, the worst imaginable at the moment = 5
Back pain	None = 0, very mild = 1, mild = 2, moderate = 3, severe = 4, very severe = 5
Arm or shoulder pain	None = 0, very mild = 1, mild = 2, moderate = 3, severe = 4, very severe = 5
Individual characteristics	
Age	In years
Sex	Female = 0, male = 1
Married or live with significant other	Yes = 1, no = 0
Education	8th grade or less = 0, greater than 8th grade = 1, high school graduate = 2, some college = 3, college graduate = 4, postgraduate work = 5.
Work status	Not working = 0, work full time or part time = 1
Smoking	Yes = 1, no = 0
Psychologic factors	
Depression	Yes = 1, no or maybe = 0
Anxiety	Yes = 1, no or maybe = 0
Stress	No stress = 0, mild stress = 1, moderate stress = 2, high stress = 3

Biologic and physiologic variables. This domain of variables included neck-related diagnoses and comorbidities. Two spinal surgeons determined the primary diagnoses of this study sample. For the diagnoses related to neck, they were further grouped into three categories: neck disorders, disk disorders, and neck injury [19]. Neck disorders included cervical spondylosis and allied disorders and other disorders of cervical region (e.g., spinal stenosis of cervical region, cervicalgia). ICD-9 codes for neck disorder included 721.0, 721.1, and 723. Disk disorders included any intervertebral disk disorders of cervical regions and ICD-9 codes for this category were 722.0, 722.4, 722.71, 722.81, and 722.91. Neck injury included fracture of cervical vertebra, dislocations and subluxations of cervical vertebra, and neck sprains or strains. ICD-9 codes for neck injury included 805.0, 806.0, 839.0, and 847.0 [19]. Comorbidity was measured by asking patients to indicate their past medical histories from a list of health problems. The answers for each listed health problem included no, maybe, or yes. To focus on the most prevalent health problems and to prevent false-positive associations caused by multiple comparisons, only the three most prevalent comorbidities were investigated in this study. They were cardiovascular disorders, osteoarthritis, and ulcer (Table 1).

Symptoms. The major symptom for neck pain patients was neck pain; this was measured by asking patients to rate their current neck pain intensity. Neck pain sometimes may radiate to the areas in arm or shoulder or radiate to back areas. So we also examined the symptoms from these two areas. They were measured by asking patients the following question: how much bodily pain have you had during the past 4 weeks in the following areas: shoulder/arm, back. Answers included none, very mild, mild, moderate, severe, and very severe (Table 1).

Individual characteristics. This domain of variables included age, sex, marital status, education, work status, and smoking. Education was measured as the highest grade being completed. Work status was measured using a dichotomous variable representing whether working (full time or part time) or not. Smoking was also measured by a dichotomous variable indicating whether smoking or not (Table 1).

Psychologic factors. This domain of variables included depression, anxiety, and personal stress. They were measured based on patients' subjective experience. The subjective presence or absence of depression or anxiety was measured by asking patients to indicate whether they have experienced several disorders from a list including depression and anxiety. Perceived personal stress level was examined by asking patients how much stress they have had recently in their home or family life. Response sets included "none, mild stress, moderate stress, and high stress" (Table 1).

Statistical Analysis

To examine the relationships of the clinical, psychologic, and individual factors with the generic (PCS) or specific (NDI) functional measures, both correlation and multiple regression analysis were conducted. The correlation analysis was conducted first to examine the correlation between each explanatory variable and the PCS or NDI. Depending on whether the explanatory variable was continuous or not, Pearson or Spearman correlation coefficient was calculated, respectively. Factors correlated with the PCS or NDI with a P value $<.05$ were selected for the multiple regression analysis. Two regression models were built: one with the NDI as dependent variable and another with the PCS as dependent variable. Stepwise regression with a forward entry at P value $<.15$ and a backward removal at P value $>.05$ was conducted to select significant predictors of the NDI and the PCS, respectively.

Results

Demographics Characteristics

Of the 537 study participants, 42% were male. The average age was 54.15 years and 67.8% were married or lived with a significant other. Approximately 85 percent were high school graduates or had higher education (Table 2). Based on the physicians' primary diagnoses, 21% of the study subjects suffered from neck disorders, and 16.2% suffered from cervical disk disorder; 5.4% had neck injuries. In total, less than 50% of this neck pain patient sample had the primary diagnoses related to neck.

Correlation Analysis

Table 3 summarizes the results for the correlation analysis. Most of the investigated variables were significantly correlated with the NDI (Table 3). For the biologic and physiologic variables, having cardiovascular disorders or ulcer was significantly correlated with higher NDI. But the presence or absence of any of the following conditions, neck disorders, cervical disk disorders, neck injuries, and osteroarthritis, had no significant correlation with the NDI. All three-symptom variables includ-

Table 2 Selected characteristics of study participants (*N* = 537)

Characteristics	Number	Percentage or mean
Mean age (years)	537	54.15
Sex		
Male	226	42.1
Female	311	57.9
Education		
8th grade or less	26	4.8
Greater than 8th grade	52	9.7
High school graduate	156	29.1
Some college	144	26.8
College graduate	84	15.6
Postgraduate work	75	14.0
Marital status		
Single	55	10.2
Married or live with significant other	364	67.8
Widow/divorce/separated	118	22.0
Diagnosis related to neck		
Neck disorders	115	21.4
Cervical disk disorders	87	16.2
Neck injury	29	5.4

ing neck pain, back pain, and the pain in arm or shoulder areas were significantly correlated with the NDI, with higher pain levels associated with higher NDI. Among the individual characteristics, married or lived with significant other, higher levels of education, working full time or part time, and not smoking were significantly correlated with lower NDI. Two other variables, age and sex, did not demonstrate significant correlation with the NDI. For the psychologic variables, higher levels of stress and the presence of depression or anxiety were significantly correlated with higher NDI (Table 3).

Table 3 Correlation between explanatory variables and NDI or PCS (*N* = 537)

	NDI		PCS	
	r	*P* value	*r*	*P* value
Biologic and physiologic variables				
Neck disorders	.08	.07	.04	.31
Cervical disk disorders	–.05	.24	.12	.006
Neck injuries	.002	.97	.11	.009
Cardiovascular disorders	.20	<.0001	–.24	<.0001
Ulcer	.19	<.0001	–.16	<.0001
Osteoarthritis	.06	.15	–.24	<.0001
Symptoms				
Neck pain	.59	<.0001	–.24	<.0001
Back pain	.32	<.0001	–.38	<.0001
Arm or shoulder pain	.36	<.0001	–.18	<.0001
Individual characteristics				
Age	–.06	.20	–.16	<.0001
Sex	–.06	.15	.19	<.0001
Married or live with significant other	–.09	.03	.05	.30
Education	–.34	<.0001	.31	<.0001
Work status	–.41	<.0001	.39	<.0001
Smoking	.23	<.0001	–.14	.001
Psychologic factors				
Depression	.28	<.0001	–.13	.002
Anxiety	.23	<.0001	–.10	.02
Stress	.26	<.0001	–.04	.33

NDI, neck disability index; PCS, physical component of the SF-12.

Most of the investigated variables were also significantly correlated with the PCS (Table 3). For variables in the biologic and physiologic domain, except neck disorders, all other variables were significantly correlated with the PCS. Having cervical disk disorders or neck injuries was correlated with higher PCS, whereas having cardiovascular disorders or ulcer or osteoarthritis was correlated with lower PCS. For the symptom variables, all three of them including neck pain, back pain, and the pain in arm or shoulder areas were significantly correlated with the PCS. Higher pain levels were correlated with lower PCS. Among the individual characteristics, younger age, being male, higher levels of education, working full time or part time, and not smoking were significantly correlated with higher PCS. Married or lived with significant other did not demonstrate significant correlation. Finally for the psychologic variables, the presence of depression or anxiety was significantly correlated with lower PCS, whereas the correlation between stress and the PCS was not significant (Table 3).

Multiple Regression Analysis

Table 4 shows the significant predictors of the NDI in the multiple regression analysis. They included neck pain, work status, back pain, education, stress, pain in arm or shoulder areas, depression, smoking, and anxiety (Table 4). Higher levels of neck pain were associated with higher NDI, as were higher levels of back pain and the pain in arm or shoulder areas. Working full time or part time and higher levels of education were associated with lower NDI whereas higher levels of stress, having had depression, having had anxiety, and smoking were associated with higher NDI (Table 4). The combination of these variables explained 60% of the variation for the NDI. Among these variables, neck pain accounted for the largest amount of the variation (36%), followed by work status (12%). The other remaining variables each explained less than 5% of the variation for the NDI (Table 4).

The significant predictors of the PCS in the multiple regression analysis included work status, back pain, education, neck pain, sex, cardiovascular disorders, cervical disk disorders, and age (Table 5). Working full time or part time and higher levels of education were associated with higher PCS, and so were lower levels of back pain, lower levels of neck pain, being male, and younger age. The presence of cardiovascular disorders was associated with lower

Table 4 Significant predictors of NDI in multiple regression analysis ($N = 537$)

Variables	Unstandardized regression coefficient	Standardized regression coefficient	Partial R^2*	*P* value
Neck pain	7.89	.46	.36	<.0001
Work status	−9.45	−.24	.12	<.0001
Back pain	1.24	.12	.04	<.0001
Education	−2.38	−.17	.03	<.0001
Stress	1.99	.12	.03	.0001
Arm or shoulder pain	1.50	.14	.02	<.0001
Depression	3.74	.08	.01	.008
Smoking	3.28	.07	.005	.01
Anxiety	3.88	.07	.004	.017
Model $R^2 = .60$				

*Percentage of variable explained by individual variable.
NDI, neck disability index.

PCS, whereas the presence of cervical disk disorders was associated with higher PCS (Table 5). The percentage of the variation for the PCS explained by the combination of these variables was 35%. Working full time or part time accounted for the largest percentage of the variation (16%), followed by back pain (9%). The remaining variables each accounted for less than 5% of the variation for the PCS (Table 5).

Discussion

This study used both the generic (PCS) and disease-specific (NDI) functional measures examining the relationships of an integrated range of clinical, psychologic, and individual factors with the functional status of neck pain patients. The major findings are as following: 1) a number of factors emerged to be the significant predictors of the PCS or NDI and the predictors appeared to be multidimensional and 2) the relationships of clinical, psychologic, and individual factors with the generic or disease-specific functional measures were not the same.

Multidimensional Characteristics of the Significant Predictors

The significant predictors of the NDI and the PCS both were multidimensional. Regarding the NDI, the predictors span four domains of variables (biologic and physiologic variables, symptoms, individual characteristics, and psychologic factors). As for the PCS, except for the psychologic factors, the other three domains of variables concurrently demonstrated significant associations. The multidimensional feature of the predictors for both measures suggests that interventions designed to improve the functional status of neck pain patients should be multifaceted and involve multidisciplinary teams. Targeting on a single factor or one aspect of factors may not achieve the maximal outcomes.

Generic versus Disease-Specific Measures

A previous study indicated that the generic and disease-specific measures were similar in measuring functional status and changes in functional status among neck pain patients. But in this study, these two types of instruments were somewhat different

Table 5 Significant predictors of PCS in multiple regression analysis ($N = 537$)

Variables	Unstandardized regression coefficient	Standardized regression coefficient	Partial R^2*	*P* value
Work status	4.16	.22	.16	<.0001
Back pain	−1.43	−.29	.09	<.0001
Education	1.13	.17	.04	<.0001
Neck pain	−1.34	−.17	.023	<.0001
Gender	2.28	.13	.019	.0004
Cardiovascular disorders	−1.61	−.09	.01	.02
Cervical disc disorders	2.24	.09	.008	.009
Age	−1.06	−.09	.007	.02
Model $R^2 = .35$				

*Percentage of variance explained by individual variable.
PCS, physical component of the SF-12.

in terms of their respective relationships with the clinical, psychologic, and individual factors. For example, there was no association between the psychologic factors and the PCS, whereas all three factors in this domain, including depression, anxiety, and stress, demonstrated significant association with the NDI (Tables 4 and 5). For those factors that were indeed associated with both the PCS and the NDI, most of them explained very different proportions of the variation for respective measure (Tables 4 and 5). One of the examples was neck pain. This factor accounted for 36% of the variation for the NDI but only explained about 2% of the variation for the PCS. The differences that exist between the PCS and the NDI in terms of their relationships with the same factor suggest that interventions targeting on this factor may need to consider such difference. For example, interventions targeting on psychologic variables may be better assessed by the NDI than the PCS since the PCS was not associated with psychologic variables and was not likely to detect the effects of psychologic variables.

Biologic and Physiologic Variables

Two biologic and physiologic variables were the predictors of the PCS. They were cardiovascular disorders and cervical disk disorders. The presence of cardiovascular disorders was associated with lower PCS (Table 5), consistent with previous studies in which cardiovascular disorders negatively impacted the physical health of the general population [18]. It is interesting to find that the presence of cervical disk disorders was associated with higher PCS (Table 5), suggesting that patients with such diagnoses have better physical health than patients without such diagnoses. The reason for this observation is not clear. But a detailed analysis of the clinical diagnoses for this neck pain sample indicated that less than 50% of the patients had the primary diagnoses related to neck (Table 2), whereas most of the remaining sample had the primary diagnosis related to lumbar areas (data not shown). It appears that some patients with lumbar-related conditions also suffer from neck pain, which is not surprising because the correlation between clinical diagnoses and symptoms was reported to be weak for many conditions [4]. For those patients with the primary diagnoses related to neck, approximately half had neck disorders such as cervical spondylosis, spinal stenosis of cervical region, and cervicalgia. Taken together, patients without cervical disk disorders consisted primarily of patients with neck disorders or with the primary diagnoses related to lumbar areas. Why their physical health was lower than that of cervical disk disorder patients needs further investigations.

Symptoms

All three symptom variables, neck pain, back pain, and the pain in arm or shoulder areas, were the predictors of the NDI or PCS. Neck pain and back pain were associated with both the NDI and the PCS, with higher levels of pain associated with higher NDI and lower PCS (Tables 4 and 5). The pain in the arm or shoulder regions was not only associated with the NDI but also with higher levels of pain associated with higher NDI (Table 4). The association of neck pain with the NDI is expected because one of the components for the NDI is neck pain intensity [13]. The associations of back pain or the pain in the arm or shoulder regions with the NDI are consistent with previous studies. In these studies, back pain was significantly associated with disabling neck pain [1] and a history of injury to shoulder or low back was associated with the presence of chronic neck pain [2]. The associations of back pain and the associations of neck pain with the PCS are not surprising since these conditions especially back pain have well known impacts on physical health [17,18].

Individual Characteristics

Among the individual characteristics being investigated, education and work status were predictors of both the NDI and the PCS (Tables 4 and 5). Higher education was associated with lower NDI and higher PCS. The associations of education with the NDI and the PCS are consistent with previous studies in which education was associated with back pain-related functional limitations and linked with mortality and morbidity from many conditions [20–22]. Regarding the work status, working full time or part time was significantly associated with lower NDI and higher PCS. These results are also consistent with previous studies, in which being unemployed was independently associated with musculoskeletal disability [23].

Sex and age were predictors of the PCS, with being female or older age associated with lower PCS (Table 5). Similar results have been observed in the general population [18]. Sex was not significantly associated with the NDI (Table 3). In contrast, Marchiori et al. [6] found a significant association between sex and NDI, with women reporting higher NDI than men. In our study, women also showed higher NDI than men (41.89

for women vs. 39.6 for men). But the difference is not big enough to be significant. The reason for the failure to detect significant difference is not known. Study by Marchiori et al. [6] indicated that the NDI difference between women and men was very small when there was no degeneration or small amounts of degeneration in the cervical regions and the difference became much bigger when the degeneration level increased. One possible explanation for the small difference observed in our study is that most of our study participants have no or only small amounts of degeneration in the cervical regions. But more studies are needed to confirm this hypothesis.

Smoking was a significant predictor of the NDI but not of the PCS. Patients who smoked had higher NDI than those who did not smoke (Table 4). Association of smoking with lower functional status is not surprising because similar results were observed among back pain patients [11].

Psychologic Factors

All three psychologic factors investigated, depression, anxiety, and stress, were the predictors of the NDI (Table 4). The importance of psychologic variables for the development of neck pain has been well documented [24,25]. But how these variables influence the functional status of neck pain patients is not very clear. Depression and stress have been found to play important roles for the onset and progression of back pain disabilities [26]. Given the common features shared by back and neck pain, it is plausible to observe the significant associations of depression and stress with neck pain-related functional limitations.

Limitations

This study is constrained by several limitations. First, the cross-sectional design prevents us from inferring any causal relationship between various factors and the functional measures. Second, this study was conducted in a single spine clinic and the study participants were limited to the patients seen in specialty practice, making it difficult to generalize the results to other spine clinics or to the primary care setting. Third, this study was conducted in a mixed patient population, with some chronically disabled and others having acute symptoms. Chronicity of neck pain has been found to be associated with the NDI [6]. Stratification of the patient population based on the duration of neck pain is needed in the future studies. And fourth, our measures of depression and anxiety were based on patients' subjective experience. This did not allow for the determination of duration, magnitude, or type of depression or anxiety.

Implications

There are two implications for this study. First, because the predictors of neck pain patients' functional status are multidimensional, interventions designed to maximally improve the functional status of these patients should be multifaceted and involve multidisciplinary teams. Relieving neck pain is a necessary step. But the psychologic variables should also be taken into consideration. Depression and anxiety have been found to be the predictors of functional status in this study. Screening and treating these conditions may need to become part of the treatments for some neck pain patients. Comorbidity such as cardiovascular disorders should not be ignored, neither should the individual characteristics such as work status.

The second implication is that the selection of the most appropriate measure for an intervention study should consider not only psychometric properties and practical issues but also the relationships of targeted factors with different measures. Most outcome measures have two different types, generic and disease-specific. Because they are developed for different purposes, these two types of measures are likely to be different in terms of their respective relationship with an investigated factor. For intervention studies designed to target specific factors, it is important to examine the relationships of the specific factors with both the generic and the disease-specific measures before deciding which measure to use or whether to use both types of measures.

Conclusions

In conclusion, a range of clinical, psychologic, and individual factors were the predictors of the NDI and the PCS. Their relationships appeared to be complex and multifaceted. Interventions designed to maximally improve the functional status of neck pain patients should consequently integrate the complex nature of the disorder by involving a multidisciplinary team as a part of standard clinical practice. The generic and disease-specific functional measures showed differences in terms of their respective relationships with the clinical, psychologic, and individual factors among neck pain patients. Selection of functional measures for an intervention study should consider such differences. More prospective studies are needed to confirm the relationships observed in this study.

References

1 Côté P, Cassidy JD, Carroll L. The Saskatchewan Health and Back Pain Survey: the prevalence of neck pain and related disability in Saskatchewan adults. Spine 1998;23:1689–98.
2 Mäkelä M, Heliövaara M, Sievers K, et al. Prevalence, determinants, and consequences of chronic neck pain in Finland. Am J Epidemiol 1991; 134:1356–67.
3 Van der Donk J, Schouten JSAG, Passchier J, et al. The association of neck pain with radiological abnormalities of the cervical spine and personality traits in a general population. J Rhematol 1991; 18:1884–9.
4 Wilson IB, Cleary PD. Linking clinical variables with health-related quality of life: a conceptual model of patient outcomes. JAMA 1995;273:59–65.
5 Pietrobon R, Coeytaus RR, Carey TS, et al. Standard scales for measurement of functional outcome for cervical pain or dysfunction: a system review. Spine 2002;27:55–22.
6 Marchiori DM, Henderson CNR. A cross-sectional study correlating cervical radiographic degenerative findings to pain and disability. Spine 1996;21:2747–51.
7 Rasmussen CL, Rechter LS, Hansen VK, et al. The association of the involvement of financial compensation with the outcome of cervicobrachial pain that is treated conservatively. Rheumatology 2001;40:552–4.
8 Wilson IB, Cleary PD. Clinical predictors of functioning in persons with acquired immunodeficiency syndrome. Med Care 1996;34:610–23.
9 Garratt AM, Klaber Moffett J, Farrin AJ. Responsiveness of generic and specific measures of health outcome in low back pain. Spine 2001; 26:71–7.
10 Patrick DL, Deyo RA. Generic and disease-specific measures in assessing health status and quality of life. Med Care 1989;27(Suppl):S217–32.
11 Oleske DM, Andersson GBJ, Lavender SA, et al. Association between recovery outcomes for work-related low back disorders and personal, family, and work factors. Spine 2000;25:1259–65.
12 Riddle DL, Stratford PW. Use of generic versus region-specific functional status measures on patients with cervical spine disorders. Phys Ther 1998;78:951–63.
13 Vernon H, Mior S. The neck disability Index: a study of reliability and validity. J Manipulative Physiol Ther 1991;14:409–15.
14 Hains F, Waalen J, Mior S. Psychometric properties of the neck disability index. J Manipulative Physiol Ther 1998;21:75–80.
15 Essink-Bot ML, Krabbe PF, Bonsel GJ, et al. An empirical comparison of four generic health status measures. The Nottingham Health Profile, the Medical Outcomes Study 36-item Short-Form Health Survey, the COOP/WONCA charts, and the EuroQol instrument. Med Care 1997;35:522–37.
16 Lurie J. A review of generic health status measures in patients with low back pain. Spine 2000; 25:3125–9.
17 Ware JE, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. Med Care 1996;34:220–33.
18 Ware JE, Kosinski M, Keller SD. SF-36 physical and mental health summary scales: a user's manual. Boston: The Health Institute, 1994.
19 Praemer A, Furner S, Rice DP. Musculoskeletal conditions in the United States. Rosemont: American Academy of Orthopaedic Surgeon, 1999.
20 Dionne C, Koepsell TD, Von Korff M, et al. Formal education and back-related disability. Spine, 1995;20:2721–30.
21 Franks P, Boisseau V. Educational status and health. J Fam Pract 1980;10:1029–34.
22 Weinblatt E, Ruberman W, Goldberg JD, et al. Relation of education to sudden death after myocardial infarction. N Engl J Med 1978;299:60–5.
23 Bradley EM, Ibanez D. Socioeconomic risk factors and musculoskeletal disability. J Rheumatol 1994; 21:515–22.
24 Leclerc A, Niedhammer I, Landre MF, et al. One year predictive factors for various aspects of neck disorders. Spine 1999;24:1455–68.
25 Linton SJ. A review of psychological risk factors in back and neck pain. Spine 2000;25:1148–56.
26 Clermont E, Dionne TD, Koepsell MVK. Predicting long-term functional limitation among back pain patients in primary care setting. J Clin Epidemiol 1997;50:31–43.