Research article

The influence of shoulder pain on functional limitation, perceived health, and depressive mood in patients with traumatic paraplegia

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Objective: To assess whether functional activity, perceived health, and depressive symptoms differ between individuals with traumatic paraplegia with and without shoulder pain.

Design: Cross sectional and comparative investigation using the unified questionnaire.

Setting: Neural Regeneration and Repair Division unit of Taipei Veterans General Hospital in Taiwan.

Participants: Seventy-six patients with paraplegia (23 with and 53 without shoulder pain) who had experienced spinal cord injury at American Spinal Injury Association Impairment Scale T2 to T12 neurologic level (at least 6 months previously).

Outcome measures: Spinal Cord Independence Measure (SCIM), a single item from the Medical Outcomes Study 36-Item Short-Form Health Survey, and Patient Health Questionnaire-9 (PHQ-9) depression scale.

Results: Shoulder pain was prevalent in 30% patients. Patients with shoulder pain had significantly worse perceived health and greater depressive symptoms than those without. No significant difference was found in functional ability between groups. Greater shoulder pain intensity was related to higher depressive scores ($r = 0.278$, $P = 0.017$) and lower self-perceived health scores ($r = -0.433$, $P < 0.001$) but not SCIM scores ($P = 0.342$).

Conclusion: Although shoulder pain was unrelated to functional limitation, it was associated with lower perceived health and higher depressive mood levels.

Keywords: Spinal cord injuries, Shoulder pain, Depression, Quality of life, Disability evaluation

Introduction

Shoulder pain is the most common site of upper limb pain among individuals with paraplegia, with a prevalence ranging from 33 to 42%.^{1–3} Persons with paraplegia typically have increased demands on the shoulder because they depend on upper extremity function for mobility and the execution of activities of daily living. The increased intra-articular pressure exerted during upper extremity weight-bearing activities and repetitive

motions necessitated by manual wheelchair mobility are believed to be contributing to the development of soft tissue disorders and degenerative changes in the shoulder joint.^{1,4} In patients with paraplegia, the shoulder is vital for locomotion and daily activities. Shoulder pain may impair a patient's ability to achieve independence in daily activities. Although several studies have documented the prevalence of shoulder pain in patients with paraplegia,^{1–3} the functional limitations of shoulder pain have not been studied sufficiently,^{5–8} and only few studies have addressed the issue of the impact of shoulder pain on perceived health in patients with paraplegia.^{9–11}

It has been reported that chronic pain is associated with higher levels of depressive symptoms in patients

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with spinal cord injury (SCI).^{12–16} The chronic pain-related conditions that develop following SCI are heterogeneous. Although shoulder pain is recognized as the most common and incapacitating upper limb problem in patients after SCI, studies designed to investigate its effect on mood are lacking. Therefore, the objective of this study was to determine whether shoulder pain affects the performance of functional activities and perceived health and depressive symptoms in Asian patients with traumatic paraplegia.

Methods

Participants

Patients were recruited from the outpatient clinic and inpatient rehabilitation clinic of a medical center in Taiwan. The inclusion criteria included traumatic paraplegia (neurologic levels T2–T12), age exceeding 18 years, a duration of injury of at least 6 months, and the use of a manual wheelchair as the primary means of mobility at home or in the community. Patients with brain injuries or cognitive problems, peripheral nerve lesions, a history of major depressive disorder (MDD) diagnosed by psychiatrists before the onset of SCI, neoplasms, or active medical problems were excluded. The study was approved by the Institutional Review Board of the medical center. All participants provided informed consent.

Measures

Patient demographic information and injury data

All participants completed a questionnaire comprising questions regarding basic information, including age, sex, marital status, time since the onset of SCI, the duration of wheelchair use, the frequency of wheelchair transfer per day, and the presence of shoulder pain 3 months before SCI. The level of SCI and completeness of the injury were determined by a physician based on the International Standards for Neurological Classification of Spinal Cord Injury.¹⁷ The following instruments were administered in a consistent order via an interview process.

The presence and intensity of shoulder pain

The criterion for the shoulder pain group was a current history of shoulder pain for at least 3 months. If patients reported presence of shoulder pain for at least 3 months, their intensity of shoulder pain was assessed using the wheelchair user's shoulder pain index (WUSPI), a 15-item valid and reliable questionnaire.¹⁸ Subjects rated their intensity of pain during these activities on a 10-cm visual analog scale anchored at "no pain" and "worst pain ever experienced". The total score on the

scale ranged from 0 to 150. Because some subjects did not perform all of the activities listed on the WUSPI, the questionnaire was scored using the performance-corrected score (PC-WUSPI), whereby the raw total WUSPI score was divided by the number of activities performed and then multiplied by 15. If participants had bilateral shoulder pain, the more severely affected shoulder was studied.

Depression

The diagnosis of probable MDD and the severity of depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9) depression scale.¹⁹ The PHQ-9 is based on nine-symptom criteria that define depressive disorder according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). The total score ranges from 0 to 27, with higher scores indicating greater severity of depression. Participants with scores of 10 or higher are considered to have probable MDD, whereas those with scores less than 10 are considered nondepressed.¹⁹ The PHQ-9 has been demonstrated to have good internal consistency and construct validity.^{20,21}

Self-perceived health status

A single item from the Medical Outcomes Study 36-Item Short-Form Health Survey was used to assess the subjective health status of the patients. Participants were asked to indicate their current health status on a 5-point scale, with 1 indicating excellent health and 5 indicating poor health.

Functional assessment

All patients were evaluated using the Spinal Cord Independence Measure version III (SCIM-III) by the same physician to assess the functional limitation. The SCIM is an independence scale that was specifically developed for patients with SCI, and its use is gradually increasing.²² The SCIM-III is a 19-item ordinal scale that consists of three subcategories: self-care, respiration and sphincter management, and mobility. The total score ranges from 0 to 100, with higher scores reflecting higher levels of independence. The SCIM-III has been demonstrated to have excellent reliability and validity.²³

Statistical analyses

Statistical analyses were performed using SPSS (version 18, SPSS, Inc., Chicago, IL, USA). Comparative statistics, Student's *t*-test for continuous variables, or the χ^2 -test for non-ordered categorical variables were used to compare between the shoulder pain and non-shoulder pain groups. Spearman's correlation coefficient was used to measure significant associations between

shoulder pain intensity and SCIM scores, perceived health, and depressive scores. To evaluate the influence of clinical parameters on the presence of shoulder pain, logistic regression analysis was performed. Age, time since SCI, and the presence of shoulder pain before SCI were entered as the risk variables. For all analyses, statistical significance was defined by $P < 0.05$.

Results

Seventy-six patients with traumatic paraplegia who used a manual wheelchair as their primary means of mobility were included in the study. The demographic and clinical characteristics of the patients with and without shoulder pain are presented in Table 1. The average age of the subjects at the time of interview was 40.5 years (range: 20–68), and the average time since the onset of SCI was 2.9 years (range: 0.5–11). Twenty-three (30%) participants reported current shoulder pain. Additionally, 11 of these 23 subjects reported that they had experienced bilateral shoulder pain, 7 had pain on the left only, and 5 reported pain on the right side only. In all the 12 patients with unilateral shoulder pain, they were all right handed. There was no correlation between handedness and shoulder involved. The mean duration of shoulder pain experienced by the participants was 2.1 years (range: 0.5–7).

There were no significant differences in age, sex, level of SCI, completeness of SCI, time since injury, amount of wheelchair transfer, transfer methods, and time in

wheelchair per day between the patients with and without shoulder pain. However, significant differences between the two groups were found for the presence of previous shoulder pain ($P = 0.027$). The presence of shoulder pain before SCI conferred an odds ratio of 12.03 (95% confidence interval = 1.15–125.87, $P = 0.038$) for shoulder pain after SCI.

Table 2 shows the differences in functional limitation, perceived health, and PHQ-9 scores between the two groups. Persons with shoulder pain displayed significantly lower perceived health and higher depressive scores than those without shoulder pain. Overall, 15 patients (19%) met the criteria for probable MDD. Specifically, 10 of 23 patients with shoulder pain and 5 of 53 patients without shoulder pain met the criteria for probable MDD, indicating that patients with shoulder pain were significantly more likely to have probable MDD ($P = 0.001$). However, the SCIM scores of persons with shoulder pain did not differ significantly from those of persons without shoulder pain.

Spearman's correlation analysis was performed to assess the relationships among shoulder pain intensity, perceived health, and SCIM and PHQ-9 scores. Higher levels of shoulder pain were associated with higher depressive scores ($r = 0.278$, $P = 0.017$) and lower perceived health ($r = -0.433$, $P < 0.001$). Conversely, the relationship between the PC-WUSPI scores and the total scores of SCIM was not significant ($P = 0.342$).

Table 1 Demographic and injury-related data of patients with and without shoulder pain

Variable	With current shoulder pain ($n = 23$)	Without current shoulder pain ($n = 53$)	P-value
Age (years)	44.7 $\pm$ 12.9	38.6 $\pm$ 12.9	0.065
Sex (F/M)	5/18	13/40	1.000
WUSPI score	–	24.90	
PC-WUSPI score	–	41.25	
Level			
High-level (T2–T7)	9	13	
Low-level (T8–T12)	14	40	0.271
ASIA classification			
A	13	33	
B	1	6	
C	6	8	
D	3	6	0.505
Time since SCI (months)	30.0 $\pm$ 18.9	36.2 $\pm$ 34.6	0.461
Number of transfers/day (time/day)	11.2 $\pm$ 4.0	8.6 $\pm$ 2.4	0.100
Transfer methods			
Standing transfer	2	6	
Seated transfer	19	42	
Lift transfer	2	5	1.000
Manual wheelchair use (h/day)	9.30 $\pm$ 3.22	8.60 $\pm$ 2.76	0.338
Shoulder pain before SCI (n)	4	1	0.027

Values are presented as the mean $\pm$ standard deviation or number. Significant results ($P < 0.05$) are given in bold numbers.

The high-level group was defined by a level of T2–T7, and the low-level group was defined by a level of T8–T12.

F, female; M, male; PC-WUSPI, performance-corrected wheelchair user's shoulder pain index; ASIA, American Spinal Injury Association; SCI, spinal cord injury.

Table 2 Comparison of functional limitation, perceived health, and depressive mood between patients with and without shoulder pain

	With current shoulder pain (n = 23)	Without current shoulder pain (n = 53)	P-value
PHQ-9	8.04 ± 5.65	5.20 ± 4.36	0.020
Perceived health	1.65 ± 0.83	2.54 ± 0.88	0.000
SCIM*			
SCIM_self-care	15.5 ± 4.2	16.6 ± 4.0	0.277
SCIM_RS	28.0 ± 7.8	26.8 ± 7.3	0.548
SCIM_Mobility 1	7.6 ± 2.4	8.4 ± 1.8	0.122
SCIM_Mobility 2	7.2 ± 5.7	7.6 ± 4.8	0.691
SCIM_total score	54.73 ± 19.55	59.66 ± 14.73	0.772

Data are presented as the mean ± standard deviation. Significant results ($P < 0.05$) are given in bold numbers.

*Higher SCIM scores indicate greater perceived disability.

PHQ-9, Patient Health Questionnaire-9; SCIM, spinal cord independence measure; RS, respiration and sphincter management.

Discussion

The objective of present study was to assess whether the presence of depressive mood, perceived health, and functional activity differed between individuals with traumatic paraplegia in the presence and absence of shoulder pain. This is the first study to identify the negative impact of shoulder pain on the mood of patients with paraplegia. This study also confirmed prior findings of a negative impact of shoulder pain on perceived health. Nevertheless, the presence of shoulder pain does not interfere with the independent performance of activities of daily living in patients with SCI.

Demographic and injury characteristics associated with the presence of shoulder pain

In our study, approximately 30% of patients with paraplegia reported shoulder pain. The prevalence of shoulder pain in the present study was similar to that in other studies.^{1–3} Bayley *et al.*¹ examined 94 patients with paraplegia and found that 33% reported shoulder pain on transferring. Sie *et al.*² interviewed 103 patients with paraplegia, 36% of whom reported shoulder pain. Curtis examined 103 patients with paraplegia and found that 42% had shoulder pain.³

Research on the effect of age and the duration of spinal injury on the presence of shoulder pain is conflicting.^{5,7,24–27} In this study, we found that the length of time from spinal injury was unrelated to the presence of shoulder pain. There was a trend that participants with shoulder pain were older; however, this difference was not statistically significant.

Our study demonstrated that individuals with a history of shoulder pain prior to SCI are more likely to have shoulder pain after SCI. The results are similar to those of McCasland *et al.*, who reported that a previous shoulder injury is a risk factor for having shoulder pain after SCI.²⁷ Based on these results, a detailed shoulder pain or injury history

should be completed for all patients with SCI. Those with a history of shoulder pain should be offered focused assessment and care.

The influence of shoulder pain on functional limitation

In our study, we found that the presence of shoulder pain was unrelated to functional limitation. In addition, a higher intensity of shoulder pain was not associated with reduced functional independence. Our finding was consistent with previous studies examining the impact of shoulder pain on functional activities. Silfverskiöld and Waters examined 60 patients with SCI to determine the incidence of shoulder pain and associated functional disability during the first 18 months after SCI. He found that the patients with paraplegia did not have significant functional disability resulting from shoulder pain.⁸ Sinnott *et al.* examined 42 subjects with paraplegia with shoulder pain and found that they maintained a high level of functional independence despite shoulder pain.⁶ However, those two studies did not assess the functional limitation using standardized measurements of function. Ballinger *et al.*⁷ used the functional independence measure (FIM) instrument to examine the functional ability of 89 adult men with traumatic tetraplegia and paraplegia and found that shoulder pain was unrelated to functional limitation. Samuelsson *et al.*⁵ used the Klein Bell ADL scale to examine 56 subjects with paraplegia and found no difference in activity of daily living performance in the presence and absence of shoulder pain. However, the FIM and the Klein Bell ADL scale were not developed specifically for patients with SCI. Although the FIM is often considered the gold standard for assessing functional activities, it has some known limitations concerning its use to assess function for individuals with SCI. First, the FIM was designed to evaluate individuals with all types of impairment,

and consequently, it lacks the ability to measure specific functional skills that are important in the rehabilitation of patients with SCI. Second, the measure has a lack of sensitivity for the assessment of functional differences between individuals.^{28,29} In our study, we used the SCIM to determine the functional limitation among the study population. The SCIM has the following advantages. First, it includes functional skills considered more important for individuals with SCI. Second, it was more sensitive than the FIM for evaluating functional changes for patients with SCI.^{22,30} Although a more sensitive measurement was used in this study, we found no association between shoulder pain and functional limitation measures, indicating that individuals with paraplegia can manage their daily activities despite shoulder pain. This might be explained in part by the fact that most people with paraplegia have to maintain self-independence regardless of shoulder pain. They have to propel wheelchairs, transfer to and from wheelchairs, and do dressing even if they have shoulder pain.

The influence of shoulder pain on self-perceived health status

Similar to prior studies, we found that the patients with paraplegia and shoulder pain had significantly poorer self-perceived health than their counterparts without shoulder pain.^{9–11} Moreover, we found that greater shoulder pain intensity was associated with lower levels of self-perceived health. In patients with paraplegia, the shoulder is vital for daily activities, transfers, and mobility. Shoulder pain during those activities can be devastating to quality of life.

The influence of shoulder pain on depression

Depression is a well-known consequence of SCI. The published reports regarding the prevalence of depression among persons with SCI reported rates ranging from 23 to 48%,^{31–33} depending on the study samples, measures, and definition of depression. Overall, the prevalence of depression was lower in this study, with 15 (19%) patients having probable MDD. The reason for the relative lower rates of depression in this study could be that patients with a history of major depression prior to SCI were excluded from this study.

Depressive symptoms are associated with increased hospital stay, fewer functional improvements, less functional independence, increased medical complications, diminished quality of life, and poor social integration in the SCI population.^{34–37} Several studies identified pain as an important factor that negatively affects depressive symptoms.^{12–16} However, previous research addressed the impact on depression on the entire

etiology of chronic SCI pain. The effect of isolated shoulder pain on depressive mood has not been investigated. We analyzed the relationship between the presence of shoulder pain and psychological functioning, which has not been studied previously. Our result indicated that patients with shoulder pain have higher levels of depressive symptoms than those without shoulder pain. Furthermore, the relationship between shoulder pain intensity and the severity of depressive mood indicates that persons experiencing greater shoulder pain have higher levels of depressive mood. Given the negative impact of shoulder pain on perceived health and psychological prospective among persons with paraplegia, it is critical that rehabilitation programs incorporate shoulder pain screening and treatment to improve quality of life and mood in this population.

Limitations

There were several limitations in this study. First, diagnoses of probable MDD were not conducted through structured interviews based on the DSM-IV but were made using self-reported instruments, which may lead to overestimation or underestimation of the incidence. Second, the sample size was relatively small, particularly in the subgroups of patients with shoulder pain, which could have influenced the results. Therefore, future studies should include a larger number of patients to confirm our results. Third, the participants are limited to patients with paraplegia from a single hospital system, and the patient sample may not be representative of patients with paraplegia in the overall population.

Conclusion

Our research demonstrated that the presence with shoulder pain does not interfere with the independent performance of activities of daily living in patients with paraplegia. Shoulder pain, however, was associated with lower perceived health and higher depressive mood. Given this finding, the development of preventive and management strategies to decrease the prevalence of painful shoulder would be beneficial to this population.

Acknowledgments

The authors thank Ms Ling-Chen Tai for reviewing the statistical analysis.

Disclaimer statements

Contributors JCW acquired the information and authored the first draft of the manuscript. RCC helped with revision of the manuscript. YAT designed the study. WCH and HC helped with the interpretation of

the data. HLW obtained ethics approval. SFH designed the study and a critical review of the manuscript.

Conflicts of interest The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics approval The study was approved by the Institutional Review Board of Taipei Veteran General Hospital, Taiwan.

Funding The authors received no financial support for the research, authorship, and/or publication of this article.

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