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Predictor factors of hemiplegic shoulder pain in a group of stroke patients

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Abstract

Background: Shoulder pain is a common complication of hemiplegia, and many risk factors may predispose a stroke patient to shoulder pain. The aim of this study was to find out the factors that can predict the hemiplegic shoulder pain (HSP) after stroke. We used explorative design methods based on Logistic Regression.

Methods: The sample of this study consisted of 152 patients (77 female and 75 male) with diagnosis of acute cerebrovascular accident (CVA) referred to the Department of Physical Medicine and Rehabilitation, Shiraz University of Medical Sciences during a period of 3 years. Several variables were considered through patients' personal medical history, physical examination, laboratory data, questionnaire, psychological tests and interview.

Results: 32% of the patients had an experience of HSP after stroke. The critical time for the occurrence of HSP was between 2 and 6 months after the onset of CVA. Logistic Regression showed that the best predictors for HSP were "Activity of daily living ability", "Increased light touch threshold" and "Increased vibration threshold".

Conclusion: Patients with serious sensory and motor disability have more chance for HSP symptoms after stroke, so each stroke treatment method should include a plan for prevention of HSP.

Keywords: Stroke; Hemiplegia; Shoulder pain

Introduction

Shoulder pain is a common complication after stroke[1-3] that may limit the patients' ability to perform daily activities. It may have negative effects on the functional potential and may impede rehabilitation.[4] This complication may increase expenses and prolong the patients' management when back to normal daily activities as well as recreational life. Associative factors to hemiplegic shoulder pain (HSP) vary in different studies. Socio-demographic characteristics of the patients such as sex,[5] age,[5-7] and the side of paralysis have been suggested to contribute to HSP. Stroke is linked with many secondary complications. Coincidence of these complications may be associated with HSP. Unconsciousness in the early stage of stroke, ipsilateral sensory impairment,[8-11] visual field deficit, communication disorders[12] and hand disability in ADL[5,13] are some of these complications. Psychological reactions of the patients also interfere in HSP and factors such as lack of motivation, anxiety[10,14] and depression[4,9,10,14] are also considered.

Many Clinicians seek to predict their patients' outcome based upon a set of independent variables. These variables may include the patients' demographic information, personal medical history, or information about the current health status. Predicting the patients' outcome is essential for therapists to plan their treatment. Since a large number of variables are associated with shoulder pain, the use of a model to predict future behavior of patients is advantageous. The aim of the present study is to explore the factors that can discriminate shoulder pain patients after stroke. In other words, this research aims at building a simple model for predicting shoulder pain after stroke which can easily be used by clinicians.

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Materials and Methods

Participants

The sample of this study consisted of the patients diagnosed with acute cerebrovascular accident (CVA), being referred to the Department of Physical Medicine and Rehabilitation, Shiraz University of Medical Sciences, during a three year period from 2001 to 2004. Throughout this period, 195 patients with the diagnosis of acute CVA were registered at the department (including both inpatients and outpatients). They were followed up for six sessions (every two months). Thirty-nine patients were excluded from the study. The majority of them did not attend the follow-up sessions and due to profound cognitive problems we could not obtain sufficient information from the others. Finally, one hundred and fifty two patients (77 women and 75 men) participated in this study. The participants were between 40 and 75 years old, the average being 61.2 years (58.7 for women and 61.7 for men). The main tools and methods used to assess the health status of the participants were interview, personal medical history, physical examination, psychological tests and laboratory results.

All the patients were interviewed, undergoing a full physical exam by an attending physiatrist in the first session. The physician filled out a health data collection sheet that documented the information about the patients such as age, sex, shoulder pain (HSP), cigarette smoking habits (including the number of cigarettes daily), the ability of the activity of daily living (ADL), history of unconsciousness in the early phase of stroke, motivation for cooperation in rehabilitation programs, and clinical visual field detection. The information was confirmed by clinical evaluation, psychological tests and checking the patients' medical records. In subsequent sessions, the health data collection sheets were reviewed and the incidence of shoulder pain and pain outcome was enquired.

The criteria for including patients as HSP were clinical assessment by a history of shoulder pain on the affected side (Visual Analog Scale more than 5 cm of 10 cm),[15] and limitation in passive and active shoulder range of motion (particularly abduction, flexion and external rotation),[16] measured with a goniometer. The activity of daily living (ADL) ability was measured by the Kenny Self-Care Evaluation.[17,18] Anxiety and depression were assessed by symptom checklist 90-revised.[19] Sensory impairment was assessed, using the Nottinghan Sensory Assessment Scale and light touch threshold was measured with the number of artificial hair on the tip of fingers, palm and dorsum of hand, and compared to contra-lateral. Vibration threshold was evaluated by a tuning fork (SKLAR 256C) on the dorsum of proximal interphalangeal joint of the index finger. Clinical visual field was detected by the direct confrontation test. The communication disorder was diagnosed if a patient had a problem when speaking or writing.

The patients were categorized into two discrete groups, based on their presenting symptoms, self report, physician diagnosis, psychological tests and medical laboratory results. One group comprised of patients with positive signs and the other of those with negative findings. Using dichotomous instead of continuous variables can help the researchers to make a simple model for clinical uses based on usual medical categorization (healthy vs. sick or normal vs. abnormal).

This study tested the effect of several variables related to HSP, using Logistic Regression design. The dependent variable was HSP and the independent variables or predictors were sex, age, cigarette smoking habits, activity of daily living ability, temporary unconsciousness, decreased motivation for rehabilitation, anxiety, depression, communication disorder, increased light touch threshold, increased vibration threshold, decreased visual field. The data were analyzed by SPSS software using descriptive statistics, chi-square and logistic regression.

Results

This study revealed that the average age of stroke was 61.2 years, with a peak incidence of between fifty one and sixty years (34.2%). Forty-nine out of 152 patients (32%) suffered from HSP during the study period. The critical time for the occurrence of HSP was 2 to 6 months after the onset of CVA (18 patients in the second to fourth month and 17 patients in the fourth to sixth month) (Table 1). Although more patients with left hemiparesis reported suffering from shoulder pain (70%) than patients with right hemiparesis (65.5%), there was no significant difference between the left and right hemiparesis for pain report ($\chi^{2} = 0.470$, $p < .493$). Table 2 shows the results of the simple phi or Cramer's V. association between the HSP and independent variables. The shoulder pain showed significant association with increased light touch threshold, increased vibration threshold, communication disorder, age, temporary unconsciousness, anxiety and depression. Activity of daily living ability

Table 1: Interval between incidence of cerebrovascular accident and hemiplegics shoulder pain.

Months	<2	2-4	4-6	6-8	8-10	10-12	Total
Patients	9	18	17	2	2	1	49

Table 2: Association coefficients between shoulder pain with other variables.

Variables	phi	P	Variables	phi	P
Activity of daily living disability	0.884	0.0001	Anxiety	0.277	0.001
Decreased motivation for rehabilitation	0.626	0.0001	Depression	0.259	0.001
Increased vibration threshold	0.618	0.0001	sex	0.118	0.147
Increased light touch threshold	0.577	0.0001	Cigarette Smoking Habits	0.065	0.728
Communication disorder	0.465	0.0001	Decreased visual field	-0.036	0.653
Age	0.385	0.0001	previous shoulder pain	0.031	0.706
Temporary unconsciousness	0.294	0.0001			

(phi.=0.884, P<0.0001) and decreased motivation for rehabilitation (phi. =0.626, P<0.0001) had a significant association with the HSP.

Four variables ("activity of daily living ability", "increased light touch threshold", "increased vibration threshold" and "decreased motivation for rehabilitation") which had the highest association coefficients with HSP were entered as predictors in the Logistic Regression. The Logistic Regression showed that the predictors were able to predict HSP significantly. The –2 likelihood of chi-square was 31.1 with P-value less than .01 percent. The pseudo R square showed a high association between shoulder pain and the predictors (Cox and Snell -R^2=.65, Nagelkerke -R^2=0.91). Therefore, independent variables contribute to predicting 90% of independent variable's variance. The overall percentage of cases correctly predicted by the model was 97.4%. Table 3 shows the values for the predictor variables in the Logistic Regression Equation. These values show the relationship between the predictor variables and HSP. For "activity of daily living ability", "increased light touch threshold" and "increased vibration threshold" the coefficients are significant. That is, they can improve our prediction. "Decreased motivation for rehabilitation" is not a good predictor in this equation.

Discussion

In our study, 32% of the patients with CVA suffered from HSP. Pinedo et al.[1] reported that painful shoulder was the commonest complication of hemiplegia seen in 40% of patients. Aras[5] in his study reported a prevalence of 63.5% while Mclean[4] reported 24%. In Ratansabapathy's[8] report, the prevalence in the first week was 17%, in the first month 20%, and in the sixth month 23%. Gamble[10] reported a 40% occurrence. It is assumed that HSP is a common complication of CVA with uncertain prognosis,[20] requiring further attention and its prevention can be a great step in management. This variability in the incidence of HSP can be due to the effectiveness of the components of the proposed management program for the prevention and treatment of HSP. The time for the occurrence of HSP is different, and studies have variable duration of follow up. Wanklyn et al.[13] also showed that the prevalence of HSP increased as a result of improper handling of patients who needed help for relocating.[21] The high prevalence of HSP in this research can be attributed to the low economic status of many patients who were not able to seek help from experts. The findings of this research lead us to the conclusion that the severity of disabilities in the areas of

Table 3: Predictor variables in the Logistic Regression Equation

Predictor variables	B	S.E.	Wald	df	Sig	R
Activity of daily living ability	5.5	1.2	20.3	1	0.0001	0.31
Increased light touch threshold	3.0	1.2	6.6	1	0.009	0.16
Increased vibration threshold	2.3	1.0	5.0	1	0.024	0.13
Decreased motivation for rehabilitation	1.8	1.1	2.6	1	0.106	0.06
Constant	-6.6	1.4	21.4	1	0.0001	

physical activity, sensory disability and communication disorder in combination with low motivation for rehabilitation are the main predictors for upcoming HSP. Motivation for rehabilitation affects the outcome of stroke. MacLean et al.[22] in a qualitative analysis of stroke patients' motivation for rehabilitation showed that the highly motivated patients might get better results in the rehabilitation programs. According to their report, patients with high and low motivation have different beliefs about rehabilitation. It might have originated from the environment in which they are rehabilitating. Based on the association coefficients, low motivated patients for rehabilitation have more chances of HSP when they find more serious disability symptoms in themselves. One possible reason for this result could be that the current ADL disability of patients has more significant impact on the self-image of low motivation patients. This means that even the same changes in the ability can create a greater permanent change in the self-image of low motivation patients. These negative beliefs can lead to more chronic locomotion situation and more pain. Increased HSP with communication disorder is explained by the effect of gestural movements on the shoulder musculature of the hemiplegic limb.[12] As in Aras' study,[5] our study revealed that age was a significant factor in HSP. Although in our study females were more involved than males, this was not statistically significant. Aras[5] also did not find any relationship with gender. Our study and that of Aras revealed a correlation between the side of involvement and HSP. In our study, 38.8% had depression, 32.2% anxiety and 23% lack of motivation. In a similar study[4] 26% and in another study,[14] 16% had depression, and anxiety was reported in 14%. It is not clear whether CVA and HSP cause anxiety and depression or vice versa. We recommend that efforts should be directed toward proper treatment of depression and anxiety to prevent and alleviate shoulder pain. The incidence of ipsilateral sensory impairment and HSP was highly reported in other[9] researches. We conclude that the upper limb sensory neurological examination is required to detect sensory loss and hence distinguish patients at risk. In two[5,8] other studies, an association between decreased motor function and HSP was reported.

HSP is a common debilitating complication of CVA. Patients with serious sensory and motor disability have more chance for HSP symptoms after stroke. Therefore, each stroke treatment method should include a plan for prevention of HSP. Heightened awareness of these risk factors may lead to early prevention or improved management of HSP.

The limitations of our study may be the question whether the patients who did not develop shoulder pain had better care or treatment than those with prevented HSP and assessment of the effect of some factors for prediction of HSP and other factors that might have been ignored by authors.

Competing interests

The authors declare that there are no competing interests involved in any part of this manuscript.

Author's contributions

Both authors were responsible for performed the statistical analysis putting findings into written format. The correspondence author made substantive intellectual to a published study, design of the study and collecting the data. Both authors read and approved the final manuscript.

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