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Orginal Article

Relationship among pain, function, and motor activity in early hemiplegic patients

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Abstract

Aim: Evaluation of the relationship among upper extremity pain, function, and motor activity in early hemiplegic patients

Material and Methods: Fifty-three subjects, who had suffered hemiplegia between 1-3 months after stroke, were included in this study. Visual Analogue Scale was used for pain assessment, Fugl-Meyer Upper Extremity Motor Assessment Scale was used for upper extremity function evaluation, and Motor Activity Log-28 was used for evaluating motor activity after the demographic data of the subjects were recorded. Brunnstrom stages were used to identify, define, and quantify the recovery stages after stroke.

Results: The average age of the individuals participating in the study was 54.56±8.10, and the Body Mass Index was 26.12±3.68. The subjects' rest pain score was 30.00±19.90 and the activity pain score 42.83±24.44. The total score of the Fugl-Meyer Upper Extremity Motor Evaluatıon Scale was 18.84±17.08, the Quality of Movement sub-parameter score of the Motor Activity Log was 28 0.89±0.87, and the Amount of Use sub parameter score was 0.93±0.92. The relationship between the upper extremity function of the patients and motor activity was observed, which showed that all sub-parameters had a moderate correlation in the positive direction (r=0.539-0.779, p<0.001). However, there was no relationship between pain, function and motor activity (r=0.054-0.238, p=0.086-0.700).

Conclusion: This study showed that upper extremity motor activity and function were significantly affected and closely related to each other in early hemiplegic patients. However, there was no correlation between pain, function and motor activity.

Keywords: Hemiplegia; Function; Motor activity; Pain.

INTRODUCTION

Cerebrovascular accident (CVA) is a sudden neurological deficit characterized by loss of motor control, sensory disturbances, cognitive impairment, speech impairment, and imbalance due to non-traumatic brain injury caused by blockage or rupture of brain blood vessels (1). Although most stroke survivors regain independent ambulation, many fail to regain functional use of their impaired upper limb (2). Although the pathogenesis of post-stroke shoulder pain seems to be multifactorial, it is often difficult to make a differential diagnosis. Changes in the shoulder complex make the glenohumeral joint vulnerable to subluxation, which might be a cause of pain as determined by previous studies (3). The traction of the capsule and soft tissue-related subluxation of the shoulder may take place in the early stages; limited range of motion due to spasticity may be formed in the later stages of stroke (4). These problems in the shoulder often disrupt the kinetic chain system, which runs sequentially from the proximal to the distal to demonstrate the desired activity in the distal segment. A biomechanical disorder in the shoulder or any segment of this kinetic chain causes a loss in the amount of energy produced in the body and its transfer to the upper limb may negatively affect the quality of the movement (5).

Regaining functional use of the upper limb after a stroke is a challenging task for patients and has a significant impact on their physical, psychological, and emotional well-being. Lack of functional ability in the upper extremities after stroke restricts usage and causes asymmetric posture and contracture in daily life, thus, exacerbating functional limitations of the upper limb. In addition to this, low upper limb motor function is also related to the risk of soft tissue injury during rehabilitation (6).

There are differences regarding healing and grade of healing among patients. There are different processes of recovery in strokes in different processes. The recovery of pathologies such as ischemia, metabolic damage,

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edema, hemorrhage, and compression occurs during the first weeks. Structural and functional reorganization in the brain forms the basis of healing mechanisms (7). Motor function usually recovers within 1-6 months, but functional healing lasts for years. There is a disagreement among scientists about the mechanisms that explain the improvement of neurological function. However, there is consensus about the significance of the role of withdrawal of local harmful factors, collateral branching from unaffected axons, emergence of new neuronal links that normally are inhibit, neurotransmitter hypersensitivity and denervation supersensitivity, dissolution of local edema, improvement of regional circulation and improvement of ischemic neuron damage in improving neurological function (8).

Based on this information, this study was planned to evaluate the relationship among upper extremity pain, function, and motor activity in early hemiplegic patients.

MATERIAL and METHODS

All participants provided informed consent before participation in this study. The experimental protocol was approved based on the ethical standards of the Declaration of Helsinki. To conduct this study, the required permission and consent was obtained from the Malatya clinical research ethics committee (2016/38).

In the power analysis performed with the NCSS PASS 13 program, the sample size was determined to have a 5% error level, and at a 95% confidence interval, a sample size of at least 50 had 80% power.

The study design was a double-blinded randomized controlled trial. Patients were recruited in this study satisfied the following inclusion criteria: had unilateral ischemic brain injury or intracerebral hemorrhage after the onset of single stroke without other diagnosed neurological or systematic deficits; had enough cognition to be able to follow the training protocol as assessed by Mini-Mental State Examination (MMSE > 21); able to walk independently up to come for treatment; patients able to communicate without having dysarthria; age 30-70 years. Patients were excluded if they had a severe injury to the rotator cuff and patients who had a shoulder surgery history.

Motor Activity Log-28 was used for daily use of the hemiparetic arm after stroke. Fugl–Meyer Motor Assessment Scale (FM) (the total and sub parameter scores of the Fugl–Meyer Motor Assessment Scale) was used to the assessment of motor function. Presence of shoulder pain was performed for each patient on admission to the rehabilitation department by a physiotherapist. The assessments were performed by a physiotherapist who is different from the physiotherapist who implements the treatment of the participants.

The primary assessment tool was set as Motor Activity Log-28, is a clinical questionnaire developed to evaluate the daily use of the hemiparetic arm outside of the treatment setting (9). Motor Activity Log-28 is reliable and valid in individuals with subacute stroke (10) and also Turkish version has shown to be valid and reliable in hemiplegic population (10). The Fugl-Meyer is an impairment assessment tool that has been shown to be reliable (11) and valid (12). It consists three independent sections: motricity and sensation of the upper limb. The Fugl Meyer upper extremity evaluation scale has 8 sub-parameters with 66 points which are: Reflex activity (4 points), Flexor synergy (12 points), Extensor synergy (6 points), Movement combining synergies (6 points), Movement out of synergy (6 points), Normal Reflexes (6 points), Wrist (10 points), Hand (14 points) and Coordination-speed (6 points). In our study the coordination-speed parameter was not evaluated and an analysis was carried out with 7 sub-parameters and 60 points (12). Presence of upper extremity pain on the affected side was scored by using a 100-mm (10-cm) VAS (13). Patients were instructed to mark their pain intensity on a 100 mm horizontal line, in which 0 states no pain and 100 mm states maximum pain the patient felt. The pain experienced during activity and at rest was recorded separately. Brunnstrom stages have been used to identify and defined to quantify the recovery stages after stroke (14). Brunnstrom defined seven stages of motor recovery and described how the hemiplegic upper limb progress as a method for assessing recovery. Higher Brunnstrom scores indicate increased motor recovery.

Statistical Analysis

The research data was evaluated using the SPSS (Statistical Package for Social Sciences) for Windows 22.0 (SPSS Inc, Chicago, IL). Kolmogorov-Smirnov test was utilized to assess the normality of distribution for tested variables (Fugl Meyer, motor activity, shoulder pain in rest and activity). Descriptive statistics were presented as mean ± standard deviation and percentage. The relationship between categorical and numerical variables before and after treatment was assessed by Spearman or Pearson Correlation Analysis. For the evaluation of correlation according Pearson's coefficient; 0-0,24 was accepted as weak relationship, 0,25-0,34 as low level relationship, 0,35-0,59 as intermediate level relationship, 0,60-0,74 as strong level relationship and 0,75-1,00 as very strong relationship (15). The statistical significance level was accepted as $p < 0{,}05$.

RESULTS

As a result of the study, 53 patients (29 male, 24 female) were evaluated. Demographic data of the patients are shown in Table 1.

Table 1. Demographic characteristics of the patients

(n=53)	Mean± SD	Min	Max
Age	54.56±8.10	37	65
Height (16)	168.64±8.08	152	185
Weight(kg)	74.16±10.81	53	120
BMI(kg/m2)	26.12±3.68	19.6	37.04

BMI: Body mass index, SD: Standard deviation

Twenty-seven patients participating in the study were affected by the right and 26 patients by the left extremity; 16 had aphasia, 51 were right dominant; 3 patients had an intercostal, 13 patients an abdominal and 37 a combined respiratory type; the breathing depth of 29 patients was normal and superficial of 14 patients. Thirty-eight patients had spasticity in the upper extremity.

The Brunnstrom motor recovery phase diagram is shown in Figure 1. It was seen that most patients were at stage 2.

The motor activity Log-28 scale was used to evaluate motor activity. In this context, the quality of movement (QoM) and the quantity of usage (QoU) were evaluated separately. Each parameter was scored between 0 and 5. Upper extremity functions of the patients were evaluated using the Fugl Meyer scale. The upper extremity pain, motor activity and function results of the patients are shown in Table 2; the relationship between them is demonstrated in Table 3, there was a moderate and strong correlation between motor activity and function of the individuals (r=0.539-0.776, p <0.001).

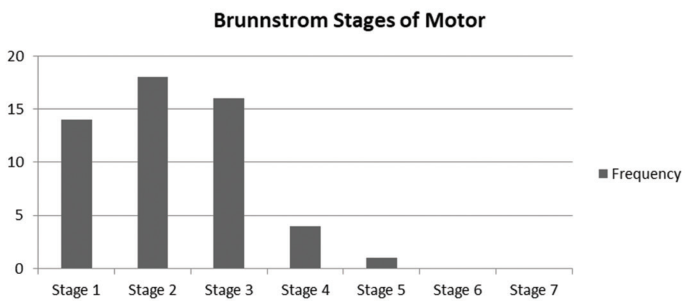

Figure 1. Frequency Distribution Brunnstrom Stages of Motor of Upper Extremity of Patients

Table 2. Value of Pain, Function and Motor Activity of Upper Extremity of Patients

(n=53)		Mean± SD	Min	Max
Pain	Rest	30.00±19.90	0	90
	Activity	42.83±24.44	0	92
Motor Activity Log-28	Quality of movement	0.89±0.87	0	3.57
	Amount of use	0.93±0.92	0	3.68
Fugl-Meyer Assesment	Reflex activity	1.1±1.00	0	2
	Flexor synergy	3.54±3.61	0	12
	Extensor synergy	1.90±1.83	0	6
	Movement combining synergies	1.90±1.83	0	6
	Movement out of synergy	1.81±1.84	0	6
	Normal Reflexes	2.54±2.38	0	6
	Wrist	2.64±2.91	0	10
	Hand	3.43±3.64	0	13
	Total	18.84±17.08	0	59

Table 3. Correlation with Function and Motor Activity of Upper Extremity of Patients

N:53		Motor ActivityLog-28			
		Quality of movement		Amount of use	
		r	p	r	p
Fugl -Meyer Assesment	Reflex activity	0.539	0.000*	0.542	0.000*
	Flexor synergy	0.645	0.000*	0.644	0.000*
	Extensor synergy	0.671	0.000*	0.665	0.000*
	Movement combining synergies	0.660	0.000*	0.651	0.000*
	Movement out of synergy	0.748	0.000*	0.745	0.000*
	Normal Reflexes	0.657	0.000*	0.652	0.000*
	Wrist	0.678	0.000*	0.679	0.000*
	Hand	0.772	0.000*	0.776	0.000*
	Total	0.774	0.000*	0.769	0.000*

P<0.001

DISCUSSION

In the present study the motor stages (Brunnstrom stages), Motor Activity Log-28 and Fugl Meyer were significantly affected in patients with hemiplegia. In addition to this, according to visual analog scale scores, patients had avearge pain. Although there was a relationship between upper extremity function and motor activity of the patients, it was seen that they were not related to pain.

In conducted studies, the prevalence of stroke varies according to sex (16). The incidence of CVA in males is higher (17) . In a study of Rand et al. 41 of the 60 patients were male (68%) and 19 female (32%) (18). Our study was in accordance with literature, and the number of male patients was higher (54%).

In a study about the variance of upper extremity disorders and functions according to dominance, Joceyn et al. showed that there is a significant relationship between the dominant side and the disorder but that there is none regarding function (19). In our study, 96% individuals were right dominant, but the affected side (right: 51%, left: 49%) was similar.

In recent years, the incidence of shoulder pain in hemiplegic patients ranges from 5%-8% (20-22). Our study showed a rest pain of 30 and an activity pain of 42. The absence of active movement and spasticity are important reasons for shoulder and upper extremity pain (22). A previous study showed that functional gains of stroke patients with severe shoulder pain are low and shoulder pain affects upper extremity functions (20). However, there was no correlation between upper extremity function and pain in our study. Studies comparing the emergence of shoulder pain with the increase in spasticity have shown that shoulder pain is less in patients with good muscle strength. Pain in hemiplegic patients increases in direct proportion to spasticity (23). Of the total patients evaluated in our study, 71.6% had spasticity in the upper extremity. Changes in pain and muscle tone also affect upper extremity function by 30%-66%. Although there was no relationship between pain and functionality in our study, the presence of spasticity may be assumed to have adversely affected the upper extremity function.

To evaluate the motor activity in our study, the Motor Activity Monitoring -28 scale was used. The results showed that the quality of movement decreased by 83% and the usage rate by 81% compared with normal individuals. It was also observed that the total score of the Fugl-Meyer scale, in which the upper extremity function was assessed, decreased by 69%. This information showed us the extent of decrease of the upper extremity function and motor activity in early hemiplegic patients.

Wade et al. also showed that the functional healing was very rapid in the first weeks and the improvement in motor function progressed rapidly up to the first two months and decreased within six months (24). In the first three months, 50-60% improvement occurs in the upper and 80-90% improvement in the lower extremities. Upper limb healing may continue for one to two years in hemiplegia rehabilitation, where the greatest functional development is experienced during the first six months (25). Our study included hemiplegic patients in the post-stroke, 1-3 months period when the healing is fastest.

Although early interventions during a stroke are aimed at joint motion angles, sitting-standing, standing balance and protection of mobility, interventions aimed at arm and hand functions are more secondary. Loss of arms functions is a major problem that causes long-term impairment, which affects 30%-66% of all stroke cases (26). Balci et al. found significant difference between hemiplegic patients' and healthy individuals' upper extremity functions (27). Few studies have objectively and quantitatively evaluated the upper and lower extremities of patients participating in a rehabilitation program (18). Although many studies have shown a relationship between different muscle groups in the lower extremity, only a few studies have included a motor function with upper extremity muscle strength (26, 28). Studies are examining the frequency and characteristics of shoulder pain in stroke patients, but studies that associate the function of the upper extremity with pain are insufficient (29). In our study, the relationship among pain, function and motor activity was examined, but it was determined that pain not be related to functionality and motor activity. This information is important regarding rehabilitation. We need to improve functioning, particularly in the early post-stroke period when the healing is at a maximum, without having to wait for the pain of the person to decrease. As functionality is gained, spasticity will be replaced by voluntary movement, and spasticity-induced pain will, thus, decrease.

Given the limitations of our study, the lack of a detailed record of spasticity suggests that a large number of patients were not investigated.

Previous studies in the literature are mostly based on investigating mobility of hemiplegic patients, whereas studies on upper extremity are relatively few. Studies on the upper extremity are mostly focused on pain and shoulder subluxation; studies on the importance of function and motor activity are inadequate. Our study will make a significant contribution to the existing information in this area.

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REFERENCES

1. Katz RT. Management of spastic hypertonia after stroke. Journal of Neurologic Rehabilitation. 1991;5(5_suppl):S5-S12.
2. Barreca S, Wolf SL, Fasoli S, Bohannon R. Treatment interventions for the paretic upper limb of stroke survivors: a critical review. Neurorehabil Neural Repair 2003;17(4):220-6.
3. Peters SB, Lee GP. Functional impact of shoulder taping in the hemiplegic upper extremity. Occup Ther Health Care 2003;17(2):35-46.
4. Wilson RD, Chae J. Hemiplegic Shoulder Pain. Phys Med Rehabil Clin N Am 2015;26(4):641-55.
5. Kibler WB. Closed kinetic chain rehabilitation for sports injuries. Phys Med Rehabil Clin N Am 2000;11(2):369-84.
6. Pong YP, Wang LY, Wang L, Leong CP, Huang YC, Chen YK. Sonography of the shoulder in hemiplegic patients undergoing rehabilitation after a recent stroke. J Clin Ultrasound 2009;37(4):199-205.
7. Chae J, Bethoux F, Bohine T, Dobos L, Davis T, Friedl A. Neuromuscular stimulation for upper extremity motor and functional recovery in acute hemiplegia. Stroke 998;29(5):975-9.
8. Netz J, Lammers T, Homberg V. Reorganization of motor output in the non-affected hemisphere after stroke. Brain 1997;120(Pt 9):1579-86.
9. Uswatte G, Taub E, Morris D, Light K, Thompson PA. The Motor Activity Log-28: assessing daily use of the hemiparetic arm after stroke. Neurology 2006;67(7):1189-94.
10. Çakar E, Dinçer Ü, Kiralp MZ, Kilac H, Tongur N, Taub E. Turkish adaptation of motor activity Log-28. Turk J Phys Med Rehabil 2010;56(1):1-5.
11. Duncan PW, Propst M, Nelson SG. Reliability of the Fugl-Meyer assessment of sensorimotor recovery following cerebrovascular accident. Phys Ther 1983;63(10):1606-10.
12. Di Fabio RP, Badke MB. Relationship of sensory organization to balance function in patients with hemiplegia. Phys Ther 1990;70(9):542-8.
13. Lindgren I, Jönsson AC, Norrving B, Lindgren A. Shoulder pain after stroke: a prospective population-based study. Stroke 2007;38(2):343-8.
14. Safaz I, Ylmaz B, Yasar E, Alaca R. Brunnstrom recovery stage and motricity index for the evaluation of upper extremity in stroke: analysis for correlation and responsiveness. Int J Rehabil Res 2009;32(3):228-31.

15. Hayran M. Sağlık araştırmaları için temel istatistik: Omega Araştırma. Ankara 2011.
16. Feigin V, Barker-Collo S, Parag V, Senior H, Lawes C, Ratnasabapathy Y, et al. Auckland Stroke Outcomes Study Part 1: Gender, stroke types, ethnicity, and functional outcomes 5 years poststroke. Neurology 2010;75(18):1597-607.
17. Fawcus R. Stroke rehabilitation: A collaborative Approach: John Wiley & Sons; 2008.
18. Rand D, Eng JJ. Disparity between functional recovery and daily use of the upper and lower extremities during subacute stroke rehabilitation. Neurorehabil Neural Repair 2012;26(1):76-84.
19. Harris JE, Eng JJ. Individuals with the dominant hand affected following stroke demonstrate less impairment than those with the nondominant hand affected. Neurorehabilitation and neural repair. 2006;20(3):380-9.
20. Teasell R, Foley N, Salter K, Bhogal S, Jutai J, Speechley M. Evidence-Based Review of Stroke Rehabilitation: executive summary, 12th edition. Top Stroke Rehabil 2009;16(6):463-88.
21. Lewis SJ, Barugh AJ, Greig CA, Saunders DH, Fitzsimons C, Dinan-Young S, et al. Is fatigue after stroke associated with physical deconditioning? A cross-sectional study in ambulatory stroke survivors. Arch Phys Med Rehabil 2011;92(2):295-8.
22. Dromerick AW, Edwards DF, Kumar A. Hemiplegic shoulder pain syndrome: frequency and characteristics during inpatient stroke rehabilitation. Arch Phys Med Rehabil 2008;89(8):1589-93.
23. Kalichman L, Ratmansky M. Underlying pathology and associated factors of hemiplegic shoulder pain. Am J Phys Med Rehabil 2011;90(9):768-80.
24. Wade D, Lewer R, Skilbeck C. Stroke, a critical approach to diagnosis, treatment and management. editon. London: Chapman and Hall; 1985.
25. Paolucci S, Antonucci G, Grasso MG, Bragoni M, Coiro P, De Angelis D, et al. Functional outcome of ischemic and hemorrhagic stroke patients after inpatient rehabilitation: a matched comparison. Stroke 2003;34(12):2861-5.
26. Levin MF, Musampa NK, Henderson AK, Knaut LA. New approaches to enhance motor function of the upper limb in patients with hemiparesis. Hong Kong Physiotherapy J 2005;23(1):2-5.
27. Balci NC, Dogru E, Aytar A, Gokmen O, Depreli O. Comparison of upper extremity function, pain, and tactile sense between the uneffected side of hemiparetic patients and healthy subjects. J Physt Ther Sci 2016;28(7):1998-2001.
28. Gillen G. Stroke rehabilitation: a function-based approach: Elsevier Health Sciences; 2015.
29. Chantraine A, Baribeault A, Uebelhart D, Gremion G. Shoulder pain and dysfunction in hemiplegia: effects of functional electrical stimulation. Arch Phys Med Rehabil 1999;80(3):328-31.