

**Original article**

**Upper Limb Dysfunction Increases Fear of Falling in People With Stroke**

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**Abstract:**

**Objective:** Our study was planned to investigate the effect of upper limb function on fear of falling in stroke patients. **Materials and methods:** A total of 61 patients, 33 women with chronic hemiplegia or hemiparesis, were included in the study. Patients' upper limb motor condition was obtained using the Fugl-Meyer Upper Extremity Rating Scale (FMA), upper limb function Arm Motor Ability Test (AMAT) and fear of falling International Fall Efficacy Scale (FES-I). Standard Mini-Mental Examination scale was used to exclude patients with mental disorders.

**Results and Discussion:** There was a highly significant negative correlation between FES-I and AMAT and FMA scores ( $p < 0.001$ ,  $r = -0.926$  and  $r = -0.888$ , respectively). There was also a significant positive correlation between FMA and stroke time ( $p < 0.05$ ). It was observed that the fear of falling with the level of upper limb dysfunction increased in parallel. **Conclusion:** It suggests situation that this is due to the fact that they experience balance problems as a result of upper limb dysfunction and when they fail to reveal protective reflexes in a quality way

**Keywords:** Fear of falling; stroke; upper limb; hemiplegia; upper limb function

*Bangladesh Journal of Medical Science Vol. 20 No. 03 July'21. Page : 539-542  
DOI: <https://doi.org/10.3329/bjms.v20i3.52795>*

**Introduction**

Stroke is a disease caused by sudden decrease or cessation of blood flow to the brain structures, leading to functional disability and resulting in partial loss of brain function. It is a condition that is the cause of tertiary death after cardiovascular disease and cancer in the world and can lead to long-term disability.<sup>1</sup>

Paresis in the upper limb after stroke is common and affects 80% of people with stroke.<sup>2,3</sup> A balanced standing in Hemiplegic/hemiparetic patients is one of the main goals of the rehabilitation process. In many studies related to hemiplegia/hemiparesis, the relationship between lower limb dysfunction and balance has been determined; in addition, upper limb dysfunction has also been shown to greatly affect balance.<sup>4,5</sup>

In the period after stroke, posture and balance disorders are frequently encountered problems. When the balance mechanism is affected, there is an increase in the risk of falling and fear of falling.<sup>6</sup> After stroke, 73% of individuals experience falls,

and 37% of them cause injuries that require medical treatment. But more importantly, by causing fear of falling in individuals, it causes a significant decrease in the activities of individuals and increases the burden of caregivers.<sup>7</sup>

It is stated that fear of falling is a problem that occurs after a stroke.<sup>8,9</sup> Researchers have found that fear of falling after a stroke leads to a decrease in physical functionality and a minimization of perceived health status.<sup>10,11</sup> In addition, physiotherapists see fear of falling after a stroke as an obstacle to functional recovery.<sup>12</sup> However, which is the opposite of this situation the effect of functional recovery on the fear of falling, is waiting to be fully clarified. The effect of upper limb function over time after a stroke on the fear of falling is not fully known. Therefore, the aim of this study is to investigate the effects of upper extremity functions on fear of falling.

**Materials and Methods**

**Participants**

The study was designed prospectively, cross-

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sectionally. This study was carried out at University Hospital. A total of 61 patients (33 K 28 E) were included in the study. The ethical approval of this study, conducted according to the principles stated in the Helsinki Declaration, was approved by the University Non-Interventional Clinical Research Ethics Committees. (Approval No: 305597). All patients were informed about the purpose of this study before informed consent was requested. Selection criteria include individuals with a minimum 6-month history of stroke, who did not receive treatment (excluding medication), and who received at least 20 points from the Mini Mental Status Test and were diagnosed with hemiplegia.

### **Assessments**

#### Demographic Information

Participants' gender, age, body mass index, dominant side, affected side and stroke duration were recorded (Table 1).

#### Fugl-Meyer Upper Limb Evaluation Scale

In the study, the Fugl-Meyer Upper Limb Evaluation Scale (FMA) was used for rough and fine motor functions of the upper extremities of the patients. In the study, the scores of the upper extremity and coordination/speed subgroups of the scale were total. It is a performance-based scale specific to hemiplegia, and each parameter is scored as 0: unsuccessful, 1: partially successful, 2: completely successful performance. Voluntary movements performed in the shoulder, elbow and forearm together with reflex activity, dynamic flexor and/or extensor synergies are evaluated. When performing wrist evaluation, three different functions of the wrist muscles are evaluated. In hemiplegia hand evaluation, 7 movements (flexion, extension and five grip functions) are evaluated. In coordination / speed assessment, finger-nose test is performed for the upper limb. During this test, tremor, dysmetria and speed of movement are evaluated. The maximum motor performance score for the upper limb is 66 points.<sup>13,14</sup>

#### Arm Motor Ability Test

Arm Motor Ability Test (AMAT) evaluates the motor ability of the hand and arm during daily life activities. The Test consists of a total of 28 component tasks, including 13 complex tasks (involving one to three components). The task speed is recorded with a

stopwatch and the functional ability and movement quality are graded on a 6-point scale. The reliability, internal consistency and validity of the test were found to be high.<sup>15</sup>

#### International Fall Effectiveness Scale

The International Fall Efficacy Scale (FES-I) is for a person when taking a bath, lying on a shelf, preparing food, walking around the house, lying on bed and getting up, responding to the door or phone, sitting or getting up from the chair, getting dressed or undressing, doing light household chores is asked how safe he feels when making a simple purchase. The person is asked to mark 1 to 10 (1 completely unsafe, 10 extremely safe) on paper, and when all points are collected a total score between 0 and 100 is obtained. The validity and reliability of this scale has been demonstrated in studies and its sensitivity to changes in fear has been proven.<sup>16</sup>

### **Statistical analysis**

For statistical analysis, IBM - SPSS version 20.0 for Windows (IBM Corp., Armonk, NY, USA) was used in the statistical package program. Histogram and normal probability graphs and Shapiro-Wilk test were applied to all variables to determine whether the distribution of variables was normally distributed. While evaluating the study data, mean, standard deviation and frequency were used as descriptive statistical methods. Spearman correlation analysis was used in the analysis of the relationships between variables. The level of significance set at  $P < 0.05$  was accepted.

**Ethical clearance:** This study was approved by Firat University, Rectorship Campus, 23100, Elazığ/ TURKEY.

### **Results**

The mean age of 61 patients included in the study was  $62.77 \pm 8.58$ , and body mass index was  $29.21 \pm 2.79$ . The demographic data and clinical features of the patients are shown in Table 1. There was also a positive significant correlation ( $p < 0.05$ ) between FMA and SVO duration. Other demographics found no significant correlation, both among themselves and with surveys.

**Table 1.** Demographic and stroke-related characteristics of the study participants. Continuous variables are presented as mean (SD), while nominal variables are presented as N (% of group).

		N=61	%
<b>Gender</b>	<i>Women</i>	33	54,1
	<i>Male</i>	28	45,9
<b>Dominant Extremity</b>	<i>Right</i>	55	90,2
	<i>Left</i>	6	9,8
<b>Affected Limb</b>	<i>Right</i>	32	52,5
	<i>Left</i>	29	47,5
<b>Stroke Type</b>	<i>Ischemic</i>	46	75,4
	<i>Hemorrhagic</i>	15	24,6
<b>X ± SD</b>		<b>min</b>	<b>max</b>
<b>Age (Years)</b>	62,77 ±8,58	46	81
<b>Stroke Time (Years)</b>	3,11 ±2,78	1	12
<b>BMI (kg/m<sup>2</sup>)</b>	29,21 ± 2,79	23,4	36,1

BMI: Body Mass Index

A very high level of significant difference was observed between FES-I and both FMA and AMAT ( $p < 0.001$ ). There was also a statistically significant difference between AMAT and FMA in which we evaluated upper limb functionality ( $P < 0,01$ ) (Table 2).

**Table 2.** Spearman correlation analysis results between FES-I, AMAT and FMA variables.

		FES-I	AMAT	FMA	X ± SD	min	max
<b>FES-I</b>	P		0,00**	0,00**	6,09±1,49	2	10
	R		-0,886	-0,926			
<b>AMAT</b>	P	0,00**		0,00**	1,84±0,74	0,66	3,41
	R	-0,886		0,967			
<b>FMA</b>	P	0,00**	0,00**		37,71±9,57	22	56
	R	-0,926	0,967				

FES-I: International Fall Efficacy Scale, FMA: Fugl-Meyer Upper Extremity Rating,

AMAT: Arm Motor Ability Test, \* $p < 0.05$  and \*\* $p < 0.01$ .

## **Discussion and Conclusion**

In this study, it was determined that there was a high level of significant association between upper limb function and fear of falling. The results supported our fear of falling hypothesis; There was a negative relationship between upper limb function and fear

of falling. Patients with stroke more than 6 months were included in this study. It was found that there was little difference between the severity of disability among individuals with a 6-month stroke and long-term stroke history. Therefore, the patients included in the study were considered as chronic hemiplegia.<sup>17</sup>

In many studies in the literature, there is a relationship between upper limb function and balance.<sup>18,19</sup> It has been shown that there is an increase in the risk of falling and fear of falling when the balance mechanism is affected.<sup>7</sup> For these reasons, the study of the effects of upper limb function on fear of falling in our study gave the opportunity to approach the issue from a different perspective. Many studies in the literature look at the effect of fear of falling on functions. However, the studies investigating the effect of upper limb function on fear of falling is limited.

It is stated that in 30% to 66% of individuals with hemiplegic stroke, the affected arm remains dysfunctional within 6 months after stroke, and the healing process of upper limb function is slower compared to lower limb function.<sup>19</sup> Another studies are found that there is a relationship between upper extremity functions and recurrent falls in individuals with hemiplegia.<sup>5</sup> I think that decreased upper extremity functions affect the fear of falling in hemiplegic individuals. Because of decreased arm functions, I believe that individuals with stroke are unable to do activities such as grabbing from a place during a fall and therefore have a higher fear of falling. The fear of falling has been shown to slow or even prevent nearly all functional development in individuals with hemiplegia.<sup>10,21,22</sup>

For these reasons, the upper limb should take an important place in rehabilitation practices. However, due to limited rehabilitation resources, late motor recovery frequency in the upper extremity, uncertain which approach is the most beneficial for the upper extremity, physiotherapy applications are often aimed at improving balance, gait and general mobility, so the upper extremity is not given the necessary importance. In our study, we have shown that upper limb functional impairment may cause fear of falling.

**Acknowledgements:** I would like to thank all the patients and the colleagues at the hospital for their cooperation.

**Financial Disclosure and Conflict of Interest:** We affirm that we have no financial affiliation (including research funding) or involvement with any commercial organization that has a direct financial interest in any matter included in this manuscript.

**Compliance with ethical standards:** Ethical approval our study was approved according to the local ethical committee. All patients gave informed written consent to be enrolled into the study according to the Declaration of Helsinki.

**Source of fund:** I affirm that we have no financial

affiliation (including research funding) or involvement with any commercial organization that has a direct financial interest in any matter included in this manuscript.

**Authors' contribution**

Furkan BİLEK conducted all the processes, Data gathering and idea owner of this study, Study design, Data gathering, Writing and submitting manuscript Editing and approval of final draft, edited and checked the final draft and References editing.

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