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Hemiplegic Shoulder Pain in Patients with Stroke in Greek Population

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Abstract: **The main objective of the study was to record the prevalence and intensity of pain in the hemiplegic shoulder in Greek stroke patients, to determine possible factors related to the onset of pain and to investigate its impact on the independence and general health of patients with stroke. Data collection through a questionnaire, consisted of a total of 42 questions. In order to grade the pain intensity of the individuals who participated in this study, surveyed the Visual Analog Scale (VAS) and Numerical Rating Scale (NRS). For the degree of independence the Barthel Index (BI) was used and for the general health status, the General Health Questionnaire (GHQ-28). The study was conducted from March to July 2017 in rehabilitation centers, in Larissa. Seventy four stroke patients, 41 men and 33 women, participated. Statistical software SPSS-22 was used for statistical analysis. The descriptive statistical analysis method was followed. The minimum value of the statistical significance level, p value, was set at 5%. The prevalence of hemiplegic shoulder pain was estimated at 43% and the intensity was mild. The following were observed: 1) pain is associated with a higher degree of dependence of the patients (p=0.027), 2) pain is correlated with the onset of stroke (p=0.005), 3) between spasticity and intensity of pain a correlation was observed (p=0.006), 4) pain correlates with sensation (p=0.001), 5) correlation was observed between pain and subluxation (p=0.008), and 6) pain correlates with duration of hospitalization (p <0.001).**

Keywords: **stroke, shoulder pain, pain, intensity, frequency, activities of daily life.**

I. INTRODUCTION

Hemiplegic shoulder pain (HSP) is a common complication after stoke [1]. Terms such as «Hemiplegic Shoulder Pain», «Post Stroke Pain» and «Poststroke Hemiplegic Shoulder Pain», are synonymous and are used to describe shoulder pain after stroke [2].

HSP is defined as «any subjective complaint of pain in the contralesional or affected hemiplegic shoulder after stroke» [3]. Clinical image between Central Post-Stroke Pain (CPSP), Complex Regional Pain Syndrome (CRPS) and HSP is very similar. As a result, many times, one overlaps the other [4,5]. Due to the fact that characteristics of HSP are not exactly the same as CPSP's, HSP may be a specific subtype of CPSP [6].

It is known that HSP increases the management cost of stroke patients, including hospitalization costs, both in hospitals and rehabilitation centres [7]. The presence of HSP, also, delays rehabilitation by increasing the length of stay of patients with HSP in rehabilitation centers [7,8,9].

The prevalence of HSP presents considerably wide variation, ranging from 5% to 84% [10]. According to a retrospective study in a rehabilitation centre, the HSP prevalence between patients with stroke is 54,8%[8]. One third of survivors

experience HSP at sometime within the first 12 months after stroke[3]. Typically, HSP starts between 8th and 10th week[5]. However, the findings on the time at which HSP occurs after stroke, vary [5,6,8,9,11,12,13,14,15]. The majority of patients with HSP rates it from moderate to severe [1,7]. Usually, occurs on its own without any specific reason, but can also occur as a result of a stimuli [6]. Pain may occur during rest, while sometimes passive movement can increase it [2].

The exact etiology of HSP is still unclear, which may be due to the diversity of its pathogenesis [2]. The existence of various factors which are likely to contribute to the outset of HSP, makes it difficult to determine the most appropriate therapeutic intervention. This has a significant impact on the successful outcome of the rehabilitation of patients with HSP and as a result, no effective interventions have been found for all patients, yet. Consequently, many of those patients continue to report significant shoulder pain [10,16].

Several factors have been associated with HSP such as age [8,14], gender [8], primary etiology of stroke [1,7], hemiplegic side [8,11,13,14,15], duration of hemiplegia [8, 17], subluxation of glenohumeral joint [1, 4, 10, 17, 18, 19], sensory disturbances [1,4,11,14,17,18,20,21], loss of voluntary motor control [1,3,11,12,15,21] and spasticity [6,13,15,18, 22].

The impact of the presence of HSP varies, including negative effects on the independence of the person [1,8,23]. Furthermore, some researchers support that patients dependent in activities of daily life, are more likely to develop HSP [2]. Moreover, Lindgren et al (2007) and Suethanapornkul et al (2008) ascertained that patients with HSP had worse general health condition in comparison to patients without pain.

In accordance with the foregoing, a clear understanding of the association between relevant factors and the presence or intensity of HSP, is necessary. In conclusion, the main objective of this research study was to investigate the frequency and intensity of HSP in Greek patients with stroke, to identify the correlation between HSP and demografic/clinical factors and to ascertain its impact on the independence and general health of patients after stroke.

II. BODY OF ARTICLE

Material and Methods:

The aim of the present study was to determine the incidence and intensity of pain in the hemiplegic shoulder of Greek stroke patients, to investigate factors that may be related to its occurrence and to determine its impact on the independence and general health of patients with cerebral stroke.

Specifically, the research questions examined in the context of the preparation of this study were: 1) “Which is the prevalence of HSP?”, 2) “Which is the intensity of HSP?”, 3) “Which is the degree of independence between the patients?”, 4) “Is there a correlation between the intensity of pain and the degree of independence?”, 5) “Which is the general health status between the patients?”, 6) “Is there a correlation between the intensity of pain and the general health status?”, 7) “ Which is the association between the degree of independence and general health status?”, 8) “Is there a correlation between the intensity of pain and age, gender, educational level, dominant hand, hemiplegic side, onset of stroke, spasticity, sensation, subluxation, previous strokes, type of stroke, duration of hospitalization in hospital and rehabilitation centre and shoulder movement?”.

The inclusion criteria adopted were: 1) patients with a diagnosis of stroke (men and women), 2) age range: 25-100 years, 3) ischemic and hemorrhagic stroke, 4) patients in the acute or chronic phase, 5) patients at a rehabilitation center, 6) hemiplegic side: right or left, 7) patients with paresis or paralysis of upper limb, and 8) patients with or without spasticity of upper limb. The exclusion criteria of the study were: 1) patients with cognitive/perceptive or communication disorder, 2) patients with another type of neurological disorder such as Parkinson’s disease or psychiatric disorder, which may limit the objectivity of the study.

The present study was carried out from March to July 2017 at two rehabilitation centers of the prefecture of Larissa and more specifically in the city of Larissa. The total number of the participants was 74. All of them were hospitalized at the rehabilitation centres. Data collection through a questionnaire, consisted of a total of 42 questions. The questions included demographic characteristics, dominant hand, hemiplegic side, onsetof stroke, previousstroke, typeof stroke, duration of hospitalization, muscletone, sensation, subluxation, shoulder movement, onset of pain after stroke, time of pain

appearance, quality characteristics of pain, record of passive and active range of motion in which the pain starts and previous shoulder injury. In order to measure the intensity of pain, theindividualssurveyed theVisualAnalog Scale(VAS) and NumericalRating Scale(NRS). VAS is a scalefrom0 to 100mm, where0 means"no pain" and 100 means "worstimaginable pain". Pain ischaracterized as"mild"(10-30mm) and "moderate-severe"(40-100mm) [24, 25, 26]. NRS is the numerical version of VAS scale (0-10 integer), where 0 means "no pain" and 10 means "unbearable pain" [26]. For the measurement of the degree of independence the Barthel Index (BI) was used [27]. For the general health status, the General Health Questionnaire (GHQ-28) was used. That questionnaire evaluates somatic symptoms, anxienty, social dysfunction and depression [28]. The sensation and spasticity were assessed with clinical examination [29]. The range of motion was measured by goniometer. The precense of subluxation was ascertained with palpation of the subacromial area [30].

Data collection took place at a single time. As most appropriate method to collect the data of the present study was "convenience sampling" with which the researchers collected as much sample as possible.

For the statistical analysis of the data, the statistical software "SPSS-22" was used. The method of descriptive statistical analysis was followed. Continuous variables were expressed in the form "mean value and standard deviation" , while the discrete variables in frequency and relative frequency (%). The minimum value of the statistical significance level, p-value, was set at 5%. In order to investigate the association, among the studied variables, the Linear Bivariate Correlation method was used. To check for regularity, the Shapiro-Wilk test was used. Spearman rank correlation was used to detect any possible correlation between the variables. For the investigation of the association between the variables and data n = 74, $pH_0 = 0$, $pH_1 = 0.5$, $\alpha = 0.05$, the power of the statistical criterion was calculated higher than 99% [31, 32].

Results:

In the current study 74 patients with stroke participated, 41 of whom were men (55.4%) and 33 women (44.6%). The age of the participants ranged from 32 to 92 years, with an average of 70.4 years and a standard deviation of 13.3. For women, the average was 72.6 years and the standard deviation 12.6. In men, the corresponding values, found 68.5 and 13.7. Five of the patients (6.8%) haven't received any education and 34 of them (45.9%) graduated from primary education. Concerning hand dominance, 67 (90.5%) of the patients were right-handed while 7 (9.5%) were left-handed. For 46 patients (62.2%) the affected side was the left one and for the rest 28 (37.8%) was the right one. Two of the patients (2.7%) had a transient ischemic attack, 56 (75.7%) had ischemic stroke and 16 (21.6%) had hemmorhagic stoke. All of the patients were hospitalized both in hospital and rehabilitation centre and 13 (7.9%) in Intensive Care Unit. Thirty-two (43.2%) reported shoulder pain.

Twenty-nine (39.2%) had spasticity on the hemiplegic shoulder, 25 (33.8%) had flaccidity and 20 (27.0%) had normal muscle tone. Forty-two (56.8%) had normal sensation on the upper limb, 11 (14.9%) had total loss of sensation and 21 (28.4%) had sensation deficits. Twenty-eight (37.8%) had subluxation of glenohumeral joint. Ten (31.37%) reported that the pain started within the first two weeks after stroke, 16 (50.0%) between 2 weeks to 2 months, 6 (18.8%) 2-6 months.

Twenty-one (65.6%) reported that the pain was brief-instantaneous, 7 (21.9%) was intermittent and 4 (12.5%) was continuous. Twenty-seven (84.4%) reported that the pain was deep and 5 (15.6%) was superficial.

During passive movement of the shoulder, 26 (81.3%) reported that pain was going worse with the flexion of the shoulder, 4 (12.5%) with the shoulder extension, 25 (78.1%) with the shoulder abduction, 1 (3.1 %) with the adduction, 1 (3.1%) with internal rotation and 16 (50.0%) with external rotation. Pain appeared at 91.3° flexion, 39.0 ° extention, 76.0° abduction, 45.0 ° adduction, 20.0 ° internal rotation and 29.0 ° external rotation. During active movement of the shoulder, 8 (50.0%) reported that pain was going worse with the flexion of the shoulder, 2 (12.5%) with the shoulder extension, 7 (43.8%) with the shoulder abduction and 5 (31.3%) with the external rotation. Pain appeared at 83.6° flexion, 43.5 ° extention, 73.6 ° abduction, 45.2 ° external rotation. None of the patients with shoulder pain had previous shoulder injury.

The prevalence of HSP was measured with both VAS and NRS scale and was found 43.24%. The intensity of HSP was done through the VAS and NRS scales and both showed that the pain was mild.

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The degree of independence through the Barthel Index scale for patients without pain was found to be 54.4 on average and for patients with pain, 47.5. Concerning the association between the intensity of pain on the hemiplegic shoulder and the degree of independence, found that the intensity of pain correlates statistically significant with the degree of independence (ρ = 0.256, p = 0.028) with VAS. The two factors, also correlate statistically significant (ρ = 0.257, p = 0.027) with NRS scale (Table 1).

Table 1: Correlation between pain and degree of independence of the patient

Correlations					
			Visual Analog Scale (VAS)	Numeric Rating Scale (NRS)	Barthel index
Spearman's rho	Visual Analog Scale (VAS)	Correlation	1,000	,999**	,256*
		Sig. (2-tailed)	.	,000	**,028**
		N	74	74	74
	Numeric Rating Scale (NRS)	Correlation	,999**	1,000	,257*
		Sig. (2-tailed)	,000	.	**,027**
		N	74	74	74
	Barthel index	Correlation	,256*	,257*	1,000
		Sig. (2-tailed)	,028	,027	.
		N	74	74	74
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

The average of general health status, which was assessed with GHQ-28, was 29.3. No statistically significant correlation was found between the intensity of pain and general health status (VAS: ρ=0.055, p=0.763 and NRS: ρ=0.056, p=0.762) and also, between the degree of independence and general health status (ρ=0.067, p=0.569).

No statistically significant correlation was also found between the intensity of pain and gender (VAS: ρ=-0.160, p=0.174 and NRS: ρ=-0.156, p=0.183), between the intensity of pain and age (VAS: ρ=0.042, p=0.720 and NRS: ρ=0.044, p=0.712), between the intensity of pain and educational level (VAS: ρ=0.100, p=0.395 and NRS: ρ=0.107, p=0.364), between the intensity of pain and dominant hand (VAS: ρ=-0.116, p=0.325 and NRS: ρ=-0.116, p=0.324) and between the intensity of pain and hemiplegic side (VAS: ρ=0.084, p=0.474 and NRS: ρ=0.075, p=0.525).

Statistically significant correlation was found between the intensity of pain and the onset of stroke (VAS: ρ=0.324, p=0.005 and NRS: ρ=0.326, p=0.005) (Table 2) and between the intensity of pain and spasticity (VAS: ρ=0.315, p=0.006 and NRS: ρ=0.315, p=0.006) (Table 3). Statistically significant correlation was also found between the intensity of pain and sensation (VAS: ρ=0.373, p=0.001 and NRS: ρ=0.379, p=0.001) (Table 4) and between the intensity of pain and subluxation (VAS: ρ=0.305, p=0.008 and NRS: ρ=0.310, p=0.007) (Table 5). No statistically significant correlation was found between the intensity of pain and previous stroke (VAS: ρ=0.017, p=0.883 and NRS: ρ=0.007, p=0.949) and also between the intensity of pain and type of stroke (VAS: ρ=-0.044, p=0.711 and NRS: ρ=-0.047, p=0.692). Statistically significant correlation was found between the intensity of pain and duration of hospitalization in the rehabilitation centre (VAS: ρ=0.999, p<0.001 and NRS: ρ=0.335, p=0.004) (Table 6).

Concerning the correlation between the intensity of pain and duration of hospitalization in the hospital (VAS: ρ=0.225, p=0.054 and NRS: ρ=0.221, p=0.058) and the intensity of pain and shoulder movement (VAS: ρ=0.177, p=0.131 and NRS: ρ=0.191, p=0.103), no statistically significant correlation was found.

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Table 2: Correlation between pain and the onset of stroke

Correlations					
			Onset of stroke (days)	Visual Analog Scale (VAS)	Numeric Rating Scale (NRS)
Spearman's rho	Onset of stroke (days)	Correlation Coefficient	1.000	.324**	.326**
		Sig. (2-tailed)	.	**.005**	**.005**
		N	4	74	74
	Visual Analog Scale	Correlation Coefficient	.324**	1.000	.999**
		Sig. (2-tailed)	.005		.000
		N	74	74	74
	Numeric Rating Scale	Correlation Coefficient	.326**	.999**	1.000
		Sig. (2-tailed)	.005	.000	.
		N	74	74	74
**. Correlation is significant at the 0.01 level (2-tailed).					

Table 3: Correlation between pain and spasticity

			Visual Analog Scale (VAS)	Numeric Rating Scale (NRS)	Spasticity
Spearman's rho	Visual Analog Scale (VAS)	Correlation Coefficient	1.000	.999**	.315**
		Sig. (2-tailed)	.	.000	.006
		N	74	74	74
	Numeric Rating Scale (NRS)	Correlation Coefficient	.999**	1.000	.315**
		Sig. (2-tailed)	.000	.	.006
		N	74	74	74
	Spasticity	Correlation Coefficient	.315**	.315**	1.000
		Sig. (2-tailed)	**.006**	**.006**	.
		N	74	74	74
**. Correlation is significant at the 0.01 level (2-tailed).					

Table 4: Correlation between pain and sensation

Correlations					
			Sensation	Visual Analog Scale	Numeric Rating Scale
Spearman's rho	Sensation	Correlation Coefficient	1.000	.373**	.379**
		Sig. (2-tailed)		**.001**	**.001**
		N	74	74	74
	Visual Analog	Correlation Coefficient	.373**	1.000	.999**
		Sig. (2-tailed)	.001	.	.000
		N	74	74	74
	Numeric Rating	Correlation Coefficient	.379**	.999**	1.000
		Sig. (2-tailed)	.001	.000	.
		N	74	74	74
**. Correlation is significant at the 0.01 level (2-tailed).					

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Table 5: Correlation between pain and subluxation

Correlations					
			Subluxation	Visual Analog Scale (VAS)	Numeric Rating Scale (NRS)
Spearman's rho	Subluxation	Correlation Coefficient	1.000	.305**	.310**
		Sig. (2-tailed)	.	**.008**	**.007**
		N	74	74	74
	Visual Analog Scale (VAS)	Correlation Coefficient	.305**	1.000	.999**
		Sig. (2-tailed)	.008	.	.000
		N	74	74	74
	Numeric Rating Scale (NRS)	Correlation Coefficient	.310**	.999**	1.000
		Sig. (2-tailed)	.007	.000	.
		N	74	74	74
**. Correlation is significant at the 0.01 level (2-tailed).					

Table 6: Correlation between pain and time in duration of hospitalization

Correlations					
			Visual Analog Scale (VAS)	Numeric Rating Scale (NRS)	Time in duration of hospitalization
Spearman's rho	Visual Analog Scale (VAS)	Correlation Coefficient	1.000	.999**	.335**
		Sig. (2-tailed)	.	**.000**	**.004**
		N	74	74	74
	Numeric Rating Scale (NRS)	Correlation Coefficient	.999**	1.000	.334**
		Sig. (2-tailed)	.000	.	.004
		N	74	74	74
	Time in duration of hospitalization	Correlation Coefficient	.335**	.334**	1.000
		Sig. (2-tailed)	.004	.004	.
		N	74	74	74
**. Correlation is significant at the 0.01 level (2-tailed).					

Discussion:

This study focused on the patients and the perception they have about pain in the hemiplegic shoulder and how they experience it after a stroke. As for the prevalence of HSP, a very high variance (5-84%) is observed. In patients with acute stroke, the variation has a smaller range (17-37%) [1,11,13,17]. In the present study, the prevalence of HSP was calculated on both scales (VAS and NRS) at 43%. The wide variation between the different studies is due to the heterogeneity of the methodology followed by each of them (import criteria, time elapsed since hemiplegia, severity of the disease, difference in quality of care). The intensity of pain in the sample of the current study was calculated as mild. This result agrees with similar studies referring to the particular variable [7,23]. Regarding the association between the pain level and patient independence, there are no bibliographic data. Possibly, the existence of an association is considered to be self-evident. This study wanted to investigate this association from a statistical point of view, and noticed a significant correlation between the two variables. Indeed, the existence of pain in the hemiplegic shoulder after stroke is associated with a higher degree of patient dependence. In the past, studies have shown a significant correlation between poor general health and pain in the HSP [1,14,33]. In contrast, in a similar study, no correlation between pain and anxiety-depression was found [17]. In the present study, there was no correlation between the VAS and NRS ranges with the GHQ-28 scale. The heterogeneity of the results appears to be mainly due to the different general health measurement tools used in the various studies. The lack of a common denominator at this point makes it impossible to have an overall assessment of the association. The relationship between degree of

independence and general health status is also an issue that has not been investigated in any study so far. The result of this research study has shown that the degree of independence and general health status are not statistically significant.

In terms of sex, a large number of studies have shown that there is no relationship between sex and pain, on hemiplegic shoulder in patients with stroke [3,6,9,11,12,14,17,21]. A single study to date has shown the opposite effect [8]. In this study, there was no correlation of pain with sex. It is particularly difficult to draw conclusions about the role of the gender. Studies are necessary with a more reliable and valid sample and with the assistance of weighted socio-demographic factors. The same applies to the age factor. The present study found that age is not related to pain, on the hemiplegic shoulder in patients with stroke. The results are consistent with several other studies [3,6,9,11,12,15,17,21,34]. Correlation between pain and age was observed in the results of Demirci et al (2007) and Hadianfard et al (2008). Concerning the relationship between the level of pain, on the hemiplegic shoulder in patients with stroke, and education level and the dominant hand, there are no results from previous studies. In the present study, no statistically significant correlation was observed for any of the three factors, mentioned above. Regarding the relationship between pain, on hemiplegic shoulder in stroke patients and hemiplegic side, there are several studies but with shared results. There are studies that suggest a relationship [8, 11,13,14,15] and studies to the contrary [3,6,7,9,12,17]. The results of this work agree with the studies that do not find a correlation. Lack of initial methodological design (representative sampling, common exploratory tools, weighting of common factors, etc.) makes it impossible to extract a centralized statistical result.

In the results of this study, it was observed that the pain in the hemiplegic shoulder in patients with stroke is statistically significant correlated with the time of stroke. The results are consistent with those of all previous studies [1,5,8,9,11,17]. The existence of a common trend of the result, despite the random heterogeneity of the studies above, enhances the reliability of the result. Regarding the relationship between spasticity and pain, the opinions vary. many recent studies refer to a correlation [613,15,18,22]. On the other hand, another group of research studies argues the opposite [9,12,17,35]. In this study, there was a correlation between spasticity and pain. In the present study, in relation to the sensory deficit and pain relation, on the hemiplegic shoulder in patients with stroke, correlation was observed. The results are consistent with the results of other studies [1,4,11,14,18,20,21]. In terms of pain and subluxation of glenohumeral joint, there are studies that support the relationship between them [1,4,17,18], and studies that contradict to this conclusion [6,9]. In this study, a correlation was found between pain and subluxation of glenohumeral joint.

Regarding the relationship between the level of pain and the existence of previous stroke, there are no results from similar research so far. The result of this study did not show a statistically significant relationship. There is no statistically significant relationship between pain and type of stroke. The same result was found in previous studies [3,6,7,12,15,34]. Regarding the duration of hospitalization and pain, on the hemiplegic shoulder, there was statistically significant correlation between them. Similar results do not come out from previous studies. Furthermore, there are no studies on the relationship between pain, on the hemiplegic shoulder in patients with stroke, and the time from the onset of the stroke until they went to a rehabilitation center. In the present study no correlation was observed between the two variables. Regarding pain on hemiplegic shoulder and shoulder movement, we did not find a statistically significant correlation.

III. CONCLUSION

The lack of generalization of the results of this study in the general population of Greece due to the sampling method is offset by the quality and quantity of the analyzed information. In no previous, similar, study, there was such material. In the present study, data on variables, similar to previous studies or variables that have not been studied in the past, were recorded and analyzed, the trends already suggested, from previous surveys, were investigated, and new correlations were proposed. The prevelance of shoulder pain in the current study was 43.24%, the majority of whom had mild pain. Half of the patients who reported shoulder pain, developed pain within first year, and especially between 2 weeks to 2 months after stroke. Shoulder pain seems to restrict patients' daily life after stroke. Also, the shoulder pain was related to spasticity, subluxation of glenohumeral joint, sensory distrubances, onset of stroke and duration of hospitalization in the rehabilitation centre. On the other hand, gender, age, educational level, dominant hand, hemiplegic side, previous stroke, type of stroke, duration of hospitalization in the hospital and shoulder movement it seems that they are not factors that contribute to the appearance of shoulder pain. In conclusion, shoulder pain is common in patients with stroke. However, it is hard to correlate the shoulder pain of patients with stroke with a single cause, because of its multifactorial nature and because more than one factor can cause shoulder pain. Further research is required to elucidate the etiologic factors of shoulder pain after stroke, so that the appropriate treatment methods can be determined in the future and its impacts on patients' life can be reduced.

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