

## The Correlation of the Limitations of Movement of the Shoulder Joint with the Functional Ability of Frozen Shoulder Patients at the Medical Rehabilitation Institute Dr. Mohammad Hoesin Palembang

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### Abstract

**Background:** Frozen shoulder is a condition of the shoulder joint that experiences inflammation, pain, adhesions, atrophy and shortening of the joint capsule resulting in limited motion. In frozen shoulder patients, the limited range of motion of the shoulder joint can affect and reduce functional ability. This study aims to analyze the correlation between the limited area of motion of the shoulder joint with the functional ability of frozen shoulder patients at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang. **Methods:** This study was an observational analytic study, correlation test, with a cross sectional design. There were 29 frozen shoulder patients who met the inclusion criteria in the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang in November 2018 was taken as a sample using consecutive sampling techniques. Functional ability was assessed using the quickDASH questionnaire and the area of motion was measured using a goniometer, then analyzed. **Results:** The results of the correlation test showed significant results between functional abilities and the area of motion of the shoulder joints. Active flexion ( $p = 0.000$ ;  $r = -0.669$ ), active extension ( $p = 0.004$ ;  $r = -0.520$ ), active abduction ( $p = 0.000$ ;  $r = -0.663$ ), active adduction ( $p = 0.022$ ;  $r = -0.423$ ), passive flexion ( $p = 0.001$ ;  $r = -0.589$ ), passive extension ( $p = 0.002$ ;  $r = -0.543$ ), passive abduction ( $p = 0.000$ ;  $r = -0.676$ ), passive adduction ( $p = 0.038$ ;  $r = -0.388$ ). **Conclusion:** There is a significant correlation between limited joint motion and functional ability in frozen shoulder patients at the Medical Rehabilitation Installation of Dr. Mohammad Hoesin Palembang

**Keywords:** Frozen Shoulder, Joint Motion Area, Functional Ability

## 1. Introduction

The shoulder joint or glenohumeral joint is a ball and socket joint with three degrees of freedom of motion and is one of the greatest ranges of movement in all joints. Range of movements in the shoulder joint are abduction, adduction, anteversion, retroversion, external rotation and internal rotation<sup>1</sup>. The extent of motion in the shoulder joint and the structure of the humeral head loop angle of 180° and the glenoidal scapulae cavity angle of only 120° causes 1/3 of the humeral head surface not to be covered by the glenoidalis scapulae fossa, so that the shoulder joint becomes unstable. Due to this instability, the shoulder joint is prone to injury, inflammation, and tears of muscles and ligaments<sup>2</sup>. Inflammation of the shoulder joint includes frozen shoulder, scapulohumeral peri-arthritis, rotator cuff tendonitis and subacromial bursitis<sup>3</sup>.

Frozen shoulder or adhesive capsulitis is a condition where there is inflammation, pain, adhesions, atrophy and shortening of the joint capsule resulting in limited motion of the shoulder joint<sup>4</sup>. Obesity, thyroid dysfunction, heart disease, Dupuytren's contracture, breast cancer therapy and neurological disorders can increase risk factors for frozen shoulders. Based on research in the United States, the average prevalence of frozen shoulder occurs most often at the age of 40 to 60 years and is more common in women (58.4%) than in men (41.6%)<sup>5</sup>. Diagnosis of frozen shoulder is the presence of progressive pain symptoms that can interfere with sleep at night, limited range of motion or active and passive range of motion in elevation and rotation movements for at least 1 month, and impaired functional activities such as flexion, extension and abduction movements. getting irritated due to pain or stiffness<sup>6</sup>.

Frozen shoulder has three clinical phases, namely a painful stage, frozen stage, and a thawing stage that develops progressively, these three phases develop around six months to two years<sup>7</sup>. Frozen shoulder causes the capsule in the shoulder joint to contract and form scar tissue. Complaints that often occur in motion and function in the shoulder joint are

basically pain and stiffness that result in limited range of motion in the shoulder joint<sup>8</sup>.

In Fernandes' research, the decline in functional abilities in the form of physical, psychological, social and environmental activities greatly determines the quality of life in frozen shoulder sufferers. This is also supported by Suprawesta et al<sup>9</sup>. said that limited range of motion can result in decreased functional activity. Decreased functional ability can cause a person's quality of life to be impaired, especially in the ability for physical activity. Functional physical activity in the shoulder joint is the activity of moving the shoulder joint with the aim of carrying out functional movements of a person in everyday life such as shampooing, rubbing the back while bathing, wearing and removing undershirts (t-shirts), wearing button-down shirts, wearing pants, taking above objects, relieving heavy weights, taking objects in the back pocket of the pants<sup>10</sup>.

The functional ability of the shoulders can be measured using the QuickDASH questionnaire. The QuickDASH questionnaire was used to assess upper extremity function. The QuickDASH questionnaire consists of 11 questions and is simpler than the DASH questionnaire. The value of the QuickDASH questionnaire ranges from 0 (normal or no interference) to 100 (abnormal)<sup>11,12</sup>.

The QuickDASH questionnaire is the best questionnaire for assessment of the upper limbs, very easy to apply, analyze and understand. This questionnaire is good to use for research on the upper limb because it is the most tested, most frequently used, more responsive, valid and reliable<sup>13,14</sup>. Based on research by Franchignoni et al (2014), the QuickDASH questionnaire has a sensitivity of 79% and a specificity of 75% in measuring functional disorders in the upper extremities.

There are many patients with frozen shoulder found and the authors have not found research on the limitations of joint motion with functional abilities in frozen shoulder in Indonesia, therefore the authors are interested in conducting research on whether there is a strong relationship between the limited area of motion of the shoulder joint with functional

abilities which the assessment method uses. The QuickDASH questionnaire and this study are also useful as an evaluation material to determine the success rate of therapy in patients as well as information material to increase understanding of the relationship between the area of motion of the shoulder joint and the functional ability of frozen shoulder.

## **2. Research methods**

This type of research is an observational analytic study, correlation test, with a cross sectional design. This type of research was chosen to determine the correlation between the limited area of motion of the shoulder joint with the functional ability of frozen shoulder patients at the Medical Rehabilitation Institute Dr. Mohammad Hoesin Palembang.

This research was started in August 2018 to December 2018 at the Medical Rehabilitation Installation of Dr. Mohammad Hoesin Palembang.

The population in this study were all frozen shoulder patients in the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang in the period November 2018

The samples in this study were all frozen shoulder patients who met the inclusion and exclusion criteria in the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang in the period November 2018.

The sampling method in this study was carried out by consecutive sampling in which all subjects who met the research requirements were taken until the sample size was met, namely sampling based on frozen shoulder patients who met the inclusion and exclusion criteria who came to the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang in October 2018 - November 2018 until the number of samples is met.

Inclusion criteria were frozen shoulder patients diagnosed by physicians who specialize in physical medicine and medical rehabilitation at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang.

Exclusion criteria were frozen shoulder

patients who were unable or unwilling and did not cooperate in filling out a questionnaire or being interviewed. Patients who have experienced acute trauma to the shoulder joint, other infections of the shoulder joint and malignancy of the shoulder who have been diagnosed by a doctor.

The independent variable in this study is the limited area of motion of the shoulder joint in frozen shoulder patients.

The dependent variable is the dependent variable in this study is the functional ability of frozen shoulder patients.

Data obtained from the results of interviews and filling out the questionnaire will be processed and analyzed to see the significance of the relationship between variables and test the hypothesis. Data analysis was carried out by univariate and bivariate methods using SPSS data processing software version 24. The research data were analyzed descriptively and analytically which were presented in the form of distribution and frequency tables and explained in narrative form.

Univariate analysis was carried out to determine the value of the frequency distribution, namely the mean, standard deviation, minimum and maximum values of the limited range of motion and functional abilities in patients with frozen shoulder. The bivariate analysis used in this study is the Pearson / Spearman test which aims to obtain a strong relationship between the dependent variable and the independent variable. If the data distribution is normal, then the Pearson correlation measure is used, if the data distribution is not normal then the Spearman correlation measure is used. There is a significant correlation between the two tested variables if it has a significant p value ( $p < 0.05$ ). The strength of correlation ( $r$ ) 0.0-0.2 is very weak, 0.2-0.4 is weak, 0.4-0.6 is moderate, 0.6-0.8 is strong, and 0.8 -1.0 is very strong. The strength of a positive (+) correlation indicates the direction of the unidirectional correlation, while a negative (-) value indicates the opposite direction of the correlation.

## **3. Result**

This study was an observational analytic study with a cross sectional design. This study was taken directly by researchers with interviews and measurements of range of movement of frozen shoulder patients who came to the Medical Rehabilitation Installation of Dr. Mohammad Hoesin Palembang in November 2018. The number of patients who came in November 2018 was 29 people who had met the inclusion and exclusion criteria for the study.

General Characteristics of Research Subjects in **Table 1**, the general characteristics of research subjects are presented, consisting of gender, age and diagnosis of frozen shoulder. Of the 29 frozen shoulder patients, 7 (24.1%) were male and 22 (75.9%) female. This study shows that frozen shoulder patients are more in women than men.

Based on age, people with frozen shoulders mostly occurred at the age of 50-59 years (51.7%). There were 2 patients (6.9%) at the age of less than 49 years, 8 patients (27.6%) at the age of 60-69 years, and 4 patients (13.8%) at the age of more than 70 years.

Based on the diagnosis of frozen shoulder, most occurred in the right frozen shoulder as many as 25 patients (86.2%). Then on the left frozen shoulder and bilateral each as many as 2 people (6.9%).

Characteristics of Research Subjects Based on Range of Movement Range of movement in frozen shoulder patients was measured using a goniometer that assesses active and passive flexion, extension, abduction and adduction. Of the 29 patients, the average value of active flexion motion was 117.24 with a standard deviation value of 31.498, a minimum value of 50 and a maximum value of 180. In active extension motion, the average value was 35.69 with a standard deviation value. 7,874, the minimum value is 20 and the maximum value is 60.

In active abduction motion, the average value is 112.59 with a standard deviation value of 36.12, a minimum value of 35 and a maximum value of 180. In active adduction motion it is 56.38 with a standard deviation value of 21.251, the minimum value is 10 and a

maximum value of 90.

In passive flexion motion, the average value is 123.79 with a standard deviation value of 29.691, a minimum value of 60 and a maximum value of 180. In passive extension motion, the average value is 42.07 with a standard deviation value of 8.610, the minimum value is 25 and the maximum value is 60.

In passive abduction motion, the average value is 117.41 with a standard deviation value of 31.527, a minimum value of 45 and a maximum value of 180. In passive adduction motion it is 62.93 with a standard deviation value of 19.754, a minimum value of 20 and a value a maximum of 90.

Bivariate analysis was conducted to determine the meaningful relationship between the dependent variable and the independent variable. The dependent variable in this study is functional ability, while the independent variable is a range of movement consisting of flexion, extension, abduction and adduction which is measured actively and passively. The normality test used was Shapiro-Wilk because the subjects were 29 patients. In this study, the Pearson correlation test was used if the data were normally distributed and as an alternative, the Spearman correlation test was used if the data were not normally distributed.

In the normality test, data is normally distributed at the value of range of movement of active flexion movement of 0.156, active abduction of 0.69, active adduction of 0.23, passive flexion of 0.221, passive extension of 0.338, passive abduction of 0.061 and passive adduction of 0.152. The QuickDASH result value is 0.088, which means that the data is normally distributed. Meanwhile, the active extension value is 0.016, which means the data is not normally distributed. Therefore for active flexion movements, active abduction, active adduction, passive flexion, passive extension, passive abduction and passive adduction using the *Pearson correlation* test. Meanwhile, the active extension uses the Spearman correlation test.

Multivariate analysis in this study uses multiple linear regression because it has more

than one independent variable. The analysis was performed using the backward method, i.e

variables that did not meet the P-out (0.10) were removed from the model.

**Table 1. Sample Distribution Based on General Characteristics (N = 29)**

No	General Characteristics	N	%
1	Gender		
	Male	7	24.1
	Female	22	75.9
2	Age		
	≤ 49 years	2	6.9
	50 – 59 years	15	51.7
	60 – 69 years	8	27.6
	≥ 70 years	4	13.8
3	Diagnosis of <i>frozen shoulder</i>		
	Right	25	86.2
	Left	2	6.9
	Bilateral	2	6.9

**Table 2. Frequency Distribution of Frozen Shoulder Patients' Range of Movement**

	Mean	Std. Deviasi	Min	Max
<b>Active Flexibility</b>	117.24	31.498	50	180
<b>Active Extension</b>	35.69	7.874	20	60
<b>Active Abduction</b>	112.59	36.120	35	180
<b>Adduction is Active</b>	56.38	21.251	10	90
<b>Passive Flexion</b>	123.79	29.691	60	180
<b>Passive Extension</b>	42.07	8.610	25	60
<b>Passive Abduction</b>	117.41	31.527	45	180
<b>Passive Adduction</b>	62.93	19.754	20	90

#### 4. Discussion

The data of this study were taken at the Medical Rehabilitation Installation as many as 29 frozen shoulder patients who had met the inclusion and exclusion criteria. This research was conducted in November 2018 at the Dr. Hospital Medical Rehabilitation Installation. Mohammad Hoesin Palembang.

The results of this study indicate that women (75.9%) suffer more from frozen shoulders than men (24.1%). This is the same as previous research conducted by Fernandes (2015) which states that frozen shoulder occurs most often in women (53.5%) than in men (46.5%). This is also supported by research conducted by Kingston et al. (2018) states that women have a percentage of 58.4% and men at 41.6%, which means that women suffer from frozen shoulder more often than men. In addition, this is also supported by a theory contained in a journal entitled Frozen

Shoulder-A stiff problem that requires a flexible approach which states that women have a risk of suffering from frozen shoulders more often than men due to the decrease in estrogen and progesterone hormones, especially in elderly and those who have experienced menopause<sup>15,16</sup>

In this study, it was found that based on age, frozen shoulder patients mostly occurred at the age of 50-59 years (51.7%). This is supported by research from Kingston et al. (2018) which states that the most common age for suffering from frozen shoulder is 50-59 years. Then in the study of Lynch and Edwards (2013) said that frozen shoulder most often occurs at the age of 40-60 years. Research by Guyver, Bruce and Rees states that frozen shoulder usually occurs in the 5<sup>th</sup> and 6<sup>th</sup> decades of life where at that time there is a decrease in bone mass which is also associated with menopause which causes brittle bones,

fractures and joints to experience decreased function, one of which is fluid. synovial joint is reduced<sup>17,18,19</sup>.

Based on the diagnosis of frozen shoulder, in this study it was found that the right shoulder (86.2%) was more frequently affected than the left shoulder or both. This is supported by Fernandes' research<sup>20</sup>, which states that the right shoulder is more often affected by frozen shoulder with a percentage of 95.3% than the left shoulder with a percentage of 4.7% due to the fact that the right hand is more often used for activities. which makes it more prone to trauma. In addition, in the study of Manske and Prohaska<sup>21</sup>, said that frozen shoulders are very rare in both shoulders and often occur in the right shoulder. Apart from Fernandes' research, Bagheri et al research<sup>22</sup>. It also states that frozen shoulder most often occurs in the right shoulder with a percentage of 54%, followed by the incidence of left frozen shoulder with a percentage of 36% and rarely occurs on both shoulders with a percentage of 10%.

From the results of the range of movement correlation test in shoulder joint motion with the functional ability of frozen shoulder patients, it was found that flexion, extension, abduction and adduction both actively and passively had significant correlation test results with the correlation coefficient value which had a negative direction which meant that it was higher. The value of the range of movement of motion in the shoulder joint, the smaller the functional ability score, which indicates that the more functional abilities that people with frozen shoulders can perform. However, the opposite can also happen, namely the lower the range of movement value of motion in the shoulder joint, the greater the functional ability score, which indicates that the lower the functional ability that can be performed by frozen shoulder sufferers. This is also supported by the research of Bagheri et al <sup>23,24</sup>. said that both active and passive extension and abduction movements have a correlation value of 0.001 ( $p < 0.05$ ) with a correlation coefficient of -0.33 which has a negative correlation direction. According to research by Phil Page

(2010), it is stated that in patients with frozen shoulder, the most often experienced limited area of joint motion is usually flexion, abduction and external rotation. This is also supported by the research of Lynch and Edwards<sup>25</sup>. Yang also states that the limited range of motion of the frozen shoulder is usually flexion, abduction and external rotation. In addition, on the clinical practical guidelines written by Kelly et al<sup>26</sup>. about Shoulder Pain and Mobility Deficits: Adhesive Capsulitis states that in addition to flexion, abduction and external rotation movements, limited range of movement in frozen shoulder patients also occurs in adduction and internal rotation movements.

The results of this study, obtained a significant correlation between the limitation of motion of the shoulder joint with the functional ability of frozen shoulder patients. This is also supported by Hamblen and Simpson and Brumitt who stated that in patients with frozen shoulders, there is inflammation, adhesions, atrophy and shortening of the joint capsule resulting in limited motion of the shoulder joint. As a result of the extensive inflammatory process causing increased fibroblast activity then there is thickening and shortening of the joint capsule, the result of this thickening and shortening causes the collagen matrix to become irregular so that the flexibility of the connective tissue around the shoulder joint will decrease which over time causes stiffness in the shoulder joint and then causes limited range of movement in the shoulder joint<sup>27,28</sup>. In addition, pain due to inflammation and limited range of movement in patients with frozen shoulders will cause the patient to rarely use his hands for activities resulting in decreased muscle strength around the shoulder joint and muscle atrophy which will ultimately cause decreased functional ability in patients with frozen shoulder. This theory is also supported by Morgan and Potthoff saying that the pathological process in patients with frozen shoulder is the occurrence of an inflammatory process and an increase in fibroblast activity which will cause a decrease in the range of movement in the shoulder joint and a decrease in the ability to carry out daily

activities<sup>29</sup>.

In addition to the above theory, a book entitled "Mechanical Shoulder Disorders" written by Porterfield and DeRosa states that from the anatomical structure of the shoulder only 2/3 of the glenoidalis scapulae fossa covers the sphere on the humeral head, this causes the shoulder joint to become unstable and prone to injury. Therefore, it is one of the risk factors that can increase the occurrence of injury to the shoulder. One of the most common injuries is tearing of the ligaments and muscles, which are stabilizers in the shoulder. This is also supported by Hamilton, Weimar and Lutgens<sup>30</sup> said that several factors that can affect stability, mobility, strength and range of movement in the shoulder are based on the shape of the bone structure, ligaments and muscles in the shoulder. Because stability in the shoulder joint is largely formed based on the shape of the structure of the bones, ligaments and muscles in the shoulder, disruption of the shoulder muscles will cause pain and decreased joint mobility, resulting in limited range of motion which results in decreased functional activity<sup>31,32</sup>.

In this study, the assessment of functional ability was measured using the QuickDASH questionnaire which consisted of 11 questions containing 3 questions to assess symptoms and 8 questions to assess the ability of daily activities, stating that QuickDASH consists of 11 questions containing 6 questions to assess daily activities, 2 questions to assess social activity, 2 questions to assess symptoms, and 1 question to assess sleep quality. In this study, based on the results of multivariate analysis, it was found that the motion of the shoulder joint that has a strong influence on functional abilities measured using the QuickDASH questionnaire is passive abduction. This is supported by the research of Bagheri et al.<sup>33,34</sup>. Which states that the abduction movement has a stronger influence and relationship to functional ability.

The limitation of this study is that at the time of data collection, many research subjects who came were repeat patients so that the number of research subjects was limited. This study has limited time to conduct research

because during the research process, researchers are still undergoing the learning process at the Faculty of Medicine, Sriwijaya University, Palembang.

## 5. Conclusion

Based on the results of the study regarding the correlation between the limited area of motion of the joints with the functional ability of frozen shoulder patients at the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang, it can be concluded that:

The general characteristics of the research subjects of frozen shoulder patients were female gender as much as 75.9%, the largest age group was at the age of 50-59 years as much as 51.7% and the most diagnosis of frozen shoulder was right frozen shoulder as much as 86.2%. The area of motion in patients with frozen shoulder is based on active and passive flexion, extension, abduction and adduction joint motion. In active flexion motion, it has an average value of 117.24 with a standard deviation of 31.498, a minimum value of 50 and a maximum value of 180. In active extension motion, the average value is 35.69 with a standard deviation value of 7.874. the minimum value is 20 and the maximum value is 60. In active abduction motion, the average value is 112.59 with a standard deviation value of 36.12, a minimum value of 35 and a maximum value of 180. In active adduction motion, an average value of 56.38 is obtained with a standard deviation value of 21,251, the minimum value is 10 and the maximum value is 90. In passive flexion motion, the average value is 123.79 with a standard deviation value of 29.691, a minimum value of 60 and a maximum value of 180. In passive extension motion, the average value is 42.07 with a standard deviation value of 8.610, The minimum value is 25 and the maximum value is 60. In passive abduction, the average value is 117.41 with a standard deviation value of 31.527, a minimum value of 45 and a maximum value of 180. In passive adduction motion, the average value is 62.93 with a standard deviation value of 19.754, a minimum value of 20 and a maximum value of 90.

Functional ability in frozen shoulder patients based on the quickDASH questionnaire has an average value of 34.455 with a standard deviation of 16, 7416, the minimum value is 11.4 and the maximum value is 75.

There is a significant correlation between the limited area of motion with the functional ability in patients with frozen shoulder, namely the higher the range of movement of the shoulder joint, the smaller the functional ability score, which indicates that the greater the functional ability that can be performed by frozen shoulder patients. However, the opposite can also happen, namely the lower the range of movement value of the shoulder joint motion, the greater the functional ability score which indicates that the lower the functional ability that can be performed by frozen shoulder sufferers.

Joint motion that has the strongest influence on functional ability measured using the QuickDASH questionnaire is passive abduction.

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