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Predicting factors for walking ability of postoperative patients with hemiarthroplasty at Wahidin Sudirohusodo Hospital in Makassar

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ABSTRACT

Background: The ability to make early predictors in post-surgery includes health workers preparing patients for outpatient care. The purpose of this study is to determine the factors that influence the ability to walk postoperative hemiarthroplasty patients when patients are admitted. We hypnotized that age, sex, preoperative walking status, time interval between injury to surgery, preoperative hemoglobin level, muscle weakness, muscle atrophy, anxiety level and body mass index would be predictive factors for walking ability post hemiarthroplasty surgery.
Method: An descriptive-analytic study with a cross sectional retrospective approach was conducted at the Wahidin Sudirohusodo Hospital in Makassar 2020. Patients with fractures of the proximal femur had undergone hemiarthroplasty surgery and were over 50 years of age at admission from September 2019 to October 2020. Bivariate and multivariate with logistic regression was used.
Result: 39 samples according to inclusion criteria were analyzed. Muscle atrophy has a significant correlation with p = 0,04 (p<0,05). Body mass index and muscle atrophy have the most dominant factors for predict walking ability post hemiarthroplasty (EXP (B) 7,282 & EXP (B) 0,083) eventhough not significant statistically (p = 0,116 & p = 0,073).
Conclusion: The muscle atrophy variable in this study was the most significant factor in prediction walking ability post hemiarthroplasty surgery. Also, patient with normal BMI will encourage early walk after surgery better than abnormal BMI in the same muscle-wasting condition.

Keywords: Walking ability, hemiarthroplasty, femoral neck fracture, muscle atrophy, Body Mass Index.
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INTRODUCTION

Proximal femoral fracture is a fracture that is found more frequently in the elderly population. Management starts from non-operative, percutaneous fixation, and open reduction internal fixation (ORIF) arthroplasty, both total and partial. The decision to determine the management of a femoral neck fracture depends on two factors. First, the patient's clinical condition includes age, activity and comorbidities. Second, the type of fracture, whether there is displaced or not.[1] To date, there are no medical indicators to predict when postoperative patients will finally discharge. Therefore, it is necessary to make an early predictor of the patient's walking ability after surgery.[2]

Hip fracture in the elderly is a major public health problem and accounts for a quarter of all fractures in patients over 75 years.[3] Hip fracture management is based on the fracture location: the two main categories are intra- and extra-capsular fractures. Hip hemiarthroplasty is the recommended surgical option for brittle and low bones because a large diameter hemiarthroplasty "head" component reduces the risk of dislocation.[4]

A study conducted by Yurdaku et al. regarding the postoperative outcome of hemiarthroplasty and total hip replacement 4-12 years postoperatively found the physical mobility of the Total Hip Arthroplasty (THA) group was better than hemiarthroplasty.[5]

A study conducted by Moretti VM et al. showed that age was significantly related to walking ability after surgery.[6] One of the influence risk factors is gender. A study conducted by Lars et al. found that patients gender who underwent walking exercises post-hip fracture was more in women (78%).[7]

A study conducted by Mitsuaki et al. Found that patients who used walking aids before surgery had a 6-fold worse risk of walking ability.[8] A study conducted by Bower Emily et al. in 2016 in the United States found that anxiety due to fear of falling again will affect patient rehabilitation and result in decreased ability to walk.[9]

Table 1. Bivariat analysis between variables and walking ability

Variables		Walking Ability				p-value
		Early		Late		
		n	%	n	%	
Age	<65 years	7	17,9	1	2,6	0,21
	>65 years	20	51,3	11	28,2	
Sex	Male	9	23,1	4	10,3	1,00
	Female	18	46,2	8	20,5	
Anxiety	Not Anxiety	27	69,2	11	28,2	0,13
	Anxiety	0	0	1	2,6	
Muscle Atrophy	Not Atrophy	26	66,7	9	23,1	0,04*
	Atrophy	1	2,6	3	7,7	
Muscle	Normal	5	12,8	3	7,7	0,64
	Not Normal	22	56,4	9	23,1	
Pain	No Pain	23	58,8	10	25,61	0,88
	Pain	4	10,3	2	5,1	
Hemoglobin	Normal	15	38,5	4	10,3	0,20
	Anemia	12	30,8	8	20,5	
Interval	No neglected	15	28,5	7	17,9	0,87
	Neglected	12	30,8	5	12,8	
BMI	Normal	18	46,2	11	28,2	0,09
	Not Normal	9	23,1	1	2,6	
Walking	Independent	25	64,1	10	25,6	0,38
	Dependent	2	2,6	2	2,6	

*p-value<0.05

A study conducted by Salpakoski A et al. in Finland found no difference in postoperative hemoglobin results. This study found that patients with a heavier body mass index had a greater decrease in walking ability. This study also describes patients who have a longer surgical injury time, have a worse ability to walk.[10]

Patients, especially the elderly who have decreased muscle strength, will be at risk of walking problems after hemiarthroplasty surgery.[11] More severe postoperative pain had a 6-fold worse risk of walking ability than the group who did not or have a history of mild pain after surgery.[10] A study conducted by Snyder C et al. showed the presence of muscle atrophy starting from the waist, thigh and calf of patients who had limited activity for five years. Also, there was a significant relationship between the length of time of walking onset after surgery with the incidence of postoperative complications and prolonged hospitalization.[11] This study aims to find the factors that can be used as the predictive factors of walking ability post hemiarthroplasty. It can be used as a reference for postoperative management methods.

METHOD

The research was conducted at the Teaching Hospital of the Orthopedic and Traumatology Section of the Universitas Hasanuddin Medical Faculty, Makassar. The research was conducted from November 2020 - December 2020.

The variables used in this research are

1) Dependent Variables: age, sex, walking ability before surgery, hemoglobin, Body Mass Index (BMI), intervals between surgery, anxiety, muscle tone, muscle atrophy dan pain after surgery.
2) Independent Variables: walking ability after hemiarthroplasty surgery

Thirty-nine final samples were included in this study after eliminating exclusion criteria (3 samples excluded due to the inability to walk before the surgery, two samples excluded due to not being operated and 1 sample excluded due to younger age). Patients were with fractures of the proximal femur undergone hemiarthroplasty surgery and were over 50 years of age at admission from September 2019 to October 2020.

Samples were patients with a fracture of the proximal femur, which had undergone hemiarthroplasty surgery. The sampling method was to collect the patient's Medical Record data as secondary data.

The sampling technique in this study was total sampling. This study used a research design in the form of a descriptive-analytic cross-sectional study.

The data obtained, processed by using statistical methods and presented in the form of narratives, tables, and graphs. The statistical tests used in this study were descriptive cross-tabulation and chi-square nonparametric correlation & Logistic Regression Test using the SPSS computer program. The significance of the result is shown on p-Value <0.05.

RESULT

Table 1 described the sample distribution in each variable based on walking ability. On patient with <65 years of age who can walk <3 days (early walk with proportion 17.9% while those who walk >3 days (late walk) with 2.6%. For patients aged >65 years who could walk <3 days (early walk) were 20 patients (51.3%), while the patient that walked >3 days (late walk) were 11 patients (28.2%).

In males, the patient could walk <3 days (early walk), 23.1%, while the patient could be walked >3 days (late walk) were 20.3%. Female patients who could walk <3 days (early walk) were 18 patients (46.8%), while those who walked >3 days (late walk) were eight patients (20.5%).

Distribution of patient anxiety on the ability to walk after hemiarthroplasty surgery, patients who are not anxious who can walk <3 days (early walk) are 27 patients (69.2%), while those who walk >3 days (late walk) are 11 patients (28.2%). For anxious patients who can walk <3 days (early walk), namely 0 patients (0%) while those who walk> 3 days (late walk) are one patient (2.6%).

Distribution of muscle atrophy to the walking ability of patients who have hemiarthroplasty surgery, in non-atrophic patients who can walk <3 days (early walk) are 26 patients (66.7%), while those who walk> 3 days (late walk) are nine patients (23, 1%). For atrophic patients who can walk <3 days (early walk) that is one patient (2.6%), while those who walk >3

Table 2. Multivariate Analysis

Variables		B	EXP(B)	df	Sig	95% CI for EXP(B)	
						Lower	Upper
Step 1[a]	Age	-1.405	.245	1	.316	.016	3.832
	Anxiety	-19.053	.000	1	1.000	.000	.
	Atrophy	-2.480	.084	1	.110	.004	1.758
	Hemoglobin	-.581	.559	1	.467	.117	2.676
	BMI	1.894	6.643	1	.176	.428	103.032
	Constant	19.309	2.432E8	1	1.000		
Step 2[a]	Age	-1.484	.227	1	.297	.014	3.682
	Atrophy	-2.686	.068	1	.069	.004	1.228
	Hemoglobin	-.604	.547	1	.450	.114	2.623
	BMI	1.979	7.232	1	.165	.444	117.824
	Constant	.398	1.489	1	.804		
Step 3[a]	Age	-1.623	.197	1	.272	.011	3.569
	Atrophy	-2.769	.063	1	.055	.004	1.066
	BMI	1.937	6.935	1	.159	.469	102.569
	Constant	.254	1.289	1	.871		
Step 4[a]	Atrophy	-2.487	.083	1	.073	.006	1.256
	BMI	1.985	7.282	1	.116	.614	86.338
	Constant	-.231	.794	1	.876		

days (late walk) are three patients (7.7%).

Distribution of muscle strength to the ability to walk of patients who have hemiarthroplasty surgery, at normal muscle strength that can walk <3 days (early walk), namely five patients (12.8%) while those who walk >3 days (late walk) are three patients (7, 7%). For patients with abnormal muscle strength who could walk <3 days (early walk) were 22 patients (56.4%), while those who walked >3 days (late walk) were nine patients (23.1%).

Distribution of pain to the ability to walk of patients who have hemiarthroplasty surgery, in patients with no pain who can walk <3 days (early walk), namely 23 patients (58.8%) while those who walk> 3 days (late walk) are ten patients (25, 6%). Patients with pain who could walk <3 days (early walk) were four patients (10.3%), while those who walked> 3 days (late walk) were two patients (5.1%).

Distribution of hemoglobin to the walking ability of patients who have hemiarthroplasty surgery, in normal patients who can walk <3 days (early walk) are 15 patients (38.5%) while those who walk> 3 days (late walk) are four patients (10.3%)). For anemia patients who could walk <3 days (early walk), there were 12 patients (30.8%), while those who walked> 3 days (late walk) were eight patients (20.5%).

Distribution of the interval before the injury to the ability to walk of patients who had hemiarthroplasty surgery, non-neglected patients who could walk <3 days (early walk) were 15 patients (38.5%), while those who walked> 3 days (late walk) were seven patients (17, 9%). For neglected patients who could walk <3 days (early walk) were 12 patients (30.8%), while those who walked> 3 days (late walk) were five patients (12.8%).

Distribution of Body Mass Index of patients who have hemiarthroplasty surgery, in patients with normal Body Mass Index who can walk <3 days (early walk) are 18 patients (46.2%), while those who walk> 3 days (late walk) are 11 patients (28.2%). For patients with abnormal body mass index who can walk <3 days (early walk), nine patients (23.1%), while those who walk> 3 days (late walk) are one patient (2.6%).

Distribution of walking status before surgery to the walking ability of patients who have hemiarthroplasty surgery, in independent patients who can walk <3 days (early walk), namely 25 patients (64.1%) while those who walk> 3 days (late walk) are ten patients (25.6%). For dependent patients who can walk <3 days (early walk) are two patients (2.6%), while those who walk> 3 days (late walk) are two patients (2.6%).

There was no significance between age and walking ability of patients after hemiarthroplasty surgery, with the bivariate analysis (chi-square) test showed a p-value of 0.21 (p> 0.05) for the age. On between gender and walking ability in post-hemiarthroplasty patients shows no significance with bivariate analysis (chi-square) test showed a p-value of 1.00 (p>

0.05). On anxiety factors and the patient's ability to walk after hemiarthroplasty surgery shows no significance with bivariate analysis (chi-square) test showed a p-value of 0.13 (p> 0.05). On pain factor and the patient's ability to walk after hemiarthroplasty surgery shows no significance with bivariate analysis (chi-square) test showed a p-value of 0.88 (p> 0.05). On hemoglobin factor and walking ability in post-hemiarthroplasty patients shows no significance with bivariate analysis (chi-square) test showed a p-value of 0.20 (p> 0.05). The interval factor before the injury and the patient's ability to walk after hemiarthroplasty surgery shows no significance with bivariate analysis (chi-square) test showed a p-value of 0.87 (p> 0.05). On Body Mass Index factor and the patient's ability to walk after hemiarthroplasty surgery shows no significance with bivariate analysis (chi-square) test showed a p-value of 0.09 (p> 0.05). On preoperative walking status factor and the patient's walking ability after hemiarthroplasty surgery shows no significance with bivariate analysis (chi-square) test showed a p-value of 0.38 (p> 0.05).

There was a significant correlation between muscle atrophy and walking ability in post-hemiarthroplasty patients with bivariate analysis (chi-square) test showed a p-value of 0.04 (p <0.05)

From the bivariate analysis results, it was found that those with a relationship with the ability to walk again after hemiarthroplasty surgery with a p-value of <0.25 were age, anxiety, muscle atrophy, hemoglobin, and body mass index. The cut-off value <0.25 was used to filter out potentially related factors. Even though the value is above p<0.05, many factors do not qualify but are related. This value also considers the number of samples that tend to be small and the distribution of variables that may not be normal. On multivariate analysis, factors that affect the patient's walking ability after hemiarthroplasty are muscle atrophy and body mass index, with a significance of 24.1% on the ability to walk after hemiarthroplasty surgery. Through the four stages of the test, it can be concluded that the factors affecting the patient walking ability after hemiarthroplasty is muscle atrophy and body mass index, with the largest to the smallest correlation being Body Mass Index, then Muscle Atrophy (Table 2).

DISCUSSION

In the bivariate analysis, no significance was found between the age of the patient and the outcome of hemiarthroplasty. This result is different from the results obtained from the study conducted by Nagai et al. For the gender factor, the bivariate analysis results showed no significance between this factor and the ability to walk after hemiarthroplasty surgery.[9] This is in line with Salpakoski et al. in 2013.[10] The results of the bivariate analysis of the relationship between anxiety and walking ability after hemiarthroplasty showed no significance. In this study, from the results of the bivariate analysis, there is a significance between muscle atrophy and the ability to walk after hemiarthroplasty surgery in line with the result of the research by Snyder et al. in 2012.[11]

There was no significance between muscle strength and walking ability after hemiarthroplasty in the bivariate analysis in this study. However, in another study by Salpakoski Anu et al., in 2013, different results were obtained.[10] In this study, a significant result showed a correlation between severe postoperative pain and worse walking ability, about 6-fold worse than those without pain or only experiencing mild pain after surgery.[10]

In the bivariate analysis on age, no significance was found between the age of the patient and the outcome of hemiarthroplasty. This result is different from the results obtained from the results of a study conducted by Nagai et al. regarding the risk factors that play a role in the ability to walk in postoperative patients with old age hip fracture. The method of carrying out basic rehabilitation training and using a walker in the studied patient may make a difference in the results of statistical tests.[9]

The results of this study are different from the results of research by Bower et al., which states that the walking ability of patients after hemiarthroplasty surgery is worse in patients aged 90 years and older than in patients under 90 years old. The age of the respondents in the two studies was different.[12] In this study, respondents were only mentioned> 65 years old, while in Kamel et al., the respondents' exact age was 90 years.[13]

For gender factors, the bivariate analysis results showed no significance between these factors and the ability to walk after hemiarthroplasty surgery. This result is in line with the results of a study conducted by Salpakoski Anu et al., where it was found that although the percentage of women who underwent hemiarthroplasty was higher, there was no significant difference in the group analysis that differentiated outdoor walking paths into no-to-minor groups. -difficulty and catastrophic groups.[10]

The results of this study are in line with the research of Ono et al., which states that patients with femoral neck fractures who undergo hemiarthroplasty have a female prevalence of 84.3% (59 of 70 patients) while 52.9% of them. The total sample experienced problems with the ability to walk on the right side. There was no relationship with gender but the relationship with the ASA category.[1]

The relationship between anxiety and walking ability after hemiarthroplasty showed no relationship between the two things. However, a study by Kuru et al., where this anxiety was represented as fear of falling back, found an inverse relationship, as people with higher levels of fear of falling back were less likely to fall back recovery. This result was seen in people with high premorbid function compared with those with low premorbid function.[14]

This result was also recently seen as significant in Bower et al., study at follow-up at week 12, whereas at week 4, this result was not yet significant. This result is different from the timeframe used in this study, where the cut-off time is the 3rd day after surgery.[12] This difference can be caused by the different settings in the study, wherein the study the setting was already outside the hospital, so the possibility of supervision was minimal compared to this study, where the evaluation was carried out while in the hospital, and there was supervision of medical personnel.[15]

There is a significant relationship between muscle atrophy and the ability to walk after hemiarthroplasty surgery. This result is explained by the results of a

previous study by Hagino et al. in 2002. In this study, it was seen that there was muscle atrophy starting from the waist, thighs, and calves in subjects who had limited physical activity for five weeks. Due to the immobilization phase of the patients in this hemiarthroplasty study, patients who experienced muscle atrophy in that phase took longer to walk again after surgery.[16]

There was no significant correlation between muscle strength and gait after hemiarthroplasty in the bivariate analysis in this study. However, in the study by Rosenbaum et al., it was found that elderly with persistent muscle weakness, balance disorders, and pain after hip fracture tended to fall into the catastrophic group with a higher level of ability to walk low on the division of the group by walking paths outside the room.[17]

In contrast, to the study by Mukka et al., there is a relationship between muscle strength factors and the patient's ability to walk after hemiarthroplasty surgery. Postoperative hemiarthroplasty patients have weaker lower muscle capacity than controls.[18]

Rasch et al. stated that based on the interpretation of data, slow muscle strength is a factor that has a significant relationship with the ability to walk after hemiarthroplasty surgery. Therefore, it is advisable to do intense exercise, so that muscle function returns to normal.[19]

Significant results showed an association between severe postoperative pain and worse walking ability, about six times worse than those without pain or only experiencing mild pain after surgery.[19]

This result is different from the results obtained in this study, where the results obtained are not significant. This difference can be caused by the difference in the cut-off time used in the two studies and the difference in the pain scale used.[19]

The results of this study are in line with research by Rosenbaum et al., which states that postoperative hemiarthroplasty patients have low pain complaints, so that it does not affect the ability to walk. The duration of postoperative walking exercise in this study, although minimal postoperative pain, was caused by neglected case factors and significant muscle atrophy.[17]

There was no significant association between hemoglobin and gait postoperative hemiarthroplasty. In Salpakoski's study, the value used as an indicator was the lowest postoperative hemoglobin value taken from medical records with an average of 9, whereas in this study, to assess the hemoglobin factor, the group was divided into groups with normal hemoglobin values and groups. with hemoglobin values including anemia.[10]

This result is different from the study results by Mukka et al., which states that the logistic regression analysis results show that anemia is one of the three factors that significantly affect the walking ability of patients after hemiarthroplasty surgery.[18]

There was no significant interval before the injury, was the time between the injury and the surgery. In this study, the group was divided into not neglected and neglected based on the interval length.[19] As stated in the results, there was no relationship between the length of the injury interval and the ability to walk again after hemiarthroplasty. However, Holstege et al. found a significant relationship between the interval between injury and the operation performed, where when this time interval was longer, the ability to walk again in the subject was worsened.[20] This gap can occur due to differences in the analysis of the injury interval factor, wherein in the previous study, continuous data was used as the variable, whereas in this study, the data were categorized into not neglected and neglected.[20] In this study, patients with neglected cases could practice walking after surgery faster because of the good BMI number, ability to walk before independent surgery, minimal muscle atrophy and good muscle strength were also supported by at least postoperative pain.[20] In the study of Rosenbaum was found that patients with a higher body mass index had a more drastic decrease in the ability to walk again than those with a lower body mass index.[17]

Anemia and high postoperative pain predominantly influenced patients to exercise walking earlier, even with a good BMI. This factor is divided into two categories, which can run independently or dependently before the operation.[2] The bivariate analysis results showed no relationship was found between walking factors before surgery and the ability to walk again after surgery.[21] However, from the study results used as the initial reference in this paper, there is a significant difference between people who use walking aids and their ability to walk again after surgery compared to patients who do not use previous walking aids. The use of tools and the ability to walk again can also be affected by the type of operation performed. The use of these aids is also still recommended after surgery to train muscles and help the ability to walk again.[21]

The same thing with this study is found in Nankaku et al. that concerning walking capacity before surgery in their study, patients were classified as follows: 25 community walkers, ten pedestrians at home and one non-pedestrian.[22] At the end of the follow-up period, it was observed that 24 patients (66%) maintained the same walking capacity. Among the patients who showed a pattern of decline, two return pedestrians became non-pedestrians, seven community pedestrians became pedestrian's home, and three community pedestrians became non-pedestrians.[22] There were no cases of improvement in walking capacity, which means that there is no significant relationship between the patient's walking ability before and after hemiarthroplasty surgery.

In contrast to the study results by Kamimura et al., which states that there is a significant relationship between patients with moderate to severe cognitive impairment and the ability to walk after hemiarthroplasty surgery.[23] On some differences result with the other research before, the sum of sampling and range time of the research made affect the result of this research.[23]

However, this study has several limitations regarding the number of samples and the time frame of data collecting to gain more complete results. Also, it is required to identify the patient's preexisting condition that can affect the result of the study.

CONCLUSION

The muscle atrophy variable in this study was the most significant factor predictor of the walking ability for the patient

postoperative with hemiarthroplasty. Respondents with significant muscle atrophy will most likely worsen to early walk than normal muscle in the same BMI status. Body Mass Index and Muscle Atrophy variables were the most dominant factors in predicting walking ability after hemiarthroplasty surgery, even though not significant statistically.

DISCLOSURES

Author Contribution

MS and RS contributed to making research concepts and design. KY and TQ contributed to literature search, clinical studies, and experimental studies. KY contributed in data acquisitions and analysis. All author contributed in manuscript preparation and editing.

Conflict of Interest

The authors declare that this article has no conflict of interest.

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Ethical Statement

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REFERENCES

1. Ono NK, de Andrade Lima GD, Honda EK, Polesello GC, Guimarães RP, Júnior WR, et al. Hemiarthroplasty in the treatment fractures of the femoral neck. *Rev Bras Ortop (English Ed*. 2010;45(4):382–8.
2. de Abreu EL, de Oliveira MHA. Evaluation of the quality of patients undergoing hemiarthroplasty of the hip. *Rev Bras Ortop*. 2015;50(5):530–6.
3. Baba T, Shitoto K, Kaneko K. Bipolar hemiarthroplasty for femoral neck fracture using the direct anterior approach. *World J Orthop*. 2013;4(2):85–9. Available from: https://pubmed.ncbi.nlm.nih.gov/23610757
4. Robertson GA, Wood AM. Hip hemiarthroplasty for neck of femur fracture: What is the current evidence? *World J Orthop*. 2018;9(11):235–44. Available from: https://pubmed.ncbi.nlm.nih.gov/30479970
5. Yurdakul E, Karaaslan F, Korkmaz M, Duygulu F, Baktır A. Is cemented bipolar hemiarthroplasty a safe treatment for femoral neck fracture in elderly patients? *Clin Interv Aging*. 2015;10:1063–7. Available from: https://pubmed.ncbi.nlm.nih.gov/26170644
6. Moretti VM, Post ZD. Surgical approaches for total hip arthroplasty. *Indian J Orthop*. 2017;51:368–76.
7. Nilsson LT, Jalovaara P, Franzén H, Niinimäki T, Strömqvist B. Function after primary hemiarthroplasty and secondary total hip arthroplasty in femoral neck fracture. *J Arthroplasty*. 1994;9(4):369–74. Available from: http://dx.doi.org/10.1016/0883-5403(94)90046-9
8. Noda M, Saegusa Y, Takahashi M, Noguchi C, Yoshikawa C, Mikami H, et al. Comparison of Postoperative Muscular Strength Between Gamma Nailing and Hemiarthroplasty System in Femoral Intertrochanteric Fractures. *Open Orthop J*. 2017;11:255–62. Available from: https://pubmed.ncbi.nlm.nih.gov/28567153
9. Nagai T, Okawa A. Risk Factors Affecting Postoperative Walking Ability Following Hip Fracture Surgery in the Elderly. *Orthop Muscular Syst*. 2016;05(02). Available from: http://dx.doi.org/10.4172/2161-0533.1000209
10. Salpakoski A, Törmäkangas T, Edgren J, Sihvonen S, Pekkonen M, Heinonen A, et al. Walking recovery after a hip fracture: a prospective follow-up study among community-dwelling over 60-year old men and women. *Biomed Res Int*. 2014/01/06. 2014;2014:289549. Available from: https://pubmed.ncbi.nlm.nih.gov/24511530
11. Snyder CK, Lapidus JA, Cawthon PM, Dam T-TL, Sakai LY, Marshall LM, et al. Serum albumin in relation to change in muscle mass, muscle strength, and muscle power in older men. *J Am Geriatr Soc*. 2012/08/20. 2012;60(9):1663–72. Available from: https://pubmed.ncbi.nlm.nih.gov/22905696
12. Bower ES, Wetherell JL, Petkus AJ, Rawson KS, Lenze EJ. Fear of Falling after Hip Fracture: Prevalence, Course, and Relationship with One-Year Functional Recovery. *Am J Geriatr Psychiatry*. 2016/08/17. 2016;24(12):1228–36. Available from: https://pubmed.ncbi.nlm.nih.gov/27726939
13. Kamel HK, Iqbal MA, Mogallapu R, Maas D, Hoffmann RG. Time to Ambulation After Hip Fracture Surgery: Relation to Hospitalization Outcomes. *Journals Gerontol Ser A Biol Sci Med Sci*. 2003;58(11):M1042–5. Available from: http://dx.doi.org/10.1093/gerona/58.11.m1042
14. Kuru T, Olçar H. Effects of early mobilization and weight bearing on postoperative walking ability and pain in geriatric patients operated due to hip fracture: a retrospective analysis. *TURKISH J Med Sci*. 2020; Available from: http://dx.doi.org/10.3906/sag-1906-57
15. Horikawa A, Miyakoshi N, Shimada Y, Kodama H. Comparison of activities of daily living after osteoporotic hip fracture surgery in patients admitted from home and from geriatric health service facilities. *Clin Interv Aging*. 2014;9:1847–51. Available from: https://pubmed.ncbi.nlm.nih.gov/25378917
16. Hagino T, Ochiai S, Wako M, Sato E, Maekawa S, Senga S, et al. A simple scoring system to predict ambulation prognosis after hip fracture in the elderly. *Arch Orthop Trauma Surg*. 2007;127(7):607. Available from: http://dx.doi.org/10.1007/s00402-007-0376-x
17. Sicard-Rosenbaum L, Light KE, Behrman AL. Gait, Lower Extremity Strength, and Self-Assessed Mobility After Hip Arthroplasty. *Journals Gerontol Ser A Biol Sci Med Sci*. 2002;57(1):M47–51. Available from: http://dx.doi.org/10.1093/gerona/57.1.m47
18. Mukka S, Knutsson B, Krupic F, Sayed-Noor AS. The influence of cognitive status on outcome and walking ability after hemiarthroplasty for femoral neck fracture: a prospective cohort study. *Eur J Orthop Surg Traumatol*. 2016/10/31. 2017;27(5):653–8. Available from: https://pubmed.ncbi.nlm.nih.gov/27796582
19. Rasch A, Dalén N, Berg HE. Muscle strength, gait, and balance in 20 patients with hip osteoarthritis followed for 2 years after THA. *Acta Orthop*. 2010;81(2):183–8. Available from: https://pubmed.ncbi.nlm.nih.gov/20367414
20. Holstege MS, Lindeboom R, Lucas C. Preoperative Quadriceps Strength as a Predictor for Short-Term Functional Outcome After Total Hip Replacement. *Arch Phys Med Rehabil*. 2011;92(2):236–

41. Available from: http://dx.doi.org/10.1016/j.apmr.2010.10.015
21. Shim D-G, Kwon T-Y, Lee K-B. Rectus femoris muscle atrophy and recovery caused by preoperative pretibial traction in femoral shaft fractures-comparison between traction period. *Orthop Traumatol Surg Res*. 2017;103(5):691–5. Available from: http://dx.doi.org/10.1016/j.otsr.2017.05.006
22. Nankaku PhD Pt M, Tsuboyama PhD Md T, Aoyama PhD Md T, Kuroda PhD Md Y, Ikeguchi PhD Md R, Matsuda PhD Md S. Preoperative gluteus medius muscle atrophy as a predictor of walking ability after total hip arthroplasty. *Phys Ther Res*. 2016;19(1):8–12. Available from: https://pubmed.ncbi.nlm.nih.gov/28289576
23. Kamimura A, Sakakima H, Tsutsumi F, Sunahara N. Preoperative predictors of ambulation ability at different time points after total hip arthroplasty in patients with osteoarthritis. *Rehabil Res Pract*. 2014/08/10. 2014;2014:861268. Available from: https://pubmed.ncbi.nlm.nih.gov/25180097