

RESEARCH ARTICLE

EFFECTIVENESS OF FRAGILITY FRACTURE INTEGRATED REHABILITATION MANAGEMENT FOR IMPROVING ACTIVITY OF DAILY LIVING AND QUALITY OF LIFE IN GERIATRIC POPULATION AFTER HIP FRACTURE

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ABSTRACT

Objective: The objective of the study was to determine the efficacy of Fragility Integrated Rehabilitation Management (FIRM) on the quality of life and activities of daily living in geriatric population with hip fracture and to reduce the recurrence of hip fracture. **Material and Method:** A single-group, pretest–posttest design was conducted at Seoul National University for a time period from August 2017 to January 2018 in Bundang Hospital, South Korea. Patients with age of 55 years and above, had diagnosed femoral neck fractures, reduction and internal fixation, intertrochanteric and sub-trochanteric fractures, total hip replacement (THR), bipolar hemi-arthroplasty were included in the study. Quality of life was assessed through the Euro-QOL (EQ-5D) questionnaire, while ADL's was measured through Modified Barthel Index (MBI). Non-parametric Wilcoxon Sign Rank test was used for pre-post analysis by using SPSS version 21. The level of significance was set at 95% CI ($p < 0.05$). **Results:** Wilcoxon signed rank test showed a significant improvement in activities of daily living ($p < 0.05$). Furthermore, significant improvement has also been determined in the quality of life ($p < 0.05$), after the 10th Fragility Integrated Rehabilitation Management (FIRM) and 4 Occupational Therapy (OT) sessions. **Conclusion:** Fragility Integrated Rehabilitation Management showed a significant improvement in the Activities of Daily Living (ADLs) and Quality of Life (QOL).

Keywords: Fragility fracture, geriatric, hip fracture, physical therapy, occupational therapy, rehabilitation.

INTRODUCTION

Osteoporosis is a common factor which causes most of the fragility fractures in older population which causes severe problems including daily activity limitations and gait impairments.¹⁻³ Vertebra, humerus, radius, hip are the most common sites.^{1,2} The incidence of fracture and disability after fracture increases with time due to the demographic changes and increase in life expectancy.³

In 2018, South Korea became an aged society, 14.3% population consists on adults' aged ≥ 65 years, and by 2025, it can become a super-aged society.³ Moreover in South Korea, from 2008 to 2012, the incidence of hip fracture increased by 14.1%. And after the hip fracture, mortality rate during the first year is 8.4-36%. Mortality rate is higher in hip fracture as compared to non-hip fracture and control population.⁴

Fragility hip fracture is a geriatric condition with comorbidities^{5,6} which increase socioeconomic burden because of the increased expenses of medical care. In spite of the fact that the treatment quality of hip fracture has been improved but there are still lacking of the functional recovery of the patient after surgery, thus it is a need to provide

comprehensive and multidisciplinary rehabilitation to restore the functional recovery after the surgery.^{5,7} In a previous study conducted by Abraham Adunsky et al. described the effectiveness and importance of comprehensive rehabilitation care for geriatric population after fragility hip fracture.⁸

For the purpose of comprehensive rehabilitation care, a multidisciplinary hip fracture care program comprising of orthopedic doctors, physiotherapists, occupational therapists, nurses geriatricians was designed, which is known as Fracture Integrated Rehab Management (FIRM). The main goal of FIRM was to increase the level of independence, prevention of falls and detailed discharge planning. It consist on 10 days of physiotherapy and 4 days for occupational therapy sessions after surgery, increasing gradually depending on patients' functional level.⁷

In this study a new rehabilitation strategy, FIRM which was ascertained by Korean Fragility Fracture Rehabilitation Study group⁷, was used. If the research hypothesis is proved, then it would be a big step in rehabilitation for the cases with Fragility fractures, which are rising day by day due to advancing age.^{9,10} The aim of the study was to determine the efficacy of Fragility Integrated

Rehabilitation Management (FIRM) on the quality of life and activities of daily living in geriatric population with hip fracture and to reduce the recurrence of hip fracture. This system will contribute public health by increasing quality of life in older population with fragility fracture and improve their functional recovery.

METHODOLOGY

A single-group, pretest–posttest design was conducted at Seoul National University for a time period from August 2017 to January 2018 in Bundang Hospital, South Korea. Patients with age of 55 years and above, had diagnosed femoral neck fractures, reduction and internal fixation, intertrochanteric and sub-trochanteric fractures, total hip replacement (THR), bipolar hemiarthroplasty were included in the study. Subjects were excluded if the patients had multiple fractures, revised hip surgeries, isolated greater and lesser tuberosity fractures, fractures due to infection and malignancy, or had a medical condition due to which rehabilitation wasn't possible, and declined to participate in the clinical trials. The study was started after approval from the research committee of Institutional Review Board of Seoul National University Bundang Hospital. Informed consent according to Declaration of Helsinki, was taken from each subject and assured them about the confidentiality of their data.

A total of n=14 patients fulfilled the eligibility criteria and received the FIRM protocol, which is a multidisciplinary team approach, and comprehensive rehabilitation program. FIRM was provided by rehabilitation physician, clinical nurse specialist, nutritionist, physical therapist, occupational therapist and a social worker. Participants had been provided by 2 weeks long intervention after surgery, which contained 10 days physiotherapy sessions and 4 days of occupational therapy. Each session lasts for 40mins/day (20 minutes twice a day) as shown in table 1.

The pre-interventional data was collected on 2nd postoperative day and post-interventional on 15th postoperative after the 10th FIRM session. The general demographic data in term of age, gender and BMI was obtained at the baseline. Quality of life or health status of the participants was assessed through the Euro-QOL (EQ-5D) questionnaire¹¹, while ADL's was measured through

Modified Barthel Index (MBI), and low score indicated a worse outcome.¹² As both variable were ordinal, so non parametric Wilcoxon Sign Rank test was used for pre-post analysis by using SPSS version 21. The level of significance was set at 95% CI ($p<0.05$).

RESULTS

The mean age of study participant was 82.07 ± 6.0 and BMI was 22.71 ± 4.08 . A total of n=14 participants were recruited for the study. Wilcoxon signed rank test showed a significant improvement in modified Barthel index (MBI). In MBI, self-bathing, toilet, stair climbing, dressing, ambulation, transfer is significantly improved ($p<0.05$). The personal hygiene, feeding, wheel chair, and bowel-bladder control didn't show any significant improvement ($p\geq 0.05$) after 10th Fragility Integrated Rehabilitation Management (FIRM) and 4 Occupational Therapy (OT) sessions. Furthermore, significant improvement has been determined in the quality of life. In QOL-EQ-5D, mobility, self-care, usual activities, pain/discomfort is significantly improved ($p<0.05$). However, no significant improvement has been seen in the depression/anxiety ($p\geq 0.05$), after the 10th Fragility Integrated Rehabilitation Management (FIRM) and 4 Occupational Therapy (OT) sessions.

DISCUSSION

The aim of the study was to determine the efficacy of Fragility Integrated Rehabilitation Management (FIRM) on the quality of life (QOL) and activities of daily living (ADL's) in geriatric population with hip fracture and to reduce the recurrence of hip fracture. The post-intervention analysis showed significant improvement in activities of daily living on Modified Barthel index. Previous studies demonstrated that due to decrease in rehabilitation,¹³ hip fractures leads to decrease functional independence and worsens the quality of life.¹⁴ While, rehabilitation has an important role in improving quality of life and functional independence of hip fracture patients.¹⁵ The findings of current study showed that FIRM protocol significantly improved bathing, toilet, dressing, stair climbing, ambulation walking with or without aid and transfers from bed to chair or back ($p<0.05$) after the 10th FIRM session, which correlates with the previous studies and significant improvement has been seen in the mobility and activities of daily living.^{7, 16} However, in frail elder population improvements in mobility and ADL's is of greater importance to cope up with the activities of daily life.¹⁷

Table 1: Fragility Fracture Integrated Rehabilitation Management (FIRM) Protocol

	Physical therapy protocol	Occupational Therapy Protocol
1 st Session	Evaluate to check out status of the subject.	
2 nd Session	Carry out hip ROM (AAROM and AROM) exercise according to status, level, function of subject	
	Carry out functional training on the mat for progressive exercise and stable function depending on the level of the subject (ex. Mat training - rolling, sit up, scooting)	
3 rd Session	Carry out strengthening exercise (hip abductor & extensor) & education depending on the level of the subject (on a mat). (if good motivation, re-training can be possible in the ward)	
	Carry out cardiovascular exercise for lower cardiopulmonary function due to bedding or aging depending on the level of the subject (ex. Thera Vital, UBE, daily application)	
4 th Session	Carry out tilt table standing for confirming the orthostatic hypotension of the subject's condition.	
	Carry out sit to stand exercise depending on the level of the subject	
5 th Session	Carry out non-weight bearing exercise in P-bar depending on the level of the subject (if stable, do next stage)	Initial assessment (status, level, function)
	Carry out P-bar walking depending on the level of the subject (if can carry out P-bar gait 3 roll, do next stage)	
	Carry out strengthening exercise (hip abductor & extensor) & education depending on the level of the subject (on a mat). (if good motivation, re-training can be possible in the ward)	
6 th Session	Carry out cardiovascular exercise for lower cardiopulmonary function due to bedding or aging depending on the level of the subject (ex. Thera Vital, UBE, daily application)	ADL training 1. Transfer : W/C to chair, W/C to bed, W/C to toilet, sit to standing 2. Bed mobility : sit up, roll over 3. Dressing : education of wearing pants with Reacher and purchasing 4. Home environment improvement: installing non-slip mat, safe-bar in the toilet Education of precautions after hip fracture surgery (Total Hip Replacement Arthroplasty, Complete Hip Replacement, Hemiarthroplasty, Internal Fixation).
	Go ahead with a gait endurance of 50m (25m / min = 0.4m / s). And carry out walking depending on the level of the subject. (Proceed in the order of P-bar, walker depending on the level of the subject)	
	Carry out gait with assist & supervision with rolling walker (You should check the gait pattern & posture)	
7 th Session	Carry out cardiovascular exercise for lower cardiopulmonary function due to bedding or aging depending on the level of the subject (ex. Thera Vital, UBE, daily application)	Same as 5 th session
	Carry out cardiovascular exercise for lower cardiopulmonary function due to bedding or aging depending on the level of the subject (ex. Thera Vital, UBE, daily application)	
8 th Session	Carry out stair ambulation depending on the level of the subject.	After confirming improved ADL training and function, re-educate deficient areas
	Perform treadmill exercise (1.4km/h) depending on the level of the subject.	
9 th Session	Carry out cardiovascular exercise for lower cardiopulmonary function due to bedding or aging depending on the level of the subject (ex. Thera Vital, UBE, daily application)	Same as 8 th Session
	Carry out cardiovascular exercise for lower cardiopulmonary function due to bedding or aging depending on the level of the subject (ex. Thera Vital, UBE, daily application)	
10 th Session	Evaluate to check out status of the subject.	Final assessment (status, level, function)

Table 2: Pre & Post analysis of ADLs & QOL

	Pre				Post				Z-score	MD	p-value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR			
Personal Hygiene	3.85	1.51	4.00	1.00	4.28	1.06	4.50	1.00	-1.63	-0.43	0.102
Bathing Self	1.21	1.42	1.00	1.50	2.21	1.52	3.00	2.00	-2.39	-1.00	0.017*
Feeding	8.57	3.27	10.00	0.50	9.28	2.67	10.00	0.00	-1.34	-0.71	0.180
Toilet	3.78	3.66	3.50	8.00	6.00	3.11	8.00	3.75	2.20	-2.21	0.027
Stair climbing	0.71	2.16	0.00	0.00	3.92	3.73	2.00	8.00	-2.54	-3.21	0.011**
Dressing	4.28	2.49	5.00	3.00	6.21	2.11	5.00	3.00	-3.00	-1.93	0.003**
Bowel control	7.85	3.43	10.00	5.00	9.00	2.68	10.00	0.50	-1.62	-1.14	0.104
Bladder Control	7.92	3.64	10.00	2.75	8.85	2.68	10.00	2.00	-1.28	-0.93	0.197
Ambulation Walker	6.21	4.67	8.00	9.00	10.35	3.29	12.00	4.00	-2.95	-4.14	0.003**
Wheel chair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.000
Chair bed transfer	8.00	4.40	8.00	9.00	11.21	2.75	12.00	3.25	-2.37	-3.21	0.017*
MBI_TOTAL	52.42	24.38	57.00	27.75	71.35	18.56	73.50	18.50	-3.18	-18.93	0.001***
Mobility	4.21	0.57	4.00	1.00	2.21	0.69	2.00	1.00	-3.22	2.00	0.001***
Self-care	3.85	0.77	4.00	0.25	2.71	0.82	3.00	1.00	-2.94	1.14	0.003**
Usual Activities	4.71	0.46	5.00	1.00	3.50	0.65	4.00	1.00	-3.16	1.21	0.002**
Pain/Discomfort	3.28	0.82	3.00	1.00	2.21	0.80	2.00	1.00	-2.28	1.71	0.022*
Anxiety/Depression	2.21	1.18	2.50	2.00	1.57	0.75	1.00	1.00	-1.89	0.64	0.058
EQD Total	0.34	0.20	0.34	0.13	0.63	0.09	0.63	0.17	-2.98	-0.29	0.003**

Level of Significance, P-value<0.05*, p-value<0.01**, p-value<0.001***



Moreover, in the recent study subjects were assessed after the 4 days of occupational therapy sessions along with Fragility Integrated Rehabilitation Management (FIRM), which showed a significant improvement in dressing, toilet and bathing. T. Alarcon et al. conducted a 2-years follow study, which correlates with the current findings and significant improvement has been seen in the activities of daily living such as ambulation, transfers, stair climbing, use of toilet, bathing and dressing ($p < 0.05$).¹⁸

Furthermore, significant improvement has been determined in mobility, self-care, usual activities and pain/discomfort after the 10th Fragility Integrated Rehabilitation Management (FIRM) and 4th Occupational Therapy (OT) session. In a study conducted by Shyu YI et al., it was determined the interdisciplinary team approach is effective for management of hip fracture in geriatric population and improve their quality of life by decreasing pain and improve physical function.¹⁹ Moreover, previous literature determined that the Fragility Integrated Rehabilitation Management (FIRM) can significantly improve the quality, joint range of motion and decrease in pain/discomfort in elder population with hip fracture which supports the findings of current study.²⁰

FIRM protocol included comprehensive management which was provided by multidisciplinary team such as physical therapist, occupational therapist, clinical nurse, nutritionist and a social worker, which could be an important part for the management of the hip fracture in elderly population.²¹ In some researches, it has been concluded that comprehensive management is effective in improving functional independence and activities of daily life as compared to the conventional physiotherapy.²²

In this study, anxiety and depression is not significantly improved ($p \geq 0.05$). While, depression could be a factor to decrease the mobility and functional outcomes in elderly population with hip fracture.²³ But a study reported, 1 year-long follow-up determined a decrease in depression after discharge from the hospital.¹⁹

The limitation of this study is that it was single group, one centred study. Moreover, sample size was also small, so results can't be generalized.

CONCLUSION

FIRM showed an improvement in the mobility, self-care activities, ambulation, stair climbing, and transfer. Another improvement has been also observed in the decrease in pain and discomfort due to the Hip fracture. Furthermore, activities of daily living are significantly improved, which demonstrated that FIRM is an effective protocol for hip fracture in geriatric population. It is suggested that in future studies, such conditions such as metabolic diseases and metabolic bone diseases which may hinders the improvement in hip fracture should be considered. Large sample size and multicenter studies should be incorporated in future researches.

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