FALL PREVENTION EFFORTS IN GERIATRIC POPULATION

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ABSTRACT

A randomized controlled trial to examine Fall prevention efforts in Geriatric Population with 60 female patients of 65-90 years (mean 71±5.85). Functional performance, Physical activity, emotional status, strength and psychological parameters, were measured at the beginning (T1), in the end (T2) and after 12 weeks (T3) of intervention. Intervention group showed statistically significant improvement in strength, functional performance, balance and emotional status. Moderate loss in improvement is observed after 3 month follow up. In control group there was no improvement in any parameter during intervention and after 3 month. We conclude that Progressive strength and functional training are proved to be safe and cost effective method to reduce risk of fall in geriatric patients. These methods can also be used to improve strength, balance, functional performance and producing emotional restrictions.

KEY WORD:

GERIATRIC PATIENTS; INJURIOUS FALLS; PHYSICAL TRAINING

1. INTRODUCTION

Geriatric population has been increasing rapidly since last few decades leading to many serious social & medical issues. Their number increased 3 folds in 1991 compared to 3 decades before. There were around 100 million old people in 2010 and expected todouble in 2030 and triple in 2050 (WHO).[1]

Old people suffered from many health issues such as low self efficacy, falls, decreased cognition, osteoporosis etc. Falls are commonest among elderly leading to increased morbidity, dependency and mortality.[2]

Therefore falls are associated with major health care post worldwide on old people.[3]

Falls are complex interactions between intrinsic and extrinsic risk factors. In order to improve quality of life and maintain independence better understanding of risk factor is required[1].

According to T. Mary there are effective strategies available to reduce fall but they are under utilized.[4] In a review by Alan Hanley multidisciplinary community base efforts are more effective than single intervention on fall prevention.[5]

McClure et. al in there study suggested further randomized trails to increase available evidence [6]. Many[7-12] researchers have assessed randomized controlled trails on geriatric population but few[8,10,,11] of them have followed multidimensional activity program.

Most of the study related to physical training attempted to reduce fall has been found to be unsuccessful or partiallysuccessful due to failure of older people to follow instruction.

The present study aimed to compare the effects of strength performance, physical activity, functional performance and emotional status between intervention and control group in geriatric population with history of fall. We also aimed at cost effectiveness and safety of program in high risk geriatric population.

2. MATERIAL AND METHOD:

2.1. Subjects:

A sample of 60 female patients between 65-90 yrs (mean age 71± 5.85) were selected from Raj Nursing Home for the study. Patient with history of falls related to injury and facture were included. All the patient were able to walk independently and would follow the instruction clearly. After getting consent and completing demographic data all the patients were randomized into 2 groups – Intervention (n=30) and Control (n=30).

2.2. Design:

Randamized control trail with 3 month follow up program.

2.3. Measurements:

All the measurement including strength performance, Physical activity, functional performance and emotional status are measured at the beginning (T_1), in the end (T_2) and after 12 weeks of intervention.

2.4. Interventions:

2.4.1. Strength Training:

All the patients of intervention group were given resistance training to hip and knee extensor and ankle planter flexors after a 10 min warm up exercise on stationary cycle Ergometer (ECB 55) . Training was given 3 times in week for 3 months. Training started with minimum workload initially and gradually increasing load at upcoming sessions depending on patient's tolerance level. Exercise were divided into sessions with pause in b/w sessions depending upon patient capacity. Knee extensors were performed in a sitting position while hip extensors were trained in

standing position with pulley system. 3 sessions of 10 lift were given for hip and knee bilaterally. Heal raise method was used for ankle planter flexor training. 2 sessions of 15 lifts was given for ankle bilaterally. To increase work load patient forefeet were placed on a 2 cm support, later increased to 4 cm.

2.4.2. Placebo Training:

All the participants of control group underwent placebo training 3 times per week for 3 months. Activities like quizzes, balance training on swiss ball, flexibility training etc were used.

2.4.3. Physiotherapy:

Both the group were given identical conventional physiotherapy treatment like Starching, Massage, Moist heat pack or cold pack on fall affected areas. Treatment was given 2 times per week for duration of 25 min.

2.4.4 Muscle Strength Measurement:

To minimize improvement related to motor learning, muscle strength of leg extensors and plantar flexors were documented using a measuring unit not being used as a training machine. The dimension of strength was different in measurement (one-limb maximal static force) and training (functional multilimb, dynamic concentric- eccentric submaximal strength). Handgrip strength[13] was assessed by a dynamometer to control for strength in untrained muscle groups.

2.4.5 Emotional Status

The short version of the Geriatric Depression Scale (15 items)[14]was administered, supplemented by the Philadelphia Geriatric Morale Scale (PGMS).[15] Posttraumatic emotional status following the fall was documented by subjective rating of walking steadiness, subjective rating of fear of falling,[16,17,] and the falls handicap inventory (FHI),[18] which scores for posttraumatic fall-related emotional instability and behavioral changes.

2.4.6 Incidence of Falls

Falls were defined following standard definitions. [1,16] A hospital committee adjudicated questionable fall events. Patients were required to report all falls and document falls in a fall diary every day.

2.4.7 Exercise

Balance exercises like standing with narrow base of support; walking straight or sideways and reaching activities in standing position were also given to patients in order to improve postural control. Also some standing exercises like sitting to standing heel raise semi squats were included. All exercise sessions included 5 min warm up exercise[19].

3. RESULT

Table 1- Patients Characteristics

Characteristic	Intervention (n 30)	Control (n 30)
Age	71.96± 5.92	71.86± 5.85
Height	155.3±7.2	156.6±6.6
Weight	58.5 ± 10.6	60.1±9.5
BMI Kg/m^2(Body Mass Index)	24.2±4.1	25.1±3.1
GDS (Geriatric Depression Scale Scores)	3.75±2.75	3.35±2.30
ADL (Activities of Daily Living Scores)	90 (75-100)	89 (70-100)
IADL (Instrumental Activities of Daily Living scores)	6 (3-8)	5 (2-8)
Admission to hospital because of falls	84%	87%
Recent history of injurious falls	85%	85%
Fall-related fracture of lower extremity/hip	60%	56%
Regular medication (no)	4.15±1.5	2.7±1.7
Physical activity level (scores)	9.6±5.8	8.3±3.4
Timed up-and-go (sec)	30.5±11.4	25.6±7.9
Tinetti-score (POMA)	18.6±3.9	19.2±4.1
Leg-strength (kg)	105±42	110±30

None of the variables except number of medications (P=0.042) showed significant differences between groups at baseline. Values in parentheses represent ranges.

POMA = Performance Oriented Mobility Assessment (Range 1–28; higher scores indicate better performance).

Table 2- Strength Performance

	Intervention			Control			P Value		
Strength Tests	T1(10)	T2(10)	T3(10)	T1(10)	T2(10)	T3(10)	P-Value T1	P-Value T2	P-Value T3
Leg Extension 1 RPM (Kg)	100.85± 40.25	170.78± 60.35	166.41± 55.30	110.40± 30.65	112.00± 45.50	114.80± 43.78	P=0.340	P>0.001	P>0.001
Knee Extension (N)	95.97± 30.60	132.80± 31.27	125.31± 25.51	103.57± 28.95	107.47± 35.90	106.90± 29.95	P=0.725	P<0.001	P<0.001
Ankle Plantar flexion (N)	113.99± 45.95	150.50± 48.35	146.10± 46.36	106.52± 42.94	110.78± 43.95	118.95± 47.68	P=0.345	P=0.002	P=0.021
Handgrip Strength (KPa)	101.56± 33.95	102.45± 27.90	103.25± 28.79	104.78± 26.95	106.45± 22.97	105.23± 28.35	P=0.935	P=0.947	P=0.735

Data are means ± SD for baseline values (T1), values at the end of intervention (T2), or the end of follow-up (T3). At T_1 all values were statistically insignificant (P>0.05). Results of statistical

analysis are adjusted for base-line age and medication. Values obtained at T2 and T3 are also adjusted for baseline strength. The values represent two-legged measurements (ankle plantar flexion, knee extension, knee flexion) or the sum of left/ right sided measurements (leg extension, handgrip). In measuring ankle plantar flexion, knee extension, and knee flexion, the training device and the dimension of strength in measuring (one-limb, isometric measurement). Handgrip strength represents a nontrained muscle group in the trial.

1 RPM = one repetition maximum. N = Newton.
Kpa = kilopascal.

Table 3- Functional Performance

	Intervention			Control			P Value		
Functional Tests	**T1(10)**	**T2(10)**	**T3(10)**	**T1(10)**	**T2(10)**	**T3(10)**	**P-Value T1**	**P-Value T2**	**P-Value T3**
Tinetti POMA (scores)	17.85± 4.24	26.13± 2.65	22.98± 4.52	18.95± 4.15	20.75± 4.90	19.97± 4.78	P=0.991	P<0.001	P=0.003
Timed up-and-go (sec)	30.36± 10.60	20.45± 4.27	25.31± 12.95	26.57± 8.15	28.97± 12.90	28.40± 11.95	P=0.295	P<0.001	P<0.180
Walking velocity (sec)	0.49± 0.15	0.75± 0.15	0.65± 0.20	0.51± 0.17	0.49± 0.18	0.51 ± 0.15	P=0.710	P<0.001	P=0.002
Chair-rise time (sec)	17.20± 6.45	13.50± 2.85	16.1± 4.36	16.95± 4.94	19.78± 5.95	20.15± 7.18	P=0.745	P>0.001	P=0.011
Maximal box step (cm)	56.80± 12.10	75.15± 13.90	71.25± 13.75	61.78± 16.00	65.45± 17.27	66.23± 16.35	P=0.045	P=0.007	P=0.035
Star flight (cm)	24.95± 12.90	15.25± 4.35	16.95± 5.45	25.98± 13.80	23.97± 12.25	23.50± 9.31	P=0.921	P=0.001	P=0.004
Functional reach (cm)	14.98± 5.30	20.29± 6.30	17.98± 7.0	15.38± 5.35	15.58± 5.47	17.28± 6.31	P=0.949	P=0.006	P=0.021
Balance score (scores)	12.05± 2.75	13.55± 2.27	13.45± 1.95	12.04± 3.75	11.84± 3.77	11.50± 2.81	P=0.878	P=0.005	P=0.003
ADL (scores)	90.15± 6.45	95.01± 4.46	94.65± 6.85	89.35± 8.45	93.15± 9.05	94.25± 6.97	P=0.519	P=0.423	P=0.535
IADL (scores)	5.85± 1.56	6.91± 1.17	6.88± 1.49	5.39± 1.75	5.85± 2.15	6.35± 1.90	P=0.135	P=0.219	P=0.529

Data are means ± SD and are calculated from baseline values (T1), values at the end of intervention (T2), and the end of follow-up (T3). Results of statistical analysis are adjusted for baseline age and medication. Values obtained at T2 and T3 are also adjusted for baseline functional performance. Box step values are summed results of left and right leg. Chair-rise time was counted for three sequential trials.

Table-4 – Physical Activity

	Intervention			Control			P Value		
Physical Activity (Scores)	**T0(10)**	**T2(10)**	**T3(10)**	**T0(10)**	**T2(10)**	**T3(10)**	**P-Value T1**	**P-Value T2**	**P-Value T3**
House work	1.65± 0.55	1.58± 0.64	1.72± 0.66	1.54± 0.55	1.26± 0.74	1.50± 0.60	P=0.138	P=0.235	P=0.458
Leisure activity	1.87± 3.60	0.58± 1.75	1.31± 2.95	0.57± 1.56	0.37± 1.12	0.69± 1.65	P=0.185	P=0.507	P=0.548
Physical "sports" activity	6.80± 4.35	18.95± 3.95	8.55± 4.77	5.05± 2.50	6.90± 3.75	5.75 ± 4.45	P=0.120	P<0.001	P=0.075
Total physical activity	9.99± 5.45	21.95± 4.35	11.50± 6.86	7.15± 5.30	8.32± 4.45	7.95± 5.55	P=0.056	P<0.001	P=0.235

Data are means ± SD and are calculated from retrospectively documented baseline values before admission to hospital (T0), at the end of training intervention (T2), and at the end of follow-up (T3). Results of statistical analysis for group differences are adjusted for baseline age and medication. Values obtained at T2 and T3 are adjusted for baseline physical activity (T0).

Table-5- Emotional Status

	Intervention			Control			P Value		
Tests (Scores)	**T1(10)**	**T2(10)**	**T3(10)**	**T1(10)**	**T2(10)**	**T3(10)**	**P-Value T1**	**P-Value T2**	**P-Value T3**
Falls handicap inventory (FHI)	29.50± 13.55	14.58± 12.64	11.72± 10.66	31.54± 12.55	31.26± 14.74	24.00± 14.60	P=0.538	P<0.001	P=0.001
Walking reliability	2.24± 0.60	1.58± 0.65	1.61± 0.70	2.17± 0.68	2.07± 0.60	1.95± 0.65	P=0.258	P=0.002	P=0.015
Fear of falling	1.50± 0.95	0.95± 0.85	1.11± 1.10	1.62± 0.80	1.40± 0.90	1.75 ± 0.85	P=0.739	P=0.100	P=0.115
Geriatric depression scale	3.59± 3.61	3.25± 2.93	3.25± 3.23	3.55± 2.52	2.68± 2.01	3.59± 2.56	P=0.679	P=0.840	P=0.618
Philadelphia Geriatric Center Morale Scale	6.39± 3.40	6.35± 3.67	6.59± 4.23	5.95± 3.61	5.92± 3.44	6.19± 3.90	P=0.683	P=0.859	P=0.629

Data are means ± SD and are adjusted for baseline age and medication. Values obtained at T2 and T3 are adjusted for baseline emotional status. *Fear of falling was significantly reduced within the intervention group over time.

Adherence was excellent in both groups (intervention 90.4±26.8% vs control 89.2 ± 28.3%) . Intervention group showed statistically significant improvement in strength, functional performance, balance and emotional status. Moderate loss in improvement is observed after 3 month follow up. In control group there was no improvement in any parameter during intervention and after 3 month.

4. DISCUSSION:

A variety of interventions has been studied widely for the reduction of fall risk in the geriatric community. But only few of them were found to be effective when studied in single intervention trail. Several randomized control trails and meta analysis have suggested the effectiveness of multifactorial fall prevention program. This has been proved by the fact that only seven patients required treatment to prevent one fall in multidisciplinary intervention randomized control trails compared to 32 in single intervention trail[20,21].

As every individual patient requires specific attention in treatment similarly community base programs alsoneed specific fall prevention efforts focus on each member needs and requirements[11].

Our result shows relation between fall efficacy, balance and mobility in geriatric population. Findings of this study are in consistence with K. Suraj et al[1] who suggested that old people with fear of fall might have balance deficit.

Exercise program used in the study delivered at home to reduce fall risk by nurse and thus cost effective Information about the efficacy of physical training protocols in geriatric patients recovering from injurious falls including hip-fracture patients is scant,15,16 although these patients have the highest medical costs, highest incidence of dependency, and highest mortality[22,23].

Activity level should be increase gradually in order to reduce number of falls focusing more on mobility training. More challenging balance exercises can be included in program to reduce fall rate as suggested by Sherringtonet al[24] .

This study demonstrated that combined progressive high-resistance strength training and progressive functional training improved strength, balance, and functional performance without increasing the risk of training-related adverse clinical events in frail geriatric patients with a history of injurious falls. These changes were accompanied by an improvement in subjective awareness of post fall postural stability while walking, and fewer fall related emotional and behavioral restrictions. The achieved non significant reduction in subsequent falls may be clinically relevant but needs to be confirmed in a larger follow-up study with adequate statistical power[25,26].

5. CONCLUSION:

Progressive strength and functional training are proved to be safe and cost effective method to reduce risk of fall in geriatric patients. These methods can also be used to improve strength, balance, functional performance and producing emotional restrictions.

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