Original Research Article

Impact of Balance and Fear of fall in Patients with Sarcopenia

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ABSTRACT

Aim- The aim of the study was to identify the impact of balance and fear of fall in patients with Sarcopenia and to associate balance and fear of fall with sarcopenic criteria.

Methodology- 187 subjects recruited on the basis of inclusion and exclusion criteria. Outcome measure was assessed by hand grip dynamometer, 6- meter walk test, A.L.S.T. equation, B.B.S. and F.E.S-I.

Results- Among the 4 groups, Pre-sarcopenic group (BBS=40.048, FES=21.476) had low risk for fall and low moderate concerned of fall, Sarcopenic group (BBS=36.053, FES=24.947) had moderate risk for fall and moderate concerned of fall, Sever-sarcopenic group (BBS=32.348, FES=28.087) had also moderate risk of fall but severe concerned of fall, and Non-sarcopenic group (BBS=45.458, FES=19.167) had low fall risk and low moderate fear of fall.

Conclusion- The present study concluded that fear of fall higher in sarcopenic group as compare to non- sarcopenic group. There are moderate risks for falls in sarcopenic group whereas low risk for falls in non-sarcopenic group.

Key words- sarcopenia, Hand held dynamometer (HHD), ALST (Appendicular lean soft tissue), Berg Balance Scale (BBS), Fall Efficacy Scale International (FES-I).

INTRODUCTION

The global population is ageing and disabilities later in life are becoming an urgent health issue. [1] Sarcopenia, the age related loss of skeletal muscle mass and function, is prevalent among older people. Sarcopenia (Greek; sarx means "flesh", penia means "loss") is an age related geriatric syndrome first described in meeting 1988 by Dr. Rosenberg as a phenomenon whereby the age related decline in lean body mass affects ambulation, mobility, energy intake, overall nutrient intake and status, independence and breathing. [2] Sarcopenia is associated with poor quality of life due to its deleterious effects on person's physical performance. [3] Balance control is foundation of our ability to move and function independently. Physiological changes related to ageing such as reduced muscle strength and joint ranges of motion are known factors that predispose to poor balance. Among the elderly, poor balance control is known to reduce the self confidence and may lead to functional decline and disability. [4]

A deterioration of balance function, as a consequence of disease or simply increasing age, will increase the occurrence of clinical balance problem as well as risk of balance loss and falls. [5] Factors contributing to increased risk for falls have been categorized into intrinsic

factors (those internal to the individual) and extrinsic factors (those associated with environmental features) Intrinsic factors associated with increased likelihood for falls includes changes in muscular strength, decreased joint flexibilities, impaired visual sensation, a decline in vestibular function and decreased vibratory sense. Dsouza et al 2014 concluded that falls are the emerging public health problem and a barrier to active ageing in India. There is an urgent need for coordinated and collaborative efforts of health professionals, researchers, policy makers and health care delivery system to prevents falls and promote active ageing. [6]

Currently the standard care of sarcopenia is either nutritional supplements and appetite enhancers or exercise to maintain or improve muscle strength. In spite of these treatment options many elderly still loss muscle strength and function and are subsequently at risk for the deleterious outcome of frailty. [7]

As we assess the patients for sarcopenia our criteria's vary from strength to performance. As we know most of geriatric patients fall in sarcopenic criteria, we hypothesize that fear of fall and balance will be major issues of patients with sarcopenia. In addition there is dearth of literature related to balance strategies as intervention tool for patients with sarcopenia, in this context the present study aim was to see the impact of balance and fear of fall in patients with sarcopenia.

MATERIALS AND METHODS

A Survey conducted at different places in Dehradun, India and 187 subjects recruited on the basis of inclusion and exclusion criteria. Subjects were excluded if taking any medication deemed to affect calcium and bone metabolism, any chronic metabolic bone disease, physical disability and a treatment with drugs that may influence lean soft tissue and bone mass such as cortisone treatment, person dependent on steroid or thyroid hormones, premature menopause and non-ambulatory patients.

Instruments used were handgrip-dynamometer, stop watch, 60-ins long tailors tape, and 8- meter self retracting measuring scale and weighing machine. Outcome measure was assessed by hand grip dynamometer, 6- meter walk test, A.L.S.T. equation, B.B.S. and F.E.S-I.

Procedure

Subjects were recruited from different communities in Dehradun as per inclusion and exclusion criteria. The method and procedure were explained to them. Written consent forms were signed by the subjects. Information regarding their demographic data was collected and they were asked to fulfill the FES-I questionnaire. Same subjects were assessed for balance by using B.B.S.

1. Evaluation of Sarcopenia:-

Anthropometry: - Status of age, height and weight were recorded for all subjects. Arm, Hip and calf circumference were recorded for calculation of A.L.S.T.

Hand grip strength:- Hand grip strength was measured by using a hand dynamometer, the process were performed for 3 times and the average will be taken as final reading. All participants were seated elbow 90* flexed, shoulder adducted and forearm in neutral position and are instructed to hold dynamometer with dominant hand. A cut- off for hand grip strength for men < 26 kg and for women <18 kg were taken. [8]

Physical Performance:- For physical performance gait speed was assessed by 6 meter walk test . Participants were requested to walk at their usual speed with a static start without deceleration throughout a 6 meter straight line in a room or in corridor that was 8 meter in length. Time was measured by using stopwatch. A cut- off value for both genders for gait speed is < 1 m/s. [9]

Anthropometric Equation:- In this Appendicular lean soft tissue (AL.S.T)

was calculated by using the anthropometric equation that is,

A.L.S.T./ ht^2 for Men :- [10]

-12.81- (0.029 x age …) + (0.211 x weight…) + (0.153 x height….) + (0.255 x calf circumference……) + (0.141 x arm circumference …..) - (0.178 x hip circumference…..) = ……..Kg / m$^{2.}$

A.L.S.T./ht ^{2} equation for Women:-

- 2.658- (0.023 x age…) + (0.244 x weight …) + (0.028 x height….) + (0.087 x calf circumference….) – (0.058 x arm circumference…..) – (0.102 x hip circumference…..) = ……….kg /m^2.

Cut-off value for A.L.S.T./ht^2 equation for male and female are: - [11]

- For Men :- < 7.0 kg /m^2
- For female :- < 5.75 kg/m^2

2. Assessment of Fear of fall:-

- Fear of fall was assessed by using fall efficacy Scale – International (test-retest reliability ICC= 0.96). [12]
- This questionnaire contains 16 items of questions related to a person's daily activities.
- Subjects answered the simple questions like how concerned they would be about falling while doing in and out of chair.
- The options they can choose were: 1= not at all concerned, 2 = somewhat concerned, 3 = fairly concerned and 4 = very concerned. Total score = 64.
- The word 'concerned ' expresses a cognitive or rational disquiet about the possibility of falling , but does not express the emotional distress that expressed by terms such as 'worried', 'anxious', or 'fearful' .
- Interpretation:- 16-19 = low concerned 20-27 = moderate concerned , 28-64 = high concerned

3. Balance Evaluation:-

- Balance was assessed by Berg Balance Scale (inter and intra-rater reliability are 0.98 and 0.99 respectively). [13]
- Whole procedure was explained before application.

- 14 items scale designed to assess to balance of elderly by means of performing functional tasks.
- Equipment needed- Ruler, two standard chairs (one with arm rest and one without), footstool or step, stopwatch or wrist watch, 15 ft walkway.
- Completion:-
    Time- 15- 20 minutes (approx)
- Scoring- A five point scale , ranging from 0-4 , 0" indicates the lowest level of function and " 4" indicates the highest level of function. Total score = 56.
- Interpretation:- 41-56 = low fall risk
        21- 40 = medium fall risk,
        0 – 20 = high fall risk

Data Analysis

➢ Data was analyzed by using SSPS version 17.0.
➢ Descriptive statistics was used to calculate mean value and standard deviation of demographic data along with FES-I and BBS.
➢ The data was distributed in 4 groups:
- Pre- sarcopenic (PS)
- Sarcopenic (S)
- Severe Sarcopenic (SS)
- Non-sarcopenic (NS)
➢ Post-hoc test was used for comparison of balance (BBS) and fear of fall (FES-I) in between all 4 groups.
➢ Pearson correlation was used to find correlation between FES and ALST, handgrip strength and gait speed, in similar way correlation between BBS and ALST, handgrip strength and gait speed.

The statistical significance was set as 95%, confidence interval with p value < 0.05 considered to be significant.

RESULTS

The data was taken from 187 subjects, and then subjects were distributed according to European Working Group on Sarcopenia in Older

People (EWGSOP) on the basis of its stages.

- Group 1 (Pre-sarcopenic) consisted of 42 subjects. (PS)
- Group2 (Sarcopenic) consisted of 75 subjects. (S)
- Group3 (Severe-sarcopenic) consisted of 46 subjects. (SS)
- Group4 (Non-sarcopenic) consisted of 24 subjects. (NS)

Post hoc test was used for comparison of fear of fall (FES-I) between all the 4 groups. The mean for FES and results interpretation as follows: In group 1 pre-sarcopenic mean FES (21.476), had moderate concern of fall, score for group 2 sarcopenic mean FES (24.947), also had moderate concern of fall, in group 3 severe sarcopenic mean FES (28.087), had high concern of fall and in group 4 FES mean was 19.167, had moderate concern of fall. Results for comparison of fear of fall (FES-I) between all the 4 groups showed a significant difference (p= 0.000).

Table 1: Comparison of FES values between 4 groups

	MEAN	SD	F	P
GROUP 1	21.476	4.35743	18.896	0.000
GROUP 2	24.947	5.74901		
GROUP 3	28.087	6.72252		
GROUP 4	19.167	1.9708		

Post-hoc test was used for the comparison of balance (BBS) between 4 groups. The mean for BBS and interpretation for risk for fall as follows: in group 1 Pre-sarcopenic BBS (40.048), had low fall risk. In group 2 Sarcopenic BBS score (36.053), had medium fall risk. In group 3 Severe Sarcopenic BBS score (32.348), also had medium fall risk. In group 4 Non-sarcopenic BBS score (45.458), had low fall risk. Results for the comparison of balance (BBS) between 4 groups showed a significant difference (p=0.000).

Table 2: Comparison of BBS values between 4 groups

	MEAN	SD	F	P
GROUP 1	40.048	6.22721	33.981	0.000
GROUP 2	36.053	5.50158		
GROUP 3	32.348	5.49026		
GROUP 4	45.458	4.58712		

Person's correlation was done to find correlation between FES with sarcopenic criteria in 4 groups of sarcopenia. Among all 4 groups FES had significant correlation with Handgrip strength, ALST and Gait speed (p=.000, p=.001 and p=.000 respectively).

TABLE 3: Correlation of FES with sarcopenic criteria in 4 groups:

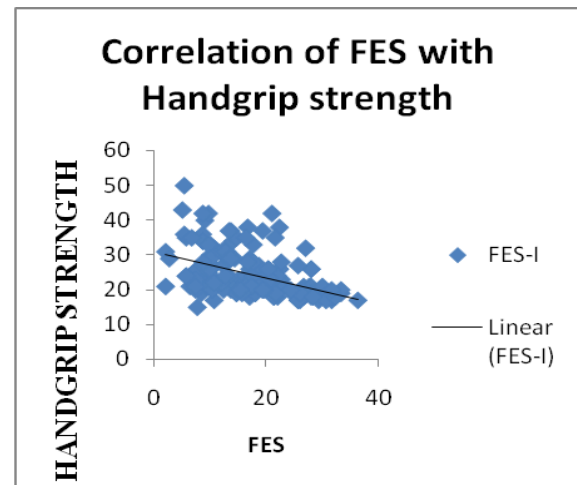| Sarcopenic Criteria	r	P
1.Handgrip strength	-.461**	.000
2 ALST	-.246**	.001
3 Gait speed	-.528**	.000

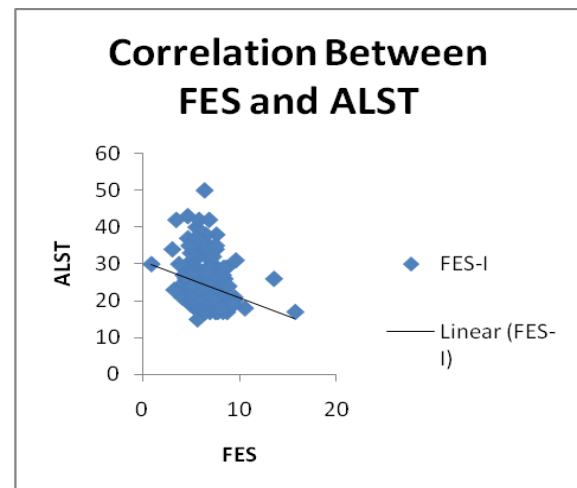**Fig. 1: Correlation of FES with Handgrip strength.**

Fig. 2: Correlation of FES with ALST.

Pearson's correlation was done to find correlation between BBS and sarcopenic criteria of 4 groups. Among all groups BBS had significantly correlated with Handgrip strength, ALST and Gait speed (p=.000, p=.005 and p=.000 respectively).

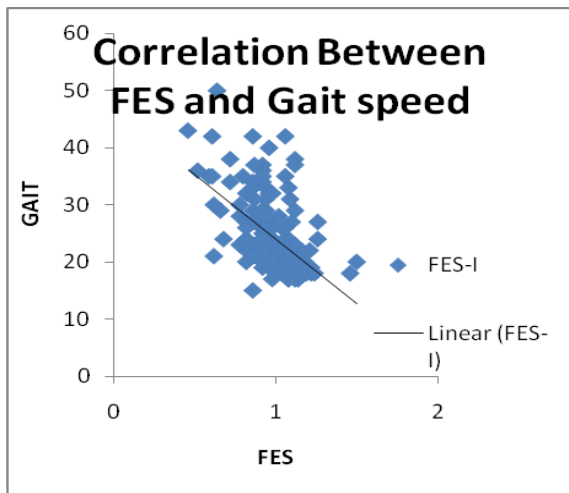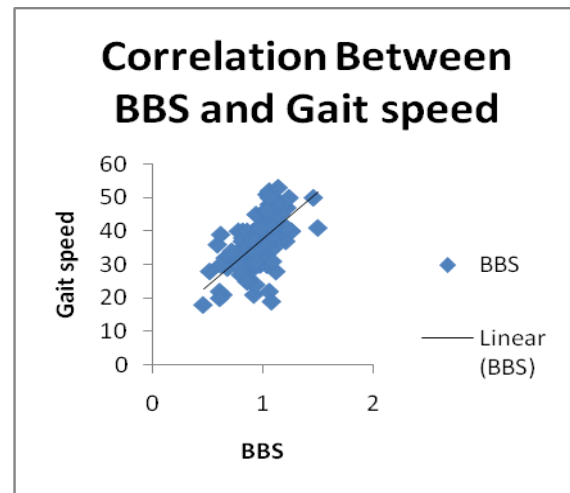Fig. 3: Correlation of FES with Gait speed

TABLE 5.4: Correlation of BBS with Sarcopenic criteria in 4 groups:

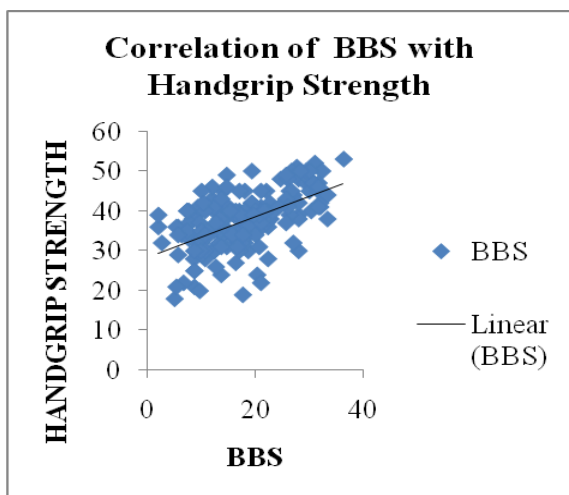| Sarcopenic Criteria	r	P
1.Handgrip strength	.571**	.000
2 ALST	.204**	.005
3 Gait speed	.589**	.000

Fig. 4: Correlation of BBS with Handgrip strength.
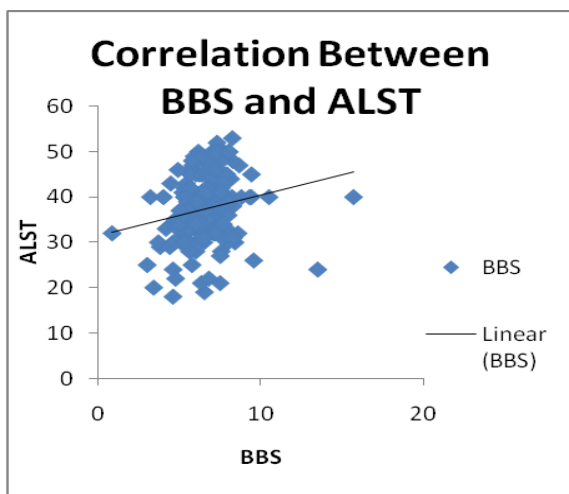
Fig. 5: Correlation of BBS with ALST.

Fig. 6: Correlation of BBS with Gait speed.

INTERPRETATION OF RESULTS

- Out of 187 subjects, 42 (23%) were Pre-sarcopenic, 75(41%) were Sarcopenic, 46 (23%) were Severe Sarcopenic and 24 (13%) were Non-sarcopenic.

- Among the 4 groups, Pre-sarcopenic group (FES=21.476) had moderate concerned of fall, Sarcopenic group (FES=24.947) had also moderate concerned of fall, Severe sarcopenic group (FES=28.087) had severe concerned of fall and Non-sarcopenic group (FES=19.167) had moderate concerned of fall.

- Among all 4 groups, fear of fall had negatively correlated with muscle strength muscle mass and physical performance.

- Among the 4 groups, Pre-sarcopenic group (BBS=40.048) had low risk for fall, Sarcopenic group (BBS=36.053) had moderate risk for fall, Sever-sarcopenic group (BBS=32.348) had also moderate risk of fall, and Non-sarcopenic group (BBS=45.458) had low fall risk.

- Balance in all 4 groups showed positive correlation with muscle strength, muscle mass and physical performance.

DISCUSSION

The result of present study reviled that out of 187 subjects, 42(23%) were pre-sarcopenic, 75(41%) were sarcopenic, 46(23%) were severe sarcopenic and 24 (13%) were non-sarcopenic. Richard N et al 1998, he added that above 70 years of older adults >50% were sarcopenic in New Mexico[34]. In support of our study Dhar A 2014, found that out of 113 subjects in Dehradun more than 65 % with mean age was 68 years were sarcopenic. [3]

Literature suggests that higher risk for sarcopenia with ageing due to decrease in muscle mass, muscle strength and reduced physical performance. In support of our study Sylvia et al also added that increase in the age results in loss of lean body mass, and accelerates and results in deficiency of skeletal muscle mass. [14]

The present study analyses the fear of fall among 4 groups, we found pre-sarcopenic had moderate concerned of fall, sarcopenic had also moderate concerned of fall, whereas severe sarcopenic had high concerned of fall and non-sarcopenic group had near the lower limit of moderate concerned of fall.

The rate of fear of fall in sarcopenic as compare to non-sarcopenic group could be due to reduction in muscle mass, strength and physical performance is much lower than non-sarcopenic group. In supports of our study Anianson et al also added that changes in muscular strength are associated with increased likelihood for fall. [15]

The fear of fall was also found lower limit of moderate fear of falls in non-sarcopenic group which could be due to ageing factor. In support of this Zilstra G et al also added that ageing is also associated with high rate of fear of fall. [16]

Present study also analyses comparison of balance among 4 groups, and found that pre-sarcopenic group had low risk for falls, sarcopenic group had moderate risk for fall, and severe sarcopenic group also moderate risk for falls whereas non-sarcopenic group had low risk for falls.

The reason for moderate risk in sarcopenic and non-sarcopenic group could be increase reduction in muscle mass, muscle strength as compare to non-sarcopenic group. In support of our study Macaluso et al added that the loss of muscle mass and decreased ability for neuromuscular activation which in turn lead to loss of muscle strength is directly associated with poor balance. [17]

In this study we also found negative correlation of fear of fall with muscle mass, muscle strength and physical performance. As the muscle mass, muscle strength and physical performance are much more reduced in severe sarcopenia followed by sarcopenia than non-sarcopenic group which justify our results of high rate of fear of fall in sarcopenic groups than non-sarcopenic. In support of our study Anianson et al also added that changes in muscle strength is associated with increased likelihood for falls.

Our study also depicts that higher rate of fear of fall in sarcopenic groups are associated with poor physical performance, which is supported by study of Abraham Josua et al who stated that there is strong positive relationship between fall related self efficacy and decreased physical activity. [6]

Present study also reviled that the balance has positive correlation with muscle mass, muscle strength and physical performance. As the muscle mass, muscle strength and physical performance much more reduced in severe sarcopenic followed by sarcopenic as compare to non-sarcopenic group which justify our results of moderate risk for in sarcopenic groups, whereas low risk for falls in non-sarcopenic group. In support of our study, Buchner et al also concluded that there is undoubtedly documented relationship between risk for falls and muscle strength. [18] Wickham and cooper in their study also

found that risk for fall in older adults is closely related to low muscle mass. [19]

The result of present study adds on literature that there is high risk for falls in sarcopenic group which presents definite need of balance training in elderly to decrease the impact of sarcopenia in older age, so it can combat the risk of fear of fall and improve the physical performance in elderly with sarcopenia.

Limitation:
- As the gait speed was used to assess the physical performance of subjects our study was limited to those subjects who were ambulatory.
- Some patients were unable to hold the dynamometer properly, so assessment could not possible.

Future study
- In place of ALST equation, DXA (Dual X-ray Absorptiometry) can be used to assess muscle mass.
- In future sarcopenic criteria if possible adjusted for older subjects who are non-ambulatory so the sarcopenic assessment will be made possible.

CONCLUSION

The present study concluded that fear of fall higher in sarcopenic group as compare to non- sarcopenic group. There are moderate risks for falls in sarcopenic group whereas low risk for falls in non-sarcopenic group.

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