

ORIGINAL ARTICLE

Comparison of Balance Impairment among Chronic Obstructive Pulmonary Disease (COPD) and Healthy Population

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is a condition that affects respiratory system. Balance impairments are increasingly seen in patients suffering from COPD resulting in the onset of risk of falls.

Objective: To compare balance impairment and fall risk between COPD patients and healthy individuals.

Methodology: A comparative cross-sectional study was conducted on 16 clinically stable COPD patients and 16 healthy individuals, with age range of 40-65 years. Berg balance scale (BBS), activity Specific balance confidence scale (ABC) and Time Up and Go test (TUG) were administered to evaluate balance impairments.

Results: Independent sample T-test was applied to compare the difference in tests in both groups. Statistically significant difference was observed between two groups in terms of their BBS, ABC and TUG all with $p < 0.05$. Pearson correlation test was used to check the correlation of age, BMI, and smoking with balance.

Conclusion: The study concluded that COPD patients have balance impairments and high risks of falls as compared to healthy individuals. Furthermore, the study shows positive correlation of BMI and no relation of age and smoking with balance impairment.

Keywords: Balance Impairments, Berg balance scale, Chronic obstructive pulmonary disease, Fall, Time up and go test.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a condition that affects respiratory system and is progressive in nature and has characteristic of airflow obstruction and respiratory distress. COPD is a major health problem globally as it is the fourth leading cause of death in developed countries and estimated to become the third leading cause in 2030.⁽¹⁾ COPD imposes a colossal pressure on people suffering from this disease, which can include a variety of symptoms. Commonly present symptoms for this condition are shortness of breath, production of sputum and cough. On the other hand less commonly present symptoms are congestion, wheezing and chest tightness. Moreover, COPD effect physical and psychological health of a person.⁽²⁾ Exercise tolerance, peripheral muscle performance and functional mobility get reduced in COPD but recent studies have demonstrated that such people have a noticeable loss in balance control.⁽³⁾

Falls in the elderly have bad impacts on social life, functional independence and life expectancy. A recent research demonstrates that COPD has second highest risk of falls after the osteoarthritis in case of chronic pathologies.⁽⁴⁾ Incidence rate of fall is 25 to 46% in COPD.⁽⁵⁾

A complex interaction exists between motor and sensory input that explains for the underlying mechanisms for balance disorders in COPD. Whenever there is a postural challenge and balance is disturbed the trunk and respiratory musculature specifically diaphragm play a vital role in stabilizing the body. It is reasonable to suggest that surge in working of respiratory muscles in people with COPD might jeopardize their role in stabilizing postures. Much of the literature has clearly stated that balance

difficulties are related with muscular weakness in cases of stable COPD.⁽⁶⁾ More severity of this disease causes patients to lose muscular girth, targeting thighs mainly. Consequently, patients have reduced levels of endurance, spiked levels of fatigue, and dyspnea even at minimum work. All these symptoms lead to decreased ability to perform daily life work activities and decrease patient tolerance towards exercise causing generalized decrease in mobility. Lower limbs muscular weakness is a non-pulmonary risk factor for falls in spite of this COPD have greater risk of falls than normal people.⁽⁷⁾

Poor postural control is common in elder population. It is known that 30% of individuals greater than 60 years of age fall at least once per year, and that the fall incidence spikes up to 45% when people reach age of more than 70 years. Faulty postural control is more common whenever there is any chronic underlying condition in elders. The PLATINO study showed that COPD is more prevalent in old population.⁽⁴⁾ Lower limb musculature weakness, labyrinthine disorders, functional dependence and the lack of ability of realigning the body if balance is disturbed are all risk factors for fall and are well established in previous studies. Additionally, the consequences of falls are costly for the health care system.⁽¹⁾ Falls are not only linked with increased chances of morbidity and increased chances of mortality but are also related to poor daily functioning and early onset admissions to hospitals, furthermore reduction in falls is pivotal health system goal. Proper assessment for the causes of faulty posture is very important in order to prevent hazards of falls.

It is important to identify risks of falls in COPD populations as they also have high rates of osteoporosis that can lead to fractures on falling and it can complicate the situation further by prolonged hospitalizations.⁽⁸⁾ In

COPD prolonged hospital stays can cause additional damage as their respiratory system has already been compromised. For proper and specific rehabilitation plan it is vital to have a deep and extensive knowledge about the profile of COPD patients with balance disorders.⁽³⁾ For above reasons this is the topic of interest for this study.

For patients with COPD extensive amount of evidence suggests that balance disorders are of notable concern. This study will add up to the existing evidence about increased risk of falling in COPD and will shed light on the dire need for adding the balance assessment in pulmonary rehabilitation. By keeping this study in mind future therapist will surely focus on balance training for those at risk in order to prevent issues related to muscular strength, coordination, balance, functional activity and falls. Techniques for preventing falls should be well taught to this patient population. Hence it is very important to properly assess postural control in COPD patients for better diagnostic, preventive, prognostic and interventional approach. Previous studies haven't studied primarily about impact of BMI on balance in COPD population. Moreover, most of the studies have used only one test to measure balance, current investigation assessed balance issues and fall risk using three different gold standard balance measuring tools.

MATERIALS AND METHODS

Ethical Consideration: Ripah Research and Ethical committee & Al-Aleem Medical College Institutional Review Board reviewed the study prior to its conduction and then published the permissions to conduct the study. An informed written and oral consent was taken from all the subjects. All subjects were made fully aware about the aim, benefits and hazards of study.

Comparative cross-sectional study with non-probability convenient sampling was used. Data was collected from Gulab Devi Hospital within 6 months. Total sample was 32 with 16 in each group.

Target Population: COPD patients from Gulab Devi Hospital and healthy population from community were recruited.

Inclusion Criteria:

❖ For COPD patients:

- ✓ COPD patients with oxygen saturation between 88 to 92 percent and clinically stable airway obstruction.⁽⁹⁾
- ✓ COPD people with age range 40-65 years
- ✓ Both males and females were recruited.

❖ For healthy population:

- Subjects with similar demographic data, absence of COPD and any other health related issue leading to impaired balance and mobility.

Exclusion Criteria:

- ❖ History of Syncope, any communication disorder.
- ❖ History of Neurological or musculoskeletal diseases leading to onset of falls or balance deficits.
- ❖ History of Any acute cardiac condition.
- ❖ History of Transient ischemic attacks
- ❖ History of Hip and knee replacements
- o **Pulse Oximeter** was used to check oxygen saturation.
- o **Abc Questionnaire:** For balance test first of all subjects were asked to fill the

Abc Questionnaire.⁽¹⁰⁻¹²⁾ Subjects were asked to rate every item from **0-100%** based on their balance confidence level for each activity.

o **Berg Balance Scale (Bbs):** Subjects were asked to perform

Berg Balance Test in order to assess dynamic as well as static balance.⁽¹³⁾

o **Time Up And Go (Tug):** Subjects were then asked to perform

Time Up And Go Test (Tug): Time Up and Go test is used as a screening test for fall risks.^(14, 15)

The data analysis was done by using SPSS version 21 for Windows software.

RESULTS

Baseline values of socio-demographic data of both groups were comparable on basis of mean± standard deviation in Table 1. This table summarized the comparison of socio-demographic variable like age, weight and height of participants and Body Mass Index (BMI) across both groups. Mean age in COPD group was 54.333±6.717 years and in healthy group was 55.966±5.031 years. Height and weight in COPD population was 1.628±0.0915 and 85.700±5.831 respectively as compared to healthy group height and weight was 1.662±0.687 and 77.366±5.333 respectively. Body mass index (BMI) in COPD group was 32.6442±4.465 and in healthy group was 28.165±3.427.

Table 2 shows minimum and maximum scores of both groups (COPD and healthy group) obtained from balance tests.

Independent sample T-test was applied to compare the difference in tests i.e. Berg balance scale (BBS), Activity specific balance confidence scale (ABC) and time up and go test (TUG) between two groups (COPD and Healthy population). The results showed that there was statistically significant difference between two groups with $p < 0.05$ in terms of their BBS, ABC score and TUG time.

Table 3 shows significant difference between COPD and healthy group in term of BBS with mean±S.D = 45.600±3.847 and 53.100±1.528 for COPD and healthy population respectively, significant difference between two groups in term of ABC with mean±S.D = 66.303±2.931 and 79.586±6.060 for COPD and healthy population respectively, and significant difference between two groups in term of TUG test with mean±S.D = 14.750±0.768 and 9.843±1.920 for COPD and healthy group respectively. The results clearly highlights the predominance of balance issues among COPD population as compared to healthy population.

Pearson correlation test was used to check the correlation of age, BMI, and smoking with BBS, TUG and ABC. According to international classification person is labeled as obese if BMI is greater than 30 kg/m².⁽¹⁶⁾

Table 4 shows correlation of BBS, TUG and ABC with age, BMI, and smoking in study sample. The results highlights the positive correlation of BMI with BBS, ABC and TUG which implies that balance is compromised with increased BMI.

Table 1: Comparison Of Socio-Demographic Variables Of Two Groups

Descriptive Statistics					
Groups		N	Minimum	Maximum	Mean±S.D
COPD	Age	30	40.00yrs	65.00yrs	54.333±6.717
	Weight	30	72.00kg	93.00kg	85.700±5.831
	Height	30	1.51m	1.85m	1.628±0.095
	BMI	30	24.25kg/m2	40.35kg/m2	32.644±4.465
Healthy Population	Age	30	43.00yrs	65.00yrs	55.966±6.031
	Weight	30	67.00kg	90.00kg	77.366±5.333
	Height	30	1.53m	1.85m	1.662±0.687
	BMI	30	24.25kg/m2	37.59kg/m2	26.165±3.427

*S.D = Standard Deviation.

This table summarized the comparison of socio-demographic variables i.e., age, height of participants, weight of participants and Body Mass Index (BMI) across both groups.

Table 2: Descriptive And Clinical Statistics Of Copd And Healthy Population

	COPD			HEALTHY POPULATION		
	Minimum score	Maximum score	(mean±S.D)	Minimum score	Maximum score	(mean±S.D)
Berg balance scale (bbs)	33.00	51.00	45.60±3.847	49.00	56.00	53.10±2.249
Activity specific balance confidence scale (abc)	63.00	74.30	66.30±2.931	69.00	90.14	79.58±6.060
Time up and go (tug)	12.00sec	16.00sec	14.75±0.768	7.00sec	13.00sec	9.84±1.92

*S.D = Standard Deviation.

Independent sample T-test was applied to compare the difference in means of tests between two groups (COPD and healthy population).

Table 3: Comparison Of Means Of Two Groups

	COPD (mean±S.D)	Healthy (mean±S.D)	Mean difference	P value
Berg balance scale	45.600±3.847	53.100±2.249	7.50	<0.05
Activity specific balance confidence	66.303±2.931	79.586±6.060	13.283	<0.05
Time up and go test	14.750±0.768	9.843±1.920	4.907	<0.05

*S.D = Standard Deviation.

Pearson correlation test was used to check the correlation of age, BMI and smoking with berg balance (BBS), activity specific balance confidence scale (ABC) and time up and go test (TUG).

Table 4: Correlation Of Bbs, Abc Questionnaire And Tug Test With Age, Bmi And Smoking

Tests	Variable	P value	Correlation coefficient (r value)
Berg balance Scale	Age	0.364	0.119
	BMI	0.000	0.506
	Smoking	0.444	0.101
Activity specific Balance confidence	Age	0.879	0.20
	BMI	0.000	0.653
	Smoking	0.455	0.098
Time Up And Go Test	Age	0.934	0.011
	BMI	0.000	0.628
	Smoking	0.593	0.070

DISCUSSION

The results of current study are consistent with a study conducted to compare balance impairments in activities of daily livings (ADLs) between stable and acute exacerbation

COPD patients (AECOPD) and healthy controls with same baseline characteristics. The results of the study revealed that the COPD patients shows significantly worse scores in these balance tests, BBS with p value less than 0.001, TUG with p value less than 0.001 and SLS with p value less than 0.001. Thus it was concluded that COPD patients have an impaired balance as compared to control group and the AECOPD patients have high risk of falls as compared to other two groups.⁽⁹⁾ Consequences of current study showed that there was statistically significant difference between two groups (COPD population and healthy individuals) with p < 0.05 in terms of their BBS, ABC score and TUG time.

A recent study showed a cuff-off value of 46 or less in BBS to be an important indicator of risk of fall. ^(17, 18) Berg et al reported that individuals showing score less than 45 are considered to be at increased fall risk.⁽¹⁹⁾ Comparatively, the findings of current investigation showed that 70.1% COPD population had a score less than 45 points and 53.4% COPD population had a score less than or equal to

46 points. Another study conducted by Lajoie et al. used BBS, logistic regression analysis suggested that a score of 50 would represent 10% chances of fall and a score or 38 or less would suggest 90% fall risk chances.⁽⁹⁾ Compared to this study, in the current study 3.3% COPD patient had a score less than 38 points and 90% COPD population had a score less than 50 points. The findings of the present research indicates that decline in BBS points towards compromised balance and increased falls risk in COPD population due to reduce exercise capacity as a result of prolonged bed rest leading to skeletal muscle atrophy.

Time Up and Go test is used as a screening test for fall risks. Individuals showing values more than 13.5 seconds are at high risk of falls.⁽²⁰⁾ A recent study highlights that TUG \geq 14 s indicates that a patient is at high risk of falling and being admitted to hospital.⁽²¹⁾ The current study's results showed that 93% COPD population had TUG score more than 13.5 indicating increased risks of falls and compromised balance in these patients.

A study suggested that a score of 67% in activity specific balance confidence scale is a strong predictor of future falls.⁽⁹⁾ The current study showed that 63.3% COPD patients had ABC score less than 67% that is clearly associated with high risk of falls and impaired balance in COPD patients.

CONCLUSION

COPD patients have balance impairments and high risks of falls as compared to healthy individuals. Furthermore, the study shows positive correlation of BMI and no relation of age and smoking with balance impairment.

Recommendations

- Further researches are needed to investigate risk factors resulting in the onset of balance impairments in COPD population.
- Interventional studies on balance impairment should be conducted. Physiotherapists must include balance assessment and postural training as a necessary part of COPD rehabilitation programs.
- Similar researches should be advocated on elderly population (age > 70years) and AECOPD (acute exacerbation of COPD) patients.

Conflict of Interest: The study has no conflict of interest to declare by any author.

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