

NORMATIVE VALUES OF 6-MINUTE WALK TEST IN PATIENTS OF CONGESTIVE HEART FAILURE

Shanza tanveer¹, Maryam shahzadi², Moqddas Iqbal³, Maham Nadeem⁴,
Raveena Rajput⁵, Aliha Abid⁶

^{1,2}Doctors institute of health sciences Sargodha Pakistan

³Sargodha institute of health sciences, Sargodha Pakistan

⁴Riphah international university Lahore, Pakistan

⁵University of Sialkot, Sialkot Pakistan

⁶Al-khidmat hospital, Bhera Pakistan

ABSTRACT

6-minute walk test has considered as one of prognostic tool for the patients with heart and respiratory problem. It is used to measure functional capacity among patients with heart failure. 300m is considered as baseline below which a person with heart failure has poorer prognosis.

Objective: To determine the normative values for 6-min walk test in patient with mild to moderate congestive heart failure.

Methods: It was a cross-sectional study with 556 total participants with mild to moderate congestive heart failure. Equal distribution of participants was done based on gender; 278 male and 278 females. After taking basic medical history, age, gender, weight, height and BMI was recorded. Patient must be stable from last 6 months were guided the procedure and performed 6-min walk test, distance covered in 6-min was noted. Data was analyzed using SPSS version 25. Means and SD was plotted in histograms for all basic values. Pearson correlation was done to find relation between 6-min walk distance and age, weight, height or BMI.

Results: Among female congestive heart failure patient's height and heart rate have height significant ($P < 0.05$) correlation with 6-min walk test values. Among males 6-minute walk test have no significant ($P > 0.05$) correlation with age, height, blood pressure, oxygen saturation and heart rate. Oxygen saturation have no

significant correlation with age, height, blood pressure, oxygen saturation and heart rate.

Conclusion: Variables age, height, heart rate, blood pressure and oxygen saturation were independent of 6-min walk test distance among male CHF patients. While height and heart rate were dependent of 6-min walk test distance among female CHF patients.

Indexed terms Congestive Heart Failure, 6-Min Walk Test, Normative Values.

I. Introduction

Cardiovascular breakdown or heart failure (HF) is one of most common health problem. One of the most morbid conditions that leads to hospital admissions. It ordinarily influences more established countries and future combined with further developed management of ongoing disease, the quantity of patients with cardiac failure about to increase.(1) Congestive heart failure (CHF) has been divided into cardiovascular failure with decreased and constant blood flow division. Nonetheless there are differences in two types; but mortality was high and comparable in two type of congestive heart failure. Various advances and equipment based treatments were discovered for management of cardiovascular failure.(2) Heart failure is a syndrome occurred due to anatomical and physiological abnormalities resulting in elevated intracardiac pressures and decreased cardiac output. Common symptoms of heart failure are shortness of breath

(SOB), ankle or lower limb edema and orthopnea with common signs of respiratory decompensation and increased or elevated Juglar venous pressure (JVP). (3) Various types of congestive heart failure explained by clinician and researches. Most common of them is acute decompensated heart failure. Common signs and symptoms of heart failure are orthopnea, shortness of breath, night time SOBs, ankle oedema and decline in physical activity level. Hypertension and hypotension both are common depending on signs and symptoms of disease.(4) Despite of improvement in management options worldwide 3000,000 death occurs due to heart failure. Congestive heart failure is considered as one of most common cause for mortality morbidity and raising general wellbeing cost. In the US alone, the quantity of congestive cardiac failure patients is multiple million every year with in excess of 550,000 new yearly announced cases.(5) The yearly expense of cardiovascular breakdown the board surpasses 35 billion dollars each year. Hospitalization in US for patients matured 65 years and more established is more than 1 million every year. (6) In clinic death rate can be just about as high as 12% for patients conceded with intense intensification of congestive cardiovascular failure.6.3% patients admitted to emergency department with acute decompensated heart failure.(7) Absolute clinical expense for cardiac failure in Unites States expected to rise from 20.09 billion dollars in 2021 to 53.1 billion dollars by 2030. Proof propose that number of cardiovascular failure cases brought up in emerging nations the people who need to contend weight of transmittable diseases and western way of life.(8) There is an unsettling absence of epidemiological

information from nations outside Europe and North America, particularly from lower and middle-income nations, despite the fact that these are assessed to convey 80% of the cardiovascular illness trouble. Low income countries have more mortality rate due to congestive heart failure rather than high income countries.(9) The annual heart failure (HF) mortality rate in Africa is 34% according to the INTERHF study. This is twice the world average of 16.5% and 3.7 times that of South America, 9%. We review evidence-based explanations for the Hyper-mortality of HF, by comparison of North American, Caribbean, Afro-Brazilian with Sub-Saharan African (SSA) nations profiles, and suggest amelioration. (10) Congestive cardiac failure has been depicted as arising clinical problem around 25 years prior it actually keeps on rising. Serious medical concern is influencing more than 37.7 million individuals around the world. In United States more than 5.5 million individuals live with cardiovascular failure. It is basic condition and patient requires quick treatment.(11) Constant poorer outcomes in congestive heart failure can be related to delay in medical care and improvement in treatment options. In case of pulmonary edema intravenous diuretics and non-invasive ventilator is used. (12) 6-minute walk test has received substantial attention as tool to examine functional status in heart and respiratory disease. Clinician uses 6 MWD as one of diagnostic parameter after heart rate reserve in patients with congestive heart failure. The current survey sums up the worth of 6 MWT in patients with HF and distinguishes it is helpfulness & limits in ordinary clinical practice in patients of HF.

II. Materials and methods

Study design was Cross-sectional study design. Data was collected from cardiology ward of Niazi Medical complex, Niazi Tower Hospital, Nazi Welfare Trust hospital and Niazi VIP hospital, Sargodha. The study was completed within 6 months duration after approval of synopsis. Sampling technique was non-probability convenience sampling. Total sample size was 556. (13) Males=278 & Females=278. **Inclusion Criteria:** Both males and females, Subjects of age between 35 and 60 years, Subjects with mild to moderate congestive heart failure & Patient must be reported stable for at least past six months (14) **Exclusion Criteria:** Patients having decompensated heart failure, Patients having severe limitations of physical activity & Patients with psychiatric disorders.(15) **6-minute walk test:** This test was performed following American thoracic society (ATS) guidelines. Place 2 cones in a hall way of 30m and ask the patient to walk across these cones for the 6 minutes as fast as and try to complete the 6 min time duration. Distance walked measured and recorded for data analysis. (16) After approval from the university ethical committee Riphah, patients were approached and selected depending on inclusion criterion. 6-minute walk test was performed by all participants after taking basic history. Data was analyzed by using SPSS 25. All qualitative data including gender was presented in the form of frequency and quantitative data like age was presented in the form of mean \pm S.D. Normative values like age, gender,height, heart rate, blood pressure, oxygen saturation etc and their relation with 6-minute walk test was presented by pearson correlation.

III. Results:

Mean age of our male participants was 41.31 years with SD for male gender is 4.2 while mean age of our female participants was 41.53 years with standard deviation of 4.3. Mostly 14% (n=39) male participants were 47 years old. 10.1% (n=28) were 39 years old. This showed a trend of congestive heart failure among males which is after 38 years of age. SD for height among male participants showed above is 1.6 while for female participants is 1.55. 37.1 % (n=103) male having 147-meter height and 27.3% (n=76) male have 145-meter height. 16.5% (n=46) have 144-meter height and only 0.7% (n=02) has 150-meter height. Mean heart rate for male patients showed above 88.7 and SD 6.5. While mean heart rate for female patients showed above 89.68 and SD 6.8. 23.4% (n=65) male patients having 85 b/m, 19.1% (n=53) patients having 100 b/m, 17.3% (n=48) patients were having 90 b/m while only 4.7% (n=13) were having 79 b/m. 21.9% (n=61) female patients having 100 b/m, 20.1% (n=56) patients having 85 b/m, 19.4% (n=54) patients were having 90 b/m while only 1.1% (n=3) were having 97 b/m. Mean blood pressure for male patients showed above 2.5 and SD 0.94. While mean blood pressure for female patients showed above 2.6 and 1.1. 36% (n=100) male patients were having blood pressure withing 150/110 mmHg, 31.7% (n=88) patients were having blood pressure within 160/120mmHg, only 14.4% (n=40) patients were having blood pressure within 140/100mmHg. 31.7% (n=88) female patients were having blood pressure within 170/120 mmHg, 24.5% (n=68) patients were having blood pressure within 160/120mmHg, while 21.9% (n=61) patients were having blood pressure within 140/100mmHg and 150/110mmHg. Mean oxygen saturation for male patients showed

above 94.47 and SD 1.12. While mean oxygen saturation for female patients showed above 94.52 and SD 1.13. 26.6% (n=74) male patients were having 94 oxygen saturation level, equal number of patients 25.2% (n=70) having 93 and 95 oxygen saturation level, while only 1.4% (n=4) were having 97 oxygen saturation. 27.3% (n=76) female patients were having 94 oxygen saturation level, equal number of patients 23.4% (n=65) having 93 and 96 oxygen saturation level, while only 1.8% (n=5) were having 97 oxygen saturation. Mean 6MWD for male patients showed above 312.4 and SD 24.9. While mean 6MWD for female patients showed above 312.4 and SD 23.86. 2.5% (n=7) walked distance of 250m, 0.4% (n=1) walked distance of 252m, 24.1% (n=76) walked distance of 290m, 31.1% (n=87) walked distance of 300m, 22.7% (n=63) walked distance of 330m, and 19.1% (n=53) walked distance of 350m. 350m is maximum distance walked and 250m is minimum distance walked. 28.8% (n=80) walked distance of 290m, 35.6% (n=99) walked distance of 300m, 12.2% (n=34) walked distance of 330m, and 23.4% (n=65) walked distance of 350m. 350m is maximum distance walked and 290m is minimum distance walked. Among males 6-minute walk test have no significant correlation with age, height, blood pressure, oxygen saturation and heart rate. Oxygen saturation has no significant correlation with age, height, blood pressure, oxygen saturation and heart rate.

IV. Discussion

This study was a cross-sectional study to determine the normative values of 6-minute walk test among congestive heart failure patients. It was with 556 total participants with mild to moderate

congestive heart failure. Equal distribution of participants was done based on gender; 278 male and 278 females. After taking basic medical history, age, gender, weight, height and BMI was recorded. Patient must be stable from last 6 months were guided the procedure and performed 6-min walk test, distance covered in 6-min was noted. Pearson correlation was done to find relation between 6-min walk distance and age, weight, height or BMI.

In present study among female congestive heart failure patients' height and heart rate have height significant (0.05) correlation with 6-min walk test values. While height and blood pressure also have significant (0.01) correlation with oxygen saturation. Cohort study was done for 5 years among the patients of heart failure due to left ventricular systolic failure and baseline assessment was done. Median 6MWD distance found was 300m was predictor of all-cause mortality. Independent variables of all cause of mortality were increasing age, increasing NYHA classification; decreasing diastolic BP and increasing urea were independent of 6MWT distance covered.(17) A study concluded impaired exercise capacity among heart failure patients have cardiac and non-cardiac causes. They found inverse correlation between 6-min walk test distance and duration of heart failure.(18) In heart failure outpatients 6-min walk test is univariate predictor of all causes of mortality and hospitalization. 6-min walk test indicted demographic and clinical covariance.(19) Main findings of this study were among female participants congestive heart failure patients' height and heart rate have height significant ($P<0.05$) correlation with 6-min walk test values. While among male participants 6-minute

walk test have no significant ($P > 0.05$) correlation with age, height, blood pressure, oxygen saturation and heart rate. Oxygen saturation have no significant correlation with age, height, blood pressure, oxygen saturation and heart rate. Weakened exercise ability cause unfavorable clinical result and they furthered showed that an assortment of boundaries, both cardiovascular and noncardiac, affect 6-MWD.(20)

V. Conclusion

Independent variables age, height, heart rate, blood pressure and oxygen saturation were independent of 6-min walk test distance among male CHF patients while height and heart rate were dependent of 6-min walk test distance among female CHF patients.

Table 1: Mean and SD of Age among participants:

Age in Years		
Male	Mean	41.3129
	Std. Deviation	4.24680
Female	Mean	41.5396
	Std. Deviation	4.34648

Table 2: 6-minute walk test SD and mean

6 Minute Walk Test		
Male	Mean	312.4892
	Std. Deviation	24.94336
Female	Mean	312.4820
	Std. Deviation	23.86692

Table 3: Pearson correlation of variables among male patients.

Gender	Variables		Age In Years	Height (M)	Heart Rate	Blood Pressure
Males	oxygen saturation	Pearson Correlation	-.012	-.009	.016	-.042
		Sig. (2-tailed)	.839	.879	.791	.491
	6-minute walk test	Pearson Correlation	.020	.085	-.058	-.014
		Sig. (2-tailed)	.734	.156	.336	.815

Table 4: Pearson correlation of variables among female patients:

Gender	Variables		Age In Years	Height (M)	Heart Rate	Blood Pressure
Female	oxygen saturation	Pearson Correlation	.080	.141*	.029	-.144*
		Sig. (2-tailed)	.181	.018	.633	.017
	6-minute walk test	Pearson Correlation	.045	-.443**	.226**	-.021
		Sig. (2-tailed)	.460	.000	.000	.731

References

1. Scott MC, Winters ME. Congestive heart failure. Emergency Medicine Clinics. 2015;33(3):553-62.
2. Gedela M, Khan M, Jonsson O. Heart Failure. South Dakota medicine : the journal of the South Dakota State

- Medical Association. 2015;68(9):403-5, 7-9.
3. Kurmani S, Squire I. Acute Heart Failure: Definition, Classification and Epidemiology. *Current heart failure reports*. 2017;14(5):385-92.
 4. Gore S, Swami SY. Hypertrophic cardiomyopathy. *Medical Journal of Dr DY Patil Vidyapeeth*. 2022;15(1):113.
 5. Dokainish H, Teo K, Zhu J, Roy A, AlHabib KF, ElSayed A, et al. Global mortality variations in patients with heart failure: results from the International Congestive Heart Failure (INTER-CHF) prospective cohort study. *The Lancet Global Health*. 2017;5(7):e665-e72.
 6. Cosma A-S, Bănescu C, Mocan S, Balla B, Negovan A. Congestive Heart Failure and Upper Digestive Endoscopic Lesions. *Acta Marisiensis-Seria Medica*. 2019;65(1):19-24.
 7. Lam CS, Teng T-HK, Tay WT, Anand I, Zhang S, Shimizu W, et al. Regional and ethnic differences among patients with heart failure in Asia: the Asian sudden cardiac death in heart failure registry. *European heart journal*. 2016;37(41):3141-53.
 8. Dokainish H, Teo K, Zhu J, Roy A, AlHabib KF, ElSayed A, et al. Global mortality variations in patients with heart failure: results from the International Congestive Heart Failure (INTER-CHF) prospective cohort study. *The Lancet Global Health*. 2017;5(7):e665-e72.
 9. Dokainish H, Teo K, Zhu J, Roy A, AlHabib KF, ElSayed A, et al. Heart failure in Africa, Asia, the Middle East and South America: the INTER-CHF study. *International journal of cardiology*. 2016;204:133-41.
 10. Ajayi AA, Sofowora GG, Ladipo GO. Explaining Heart Failure Hyper-mortality in Sub Saharan Africa: Global Genomic and Environmental Contribution Review. *Journal of the National Medical Association*. 2020;112(2):141-57.
 11. Harikrishnan S, Sanjay G, Anees T, Viswanathan S, Vijayaraghavan G, Bahuleyan CG, et al. Clinical presentation, management, in-hospital and 90-day outcomes of heart failure patients in Trivandrum, Kerala, India: the Trivandrum Heart Failure Registry. *European journal of heart failure*. 2015;17(8):794-800.
 12. Arrigo M, Parissis JT, Akiyama E, Mebazaa A. Understanding acute heart failure: pathophysiology and diagnosis. *European Heart Journal Supplements*. 2016;18(suppl_G):G11-G8.
 13. Mearns BM. The 6-min walk test is useful for assessing prognosis in stable, ambulatory patients. *Nature Reviews Cardiology*. 2012;9(8):432-.
 14. Du H, Wonggom P, Tongpeth J, Clark RA. Six-minute walk test for assessing physical functional capacity in chronic heart failure. *Current heart failure reports*. 2017;14(3):158-66.
 15. Jones S, Tillin T, Williams S, Coady E, Chaturvedi N, Hughes AD. Assessment of exercise capacity and oxygen consumption using a 6 min stepper test in older adults. *Frontiers in physiology*. 2017;8:408.
 16. Jakobsen TL, Kehlet H, Bandholm T. Reliability of the 6-min walk test after total knee arthroplasty. *Knee Surgery, Sports Traumatology, Arthroscopy*. 2013;21(11):2625-8.
 17. Ingle L, Cleland JG, Clark AL. The long-term prognostic significance of 6-minute walk test distance in patients with chronic heart failure. *BioMed Research International*. 2014;2014.
 18. Zotter-Tufaro C, Mascherbauer J, Duca F, Koell B, Aschauer S, Kammerlander AA, et al. Prognostic significance and determinants of the 6-

min walk test in patients with heart failure and preserved ejection fraction. *JACC: Heart Failure*. 2015;3(6):459-66.

19. Forman DE, Fleg JL, Kitzman DW, Brawner CA, Swank AM, McKelvie RS, et al. 6-min walk test provides prognostic utility comparable to cardiopulmonary exercise testing in ambulatory outpatients with systolic heart failure. *Journal of the American*

College of Cardiology. 2012;60(25):2653-61.

20. Ponikowski P, Van Veldhuisen DJ, Comin-Colet J, Ertl G, Komajda M, Mareev V, et al. Beneficial effects of long-term intravenous iron therapy with ferric carboxymaltose in patients with symptomatic heart failure and iron deficiency. *European heart journal*. 2015;36(11):657-68.