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REFERENCE VALUE OF 6 MINUTE WALK DISTANCE IN PATIENTS WITH CHRONIC STROKE

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ABSTRACT

BACKGROUND: The 6-minute walk test (6MWT) has strong-to-moderate evidence to assess changes in walking distance for adults with neurologic conditions undergoing rehabilitation. However, the reference value of 6MWT distance according to walking ability in chronic stroke patients in the rehabilitation unit has not been presented. Stroke rehabilitation programs aim to improve walking ability by targeting factors, such as walking velocity, walking endurance, cardiovascular fitness, and balance. Six-minute walk test (6MWT) measures the distance that a subject can quickly walk on a flat and hard surface in a period of 6 min.

OBJECTIVE: To find the reference value of 6 min walk distance depending on the walking ability as measured by functional ambulation category in patients with chronic stroke.

METHODS: This cross-sectional observational study included 100 chronic stroke patients. 6MWT was used to assess the walking ability. Walking ability was classified using the Functional Ambulation Category (FAC). Reference value of 6MWT distance was presented for each walking ability according to FAC score. The statistical analysis of the data will be done through means [standard deviations].

RESULT: Reference value of 6MWD in chronic stroke patients is 212.41 m. 6MWT distances for each walking ability were as follows: FAC 3 was 147 m, FAC 4 was 234.83 m, and FAC 5 was 287.66 m. CONCLUSION: 6MWT distance was found to be longer with better walking ability. A distance of 212.41 m during 6MWT might be useful for setting the target value for the higher level of walking ability.

KEYWORDS: 6-minute walk test, cutoff value, reference value, rehabilitation; stroke, walking independence

INTRODUCTION

Stroke is defined by WHO as “rapidly developing clinical signs of focal or global disturbances of cerebral function, with symptoms lasting more than 24 hours or leading to death with no apparent non-vascular cause”. It is an acute onset of neurological dysfunction due to an abnormality in cerebral circulation with resultant signs and symptoms that correspond to involvement of focal areas of brain.[1]

Stroke is a global health problem and is a leading cause of adult disability of 35 million deaths attributable to chronic non communicable diseases that occurred worldwide. In 2016, the Global Burden of Disease project estimated the number of incident cases of Stroke in India to be 1,175,778. In a recent systematic review, consisting mainly of cross-sectional studies, the incidence of stroke in India was estimated to between 105 and 152/100,000 people per year.[2]
This prompted the World Health Organization (WHO) to launch the Global Stroke Initiative aimed to generate population- based data on burden of stroke and to use such data to evolve strategies for prevention and management.[3]

Stroke is a leading cause of serious long-term disability. Walking dysfunction occurs in more than 80% of stroke survivors. Despite of rehabilitation efforts, 25% of all stroke survivors have residual gait impairments that require full physical assistance before hospital discharge. Consequently, gait impairments cause difficulties in performing activities of daily living and mobility. Gait abnormality is characterized by a pronounced clinical presentation of gait asymmetry, as compared to healthy people.[4]

Stroke survivors usually have decreased stance phase and prolonged swing phase of the paretic side. Further, the walking speed is decreased and the stride length is shorter. These gait abnormalities along with muscle weakness place stroke survivors at a high risk of falls. Falls usually occur during walking in community-dwelling stroke survivors. Thus, improving walking safety and speed is the major goal for stroke survivors to prevent falls and to improve quality of life. [5]

Patients with chronic stroke exhibit extremely reduced ambulatory activity and cardiovascular fitness. This is a concern, as cardiovascular fitness can predict functional recovery in patients with chronic stroke. [6]

Stroke rehabilitation programs therefore often aim to improve walking ability by targeting factors such as walking velocity, cardiovascular fitness, and balance. For these programs to be effective, an accurate and reliable means of assessing walking capacity in these patients is needed. [9]

The 6-minute walk test (6MWT) is a measurement tool used to assess walking capacity in a clinical environment. Six-minute walk test (6MWT) measures the distance that a subject can quickly walk on a flat and hard surface in a period of 6 min and is a practical and simple assessment method that do not require exercise equipment or advanced training for technicians. This test is widely used to assess aspects of walking endurance in patients with stroke and is the strongest individual predictor of community-walking activity in these patients. Safety and feasibility of 6MWT were reported for acute stroke patients, and this test has the test–retest reliability and validity with other measures of walking ability and functional independence measure (FIM) in patients with stroke. [10]

In 2002, the American Thoracic Society (ATS) published guidelines for the 6MWT with the objective of standardizing the protocol to encourage further application of the 6MWT and allow direct comparisons among different studies and populations.[10]
The ATS guidelines include test indications and contraindications, safety measures, and a step-by-step protocol and provide assistance with clinical interpretation. Key components of the protocol include the test location, walkway length, measurements, and instructions.
According to the ATS protocol, the test should be performed on a flat, enclosed (indoor) walkway 30 m in length. This protocol requires 180º turns at either end of the walkway and additional space for turning is required.[10]

The guidelines advise that shorter walkway lengths require more directional changes and can reduce the distances achieved. It is likely that the influence of directional changes may be amplified in the stroke population, who characteristically have impaired balance, asymmetrical gait patterns, and altered responses for turn preparation. Conversely, reducing the number of directional changes may increase the distance achieved.
Thus, the reference value of 6MWT according to walking ability is needed to meet the goal setting for patients with stroke who have various motor function levels.

The Functional Ambulation Category (FAC) score distinguishes six levels of walking ability based on the amount of physical support required, which can be divided into walking independence and non-independence. Its score is a quick visual measurement of walking, simple to use, easy to interpret, and cost-effective; thus, it may be an easy

way to classify the walking ability for clinicians. [11]

Presenting a reference value of 6MWT according to the FAC may allow the determination of the superiority or inferiority of the walking ability of patients with stroke, and it may be used for setting the target value for the higher level of walking ability. [11]

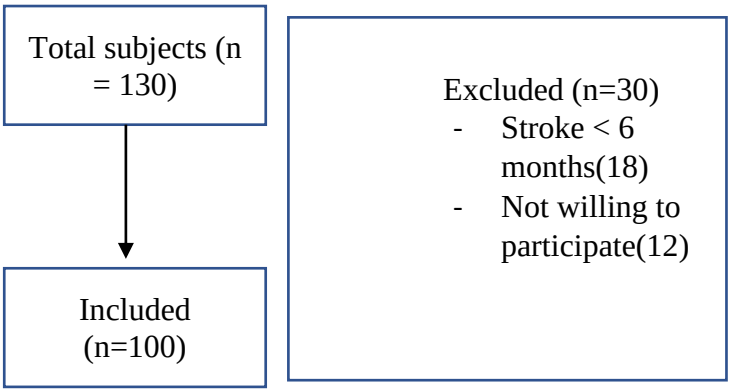
NEED OF THE STUDY

Ambulation is major concern of stroke survivors. There is insufficient literature in an Indian setting with the 6 MWD in patients with chronic stroke faced by walking dysfunction. We wanted to find their 6-minute walking distance of chronic stroke patients and also find 6-minute walking distance according to functional ambulation category in chronic stroke patients have taken the physiotherapy or not. Presenting a reference value of 6 MWD according to the FAC may allow the determination of the superiority or inferiority of the walking ability of patients with stroke and it may be used for setting the target value for the higher level of walking ability.

METHODOLOGY

The patients diagnosed with stroke in various institutions and rehabilitation centers across Gujarat were reviewed and those who met the indian criteria were requested to participate in the study. The informed consent form was filled by the patients or care givers.

The brief assessment was taken which includes the demographic data, type of stroke, severity of stroke, duration of stroke. Inclusion criteria required patients who are able to walk alone, may need intermittent or light touch to assist balance and coordination, have experienced a stroke more than 6 months, and be between the ages of 35 and 75 years. Exclusion criteria were as follows: pre-morbid modified Rankin Scale score >2; a history of severe musculoskeletal, cardiopulmonary, or psychiatric disease that can inhibit measurements; inability to provide consent owing to loss of consciousness, aphasia, dementia, or non cooperation; needs continuous assistance during walk (Functional Ambulation Category (FAC) <3.



Permission for pursuing the research problem was taken from the human resources and ethics committee of Shree B. G. Patel college of Physiotherapy, Anand on 12/09/2023. Participants were selected based on the eligibility criteria. Complete explanation of the study process was given to all the participants and an informed consent form was signed by them for publishing their information. They were informed that participation was completely voluntary without positive or negative consequences. They were also informed about confidentiality of the data and that their identities would remain anonymous in the article and data would not be shared with any third party. The 6MWT according to the American Thoracic Society (ATS) guidelines was used to evaluate the walking endurance by a physical therapist. A 30-m indoor walkway was used to conduct the test according to the ATS guidelines. The patient should sit at rest in a chair, located near the starting position for at least 5 min before the test. Patients were then instructed to walk from the starting line to the end of the walkway as many times as they could within 6 min. Patients were allowed to use their usual assistive devices, and intermittent assistance for fall prevention was provided as necessary. During the test, patients are permitted to slow down, to stop, and to rest by leaning against the wall while resting as necessary, but they resumed walking as soon as they could. Feedback was given as follows. After the first minute, the subject was told the following (in even tones): “You are doing well. You have 5 min to go.” When the timer showed 2 min, the subject was told “You are doing well. You have 4 min to go.” When the timer showed 3 min, the subject was told “You are doing well. You are halfway done.” When the timer showed 4 min, the subject was told “You are doing well. You have only 2 min left.” When the timer showed 5 min, the subject was told “You are doing well. You have only 1 min to go.” When the timer showed 5 min and 50 s, the subject was told

"You have only 10 s to go." The maximal distance covered at the end of the 6MWT was recorded.

Classify the walking ability Functional ambulation category

Patients were classified by walking ability using FAC at stroke by physical therapist. The FAC has excellent reliability, good concurrent and predictive validity, and good responsiveness in patients with hemiparesis after stroke. FAC has six levels (0 to 5) that are classified according to the walking ability on the basis of the amount of physical support required, which are as follows: nonfunctional ambulatory (FAC 0); ambulatory [level II], continuous manual contact to support body weight as well as to maintain balance or to assist coordination (FAC 1); ambulatory [level I], intermittent or continuous light touch to assist balance or coordination (FAC 2); ambulatory, dependent on supervision (FAC 3); ambulatory, independent, level surface only (FAC 4); and ambulatory, independent (FAC 5). Statistical analysis Descriptive statistics are presented as numbers (percentages) and means [standard deviations (SD)]. The reference value of 6MWT distance was presented for each walking ability according to the FAC score. First, one-way analysis of variance was computed to investigate the difference between 6MWT distance and walking ability measured by FAC.

RESULTS

CHARACTERISTICS	
Number of subject (n)	100
Age (years) mean & SD	55.37 (±7.14)
Duration	25 months

	Mean	Std. Deviation
6 M W D	**220**	**64.70**

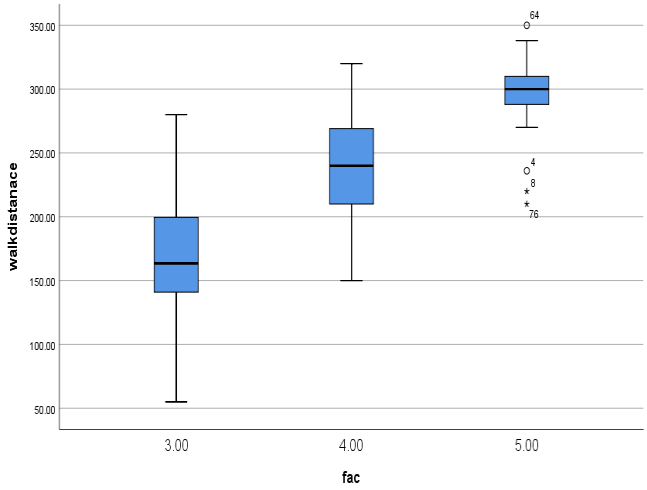
Table 1: The reference value of 6-minute walking distance.

6MWD was 220 m (SD, 64.70 m) in chronic stroke.

	FAC 3 Mean (Std. Deviation)	FAC 4 Mean (Std. Deviation)	FAC 5 Mean (Std. Deviation)
6 MWD	170.6 (45.6)	238.8 (45.07)	293 (34.7)

Table 2: The reference value of 6MWT according to walking ability. FAC; Functional Ambulation Category; 6MWT, six-minute walking test.

6MWT distance in chronic stroke according functional ambulation category; FAC 3 was 170.6 m (SD, 45.6 m); FAC 4 was 238.8 m (SD, 45.07 m); and FAC 5 was 293 m (SD, 34.7 m).



Statistical analysis was done using SPSS version 25 for windows software. Descriptive statistics are presented as means [standard deviations (SD)]. The reference value of 6MWT distance was presented for each walking ability according to the FAC score. First, one-way analysis of variance was computed to investigate the difference between 6MWT distance and walking ability measured by FAC.

This study was to find the 6-minute walking distance of chronic stroke patients and also find the 6 MWD according to functional ambulation category. Ambulation is a major concern of stroke survivors. 6 MWT is now in widespread use to assess aspects of walking-related performance in stroke survivor studies. Walking endurance as measured by the 6MWT was the strongest individual predictor of community walking activity. A previous study reported the reference value of 6MWD according to walking ability in sub-acute stroke was presented. The average distance of 6MWT was 300.1 m (SD, 166.0 m) in sub-acute stroke. 6MWT distance in sub-acute stroke was found to be longer with better walking ability ($p < .001$), which showed in the following values: FAC 2 was 141.8 m (SD, 107.3 m); FAC 3 was 224.5 m (SD, 105.8 m); FAC 4 was 352.6 m (SD, 92.8 m); and FAC 5 was 448.8 m (SD, 147.1 m). so this study found patients with a moderate to high walking ability.

In terms of the clinical implications of our study, the reference value according to FAC may be useful as a target value and for judging the walking independence in patients with stroke in the rehabilitation unit. For the chronic stroke patients, the lower-extremity motor subscale score of FMA of ≥21 could indicate a high level of mobility function and walking speed of >0.66 m/s could determine community ambulation. Combining the results of our findings with those of other motor performance tests may help to facilitate early walking independence and smooth prediction of functional prediction.

The distance walked on the 6MWT had the strongest direct association with community-walking activity and the level of community integration in community dwelling stroke survivors. Thus, it may be important to support the improvement in walking ability and determine walking independence using 6MWT in the rehabilitation units to promote community activity

A systematic review with meta-analysis has shown that stroke survivors walked on average of 284 ± 107 m during the 6MWT. However, it is highly likely that 6MWT distance will be affected by the stroke severity.

The reference value of 6MWT according to walking ability is needed to meet the goal setting for patients with stroke who have various motor function levels.

CONCLUSION

A study establishes the target reference values for 6 MWT distance for stroke patients. This value can prove to be an effective means to categorize stroke patients in clinical scenario, and can help as a good prognostic indicator for walking ability as well.

LIMITATION OF THE STUDY

This study excluded the patients with non-independent premorbid activity of daily living or with a history of severe disease to inhibit measurement. Therefore, our results are not applicable to these patients.

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