

## Co-relation of Gait speed and length of hospital stay by preoperative 10meter walk test in patients after open heart surgery

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### Abstract

**Background:** Coronary artery disease (CAD) is the principal cause of disability and death the world over and is one of the top five causes of death in Indian population. The purpose of this study was to determine if preoperative gait speed over 10 meter is a predictor of total hospital length of stay (LOS) after open heart surgery. This would help hospitals to arrange financially and proactively plan to manage risk for complications related to increased LOS. Walking speed is a prime aspect of gait and is commonly used as a goal to measure functional mobility in both clinical and research settings. Gait speed is an easy-to-determine, valid, and reliable assessment that has been frequently mentioned as a useful clinical indicator of an individual's function, disability, and performance of activities of daily living.

**Material and Methodology:** Subjects elected for open heart surgery (n=30) were selected for this study. Total 30 subjects were selected with age group 40-79 years based on inclusion and exclusion criteria with their consent were selected in this study. 10-MWT was performed to evaluate the gait speed as part of a routine pre-operative screening for open heart surgery. Data was analysed using Persons correlation of mean trial speed vs hospital stay.

**Result:** Correlation analyses revealed a very strong positive relationship between trial 1, trial 2, trial 3 and mean duration with length of hospital stay ( $p < 0.001$ ). It revealed a very strong negative relationship between speed and length of hospital stay ( $p < 0.001$ ). So, it indicates that as speed increases, length of hospital stay decreases.

**Conclusion:** According to the result, our study proves the alternate hypothesis. A significant relationship exists between a slower preoperative gait speed and an increased hospital LOS; however, this relationship is small as gait speed is only one of the several factors influencing LOS. A preoperative 10MWT may be useful to predict which patients are more likely to have an increased hospital LOS after cardiac surgery. However, external factors may impact a patient's LOS.

**Keywords:** gait speed, coronary artery bypass graft, length of stay

### Introduction

Coronary artery disease (CAD) is the principal cause of disability and death the world over and is one of the commonest causes of death in Indian population. <sup>[1]</sup> In Western populations only twenty-three percent of CVD deaths occur before the age of seventy years; in India, this number is fifty-two percent <sup>[2]</sup>.

The World Health Organization (WHO) has calculated that, with the current burden of CVD, India would lose dollars two thirty-seven billion from the loss of productivity and spending on health care over a ten-year period (2005–2015). <sup>[3]</sup>

Reasons for the high propensity to develop CVD, the high case fatality, and the high premature mortality include biological mechanisms, social determinants, and their interactions. Addressing this tremendous burden requires an understanding of both the biological and social determinants, and the complex dynamics underlying their interaction, as well <sup>[4]</sup>.

Open Heart Surgery, was defined by the National Institute of Health (NIH) as "any kind of surgery in which a specialist makes a large incision in the chest to open the rib cage and operate on the heart <sup>[5]</sup>. Over the years, refinement of surgical and anaesthetic procedures has led to significant reduction in mortality and morbidity. Over the period of years, there is reduction in mortality and morbidity rate due to advancement in surgical and anaesthetic procedure <sup>[6]</sup>.

- Types of Open heart surgeries:

#### 1. Cardiopulmonary bypass graft

For management of CAD in India CABG is the commonest surgical method. <sup>[6]</sup> Functioning of the heart and lungs are temporarily replaced by heart lung machine which act as pump and oxygenator to the body. About 50 to 60% of CABG procedures are done on beating heart and 40 to 50% done on on-pump. Currently approximately 1, 40,000 CABG procedures are done annually <sup>[7]</sup>.

#### 2. Valve replacement surgery

The replacement of one or more of the valves with an artificial heart valve, mechanical or biological is called Valve Replacement Surgery. Indications- mitral stenosis, mitral regurgitation, aortic stenosis, aortic regurgitation <sup>[8]</sup>. The mean hospital LOS after CABG surgery is 9.4(7.2) days, with a median hospitalization of 7 days <sup>[9]</sup>. Providing health care professionals with a method to predict hospital LOS after open heart surgery would help in determining patient outcomes and risk stratification and allow for better discharge planning after open heart surgery <sup>[5]</sup>.

Recently, walking speed has displayed as a indicator for future morbidity and mortality <sup>[10-11]</sup>. The most common methods of gait speed analysis include the 6-Minute Walk Test, <sup>[12-13]</sup>. the Timed Up and Go Test, <sup>[13-14]</sup> and the 10-

Meter Walk Test (10MWT) [15], each test evaluate different aspect of gait. Gait speed is an easy-to-determine, valid, and reliable assessment that has been frequently mentioned as a useful clinical marker of a person's function, disability, and performance of activities of daily living [16].

Normative values have been referenced for gait speed for different conditions, diagnoses, sex, and age groups across the population. Average self-selected gait speeds for healthy subjects aged sixty years or older have ranged from 0.60 to 1.45 meter/second [17]. Self-selected gait speeds for community-dwelling older adults have been cited to be between 0.99 to 1.6 meter/second [18-19]. A person walking at a self-selected gait speed of less than 0.25 meter/second is most likely to be reliant on more than one daily physical functions [20].

10 meter walk test is a performance measure used to assess walking speed in meters per second over short distance. 10 meter walk test is recommended to be used to obtain the most valid clinical assessment [15]. It requires 10-meter path that includes 2 meter of acceleration and 2 meter of deceleration. It can be used to assess functional mobility, gait and vestibular function.

There are studies being performed conversing the reliability explicitly for 10 meter walk test (10MWT) [21]. Similar to 10MWT, Green *et al* performed a 15 foot walk test with 102 patients with severe aortic stenosis and found a strong association between gait speed and dependent functional status and further suggested that evaluation of gait speed is a helpful marker in risk stratification [16]. The 10MWT has not been previously evaluated as a predictive tool for determining hospital or ICU LOS; however, increased morbidity and surgical complications are likely precursors to a longer hospital stay or delayed discharge.

Aim: To find the co-relation of gait speed and length of hospital stay by preoperative 10MWT in patients before open heart surgery.

### Objectives

- To determine the preoperative gait speed over 10 meter walk test.
- To evaluate the correlation of length of hospital stay (LOS) or intensive care unit (ICU) length of stay after open heart surgery. (approved by cardiac surgeon)

### Material and Methodology

An Ethical approval was taken by the ethical committee of the institution before undertaking the study and a written consent was taken from the subjects explaining the entire procedure of the study before recruiting them in the study.

Study design: Observational study.

Sample size: A total of 30 subjects were recruited in this study.

### Inclusion Criteria

- Patients planned for Open Heart Surgeries:
  - CABG surgery,
  - Valve replacement surgery,
  - Valve repair, by median sternotomy.
- Age group: 40-79.
- Patient able to walk with or without assistive device.
- NYHA-Class I & II.
- The Canadian Cardiovascular Society Angina Scale-Grade I&II.

### Exclusion Criteria

- Cardiac instability determined by the surgeon.
- Patients refused to participate in research.
- Any musculoskeletal condition of lower limb or neurological condition.
- (Pre) Syncope.
- Impaired exercise tolerance.

### Procedure

- Informed consent for participation of subjects in the study was obtained.
- Demographic data was taken and complete assessment was done.
- The patient was accompanied to the designated area, which was well-lit, unobstructed and contain clearly indicated markings at 0 and 10meter.
- The walking course was of 10meter in length with 2 cones placed at start and end point.
- 2 meter was provided for acceleration and deceleration.
- The patient was positioned with his/her feet behind and just touching the 0-m start line
- Subject was instructed to walk at their comfortable and usual pace.



Fig 1

- Simultaneously walking time was measured with a stopwatch.
- Subject begin each trial on the word "Go".
- The timer was started with the "first foot-fall" after the 0-m line and it was stopped with the "first foot-fall" after the 10-m line.
- Three trials were conducted and mean speed was calculated.

### Note

The patients may use walking aid (cane, walker).

If the patient is receiving an IV drip, he/she can perform the test without the IV only if it can be interrupted temporarily without any potential risk to the patient.

If not, then the patient can perform the test pushing the IV pole.

**Statistical Analysis**

Data analysis was performed with Software SPSS version 20.0. Pearson’s correlation test was done to correlate between gait speed and length of hospital stay of patient undergoing open heart surgery.

**Result**

**Table 1:** Correlation between trials, mean duration and speed with length of hospital stay of subjects with open heart surgery

Correlation of	Length of hospital Stay	p value
Trial 1	0.88	<0.001
Trial 2	0.85	<0.001
Trial 3	0.83	<0.001
Mean duration	0.87	<0.001
Speed	-0.87	<0.001

**Table 2:** Correlation between trials, mean duration and speed with length of hospital stay of male subjects with open heart surgery

Correlation of	Length of hospital Stay	p value
Trial 1	0.86	<0.001
Trial 2	0.81	<0.001
Trial 3	0.81	<0.001
Mean duration	0.84	<0.001
Speed	-0.85	<0.001

**Table 3:** Correlation between trials, mean duration and speed with length of hospital stay of female subjects with open heart surgery

Correlation of	Length of hospital Stay	p value
Trial 1	0.89	<0.001
Trial 2	0.94	<0.001
Trial 3	0.91	<0.001
Mean duration	0.95	<0.001
Speed	-0.9	<0.001

**Table 4:** Correlation between trials, mean duration and speed with length of hospital stay of subjects of 40-50 years with open heart surgery

Correlation of	Length of hospital Stay	p value
Trial 1	0.92	<0.001
Trial 2	0.92	<0.001
Trial 3	0.95	<0.001
Mean duration	0.97	<0.001
Speed	-0.91	<0.001

**Table 5:** Correlation between trials, mean duration and speed with length of hospital stay of subjects of 51-60 years with open heart surgery

Correlation of	Length of hospital Stay	p value
Trial 1	0.87	<0.001
Trial 2	0.84	<0.001
Trial 3	0.82	<0.001
Mean duration	0.86	<0.001
Speed	-0.89	<0.001

**Table 6:** Correlation between trials, mean duration and speed with length of hospital stay of subjects of 61-70 years with open heart surgery

Correlation of	Length of hospital Stay	p value
Trial 1	0.97	0.03
Trial 2	0.95	0.05
Trial 3	0.95	0.04
Mean duration	0.96	0.03
Speed	-0.88	0.11

Table 3: Correlation analyses revealed a very strong positive relationship between trial 1, trial 2, trial 3 and mean duration with length of hospital stay (p<0.001). It revealed a very strong negative relationship between speed and length of hospital stay (p<0.001). So, it indicates that as speed increases, length of hospital stay decreases.

Table 4: Correlation analyses revealed a very strong positive relationship between trial 1, trial 2, trial 3 and mean duration with length of hospital stay (p<0.001). It revealed a very strong negative relationship between speed and length of hospital stay (p<0.001). So, it indicates that as speed increases, length of hospital stay decreases.

Table 5: Correlation analyses revealed a very strong positive relationship between trial 1, trial 2, trial 3 and mean duration with length of hospital stay (p<0.001). It revealed a very strong negative relationship between speed and length of hospital stay (p<0.001). So, it indicates that as speed increases, length of hospital stay decreases.

Table 6: Correlation analyses revealed a very strong positive relationship between trial 1, trial 2, trial 3 and mean duration with length of hospital stay (p<0.001). It revealed a very strong negative relationship between speed and length of hospital stay (p<0.001). So, it indicates that as speed increases, length of hospital stay decreases.

Table 7: Correlation analyses revealed a very strong positive relationship between trial 1, trial 2, trial 3 and mean duration with length of hospital stay (p<0.001). It revealed a very strong negative relationship between speed and length of hospital stay (p<0.001). So, it indicates that as speed increases, length of hospital stay decreases.

Table 8: Correlation analyses revealed a very strong positive relationship between trial 1, trial 2, trial 3 and mean duration with length of hospital stay (p<0.001).

**Discussion**

We found statistically significant correlation of slower gait speed as measured by a 10 MWT and a increased hospital LOS after open heart surgery. Also, the patients having a total hospital LOS of greater than 7 days were more likely to have a slower gait speed trail averages.

Implementing the utilization of the 10MWT as a preoperative screening tool in the cardiac population might be a valuable tool for distinguishing patients at patients at high risk for a longer hospital LOS. Subsequently, this data might be valuable to get upon admission, to help with preoperative procedural planning, patient education, intensity of postsurgical care, discharge planning, dosage and intensity of rehabilitation services, and equipment procurement.

The 10MWT appears to have several potential clinical advantages over other means of gait speed assessments for this patient population. The 10MWT has the potential to be more clinically valuable in the presence of chronic disease or disability due to a limited distance requirement and reduced exertion. Wilson *et al* found that utilization of the 5MWT as a preoperative screening tool for patients awaiting open heart surgery resulted in a statistically significant increase in gait speed from the first 5MWT trial to the third trial, although the authors noted that this increase in average gait speed from trial 1 to 3 was 0.05 (0.08) m/s and did not appear to be clinically significant.

The 10MWT is a clinically relevant instrument to use in a hospital setting as it only requires a standardized stop watch and cones to clearly mark a 10-m distance. This can easily

be performed in a hallway or bedside in a patient room. Likewise, there can be different factors adding to increased LOS in cardiac patient. Correlation analyses revealed a very strong positive relationship between trial 1, trial 2, trial 3 and mean duration with length of hospital stay. It revealed a very strong negative relationship between speed and length of hospital stay ( $p < 0.001$ ). So, it indicates that as speed increases, length of hospital stay decreases.

Other factors that may be of value to consider include preoperative education, patient financial status, family support, health insurance provider, motivation of patient, and severity of cardiac disease. As LOS is a multifactorial and clinically complex phenomenon, this initial study focused on evaluating the relationship between LOS and gait speed. Therefore, Statistically significant correlation was noted between these variables in this study.

### Conclusion

In analysis of 10MWT outcome before open heart surgery, slower average gait speeds correlated with an increased hospital LOS ( $P < 0.001$ ). Patients who had a hospital LOS 7 days were significantly more likely to display slower gait speed trail averages. This data may assist clinicians in planning for postoperative care. The 10MWT may be the tool of choice because it is time efficient, requires few resources, and is easily applied to patients with variable functional limitations in a hospital setting. There may likewise other variables adding to total hospital postoperative LOS such as family support, preoperative education, culture, socioeconomic status, internal motivation of patient, financial support, and health literacy, which should be examined in future studies. This study concluded that, pre-operative 10 meter walk test can be used as predictor of length of hospital stay after open heart surgery.

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