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Prevalence Of Cardiorespiratory Impairment In Post Stroke Survivors

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ABSTRACT

Background: Stroke, caused by a blockage or rupture in brain vessels, results in sudden brain dysfunction and is a leading cause of long-term disability. Reduced activity following a stroke decreases cardiorespiratory fitness (CRF), impairs mobility, and increases the risk of future strokes and heart problems. All strokes, including ischemic and haemorrhages, raise vascular risk. Managing blood pressure, obesity, smoking, and glucose is critical for recovery and prevention.

Methods: This study is observational, and was conducted on sixty four people suffering from cardiorespiratory impairment in post stroke. A questionnaire was provided to the participants. the result were analysed according to the interpretation of questionnaire.

Result: A simple random survey of 64 post-stroke survivors revealed that 71.8% had signs of cardiorespiratory impairment, indicating a significant concern in this population.

Conclusion: Cardiorespiratory impairment is a common concern among post-stroke survivors, resulting in reduced function, a lower quality of life, and an increased risk of recurring heart problems. Based on this, 64 participants with such impairments were evaluated using a questionnaire.

Keywords: *Cardiorespiratory impairment, Stroke, Transient ischemic attack, Post stroke survivors, cardiorespiratory fitness.*

1. INTRODUCTION

A stroke is an abrupt interruption of blood flow to the brain, resulting in a decline in brain function. This interruption can be the result of either a blockage in an artery that supplies blood to the brain, commonly referred to as an ischemic stroke, or the result of a blood vessel rupture within the brain, referred to as a haemorrhagic stroke.[1] Stroke survivors are frequently deconditioned and predisposed to a sedentary lifestyle, which impairs performance in daily activities, increases the risk of falling, and may contribute to an increased risk of recurrent stroke and other cardiovascular disease. The majority of studies have focused on ischemic stroke, though the term "stroke" is frequently used to refer to a ischemic stroke, or intracerebral haemorrhage. All of these categories pose an increased risk for a future vascular event, but this risk is further elevated in patients with cerebrovascular disease and comorbid CVD.[2]

Stroke is a significant global health concern, according to the Global Burden of Disease (GBD) 2021 study. It ranks as the third leading cause of combined death and disability (more than 160 million DALYs) and the second leading cause of death (roughly 7 million). Stroke cases rise by 70%, deaths by 44%, and DALYs by 32% between 1990 and 2021. The majority of the burden (more than 87% of deaths and 89% of DALYs) occurred in low- and middle-income countries.[3] In 2021, there were 11.9 million new cases of stroke and 93.8 million stroke survivors. The study revealed regional and economic disparities, with rising rates of stroke in Oceania, East Asia, and Southeast Asia, particularly among those under 60 and in lower SDI countries. Intracerebral hemorrhage accounted for 28.8% of cases, subarachnoid hemorrhage for 5.8%, and ischemic stroke for 65.3% of cases (more in high-income countries). Males made up 52.6% of new stroke cases, while females made up 47.4%.[4] In India, there were 1,175,778 stroke incident cases in 2016. According to a recent systematic review that mostly included cross-sectional studies, the annual incidence of stroke in India is estimated to be between 105 to 152/100,000 people.[5] Cardiorespiratory impairment is a significant concern among post-stroke survivors, affecting their rehabilitation outcomes and long-term health. Studies estimate that up to 75% of stroke survivors experience reduced cardiorespiratory fitness (CRF), as measured by parameters like peak oxygen uptake (VO_2 max) and walking tests. These

impairments arise due to physical inactivity, muscle deconditioning, and neuromuscular deficits. Prolonged immobility exacerbates cardiovascular health decline, further limiting physical activity and independence.[6] Reduced lean tissue, particularly in larger leg muscles, has a negative impact on VO2 and cardiorespiratory fitness.[7] Secondary conditions, including muscle physiology and inflammation [8], impaired hemodynamic response [9], altered metabolic health [10], and. respiratory dysfunctions, can negatively impact the outcome, daily activities and physical performance.[11] Cardiovascular risk factors are hypertension, obesity, smoking, glucose metabolism.[12] Cardiorespiratory impairment post-stroke is multifactorial. Central factors include autonomic nervous system dysfunction and impaired central respiratory drive, while peripheral components involve muscle atrophy, especially of respiratory muscles, and diminished vascular reactivity. Stroke survivors typically present with a peak oxygen uptake (VO_2 peak) 40–60% lower than that of age-matched sedentary individuals.[13] Studies show that approximately 70–80% of stroke survivors exhibit reduced aerobic capacity within the first 3 months post-stroke. Respiratory muscle weakness, particularly involving the diaphragm and accessory muscles, has been reported in up to 50% of cases . Dyspnoea, exercise intolerance, and increase fatigability are common features. A cross-sectional study by Smith et al. (2019) found that 76% of chronic stroke patients had impaired pulmonary function tests, with significant reductions in forced vital capacity and forced volume in 1 second compared to normative values. Moreover, autonomic dysregulation, as evidenced by altered heart rate variability, is frequently observed and contributes to poor cardiovascular conditioning.[14]

Cardiorespiratory impairment significantly limits physical endurance and the capacity to engage in effective rehabilitation. This can delay recovery of functional independence and is immobility and prolonged hospitalization exacerbates the decline in cardiorespiratory fitness.[15] Physiotherapists play a critical role in the early identification and management of cardiorespiratory impairments post-stroke. A systematic review by Saunders et al. (2016) supports the efficacy of moderate-intensity aerobic exercise in improving VO_2 peak and walking speed in stroke survivors. Early mobilization and tailored exercise programs improve not only cardiovascular health but also reduce hospital stay and re-admission rates [16]

AIM:

To study the prevalence of cardiorespiratory impairment in post stroke survivors.

OBJECTIVE:

The primary objective of this study is to evaluate the prevalence of cardiorespiratory impairment in individuals who have survived stroke, by identifying the extent and frequency of cardiovascular and respiratory dysfunctions in this population. The secondary objective of this study is to assess the types and severity of cardiovascular and respiratory impairments in post-stroke survivors by examining how these impairments relate to functional mobility and exercise tolerance.

NEED FOR STUDY :

Cardiorespiratory impairment is a serious but often overlooked problem among stroke survivors, resulting in decreased functional capacity, poor rehabilitation outcomes, and an increased risk of secondary complications like respiratory dysfunctions, and deconditioning. Stroke-related factors, such as impaired respiratory muscle function, decreased aerobic capacity exacerbate these problems. Despite of its clinical significance, there are very few researches available on the prevalence of cardiorespiratory impairments in this population. A study focusing on this prevalence is crucial for determining the scope of the problem, preventing complications, and ultimately improving quality of life and long-term outcomes of stroke survivors.

2. METHOD

Ethical Considerations

The present study is a Survey study carried out in Krishna Hospital, Karad from January 2025 and June 2025 after obtaining permission from the ethical committee of Krishna Vishwa Vidyapeeth (deemed to be university), Karad.

Research approach: Survey study. Sampling: Simple random sampling. Study setting: Cardiorespiratory Physiotherapy department, Krishna Hospital, Karad. Sample size: 64.

Study duration: 6 months

Sample size: 64

The minimum members required for the study is calculated as follows:

FORMULA: $N = \frac{Z^2 . p . q}{L^2}$

Where :

n = required sample size

Z = standard normal deviate (typically 1.96 for 95% confidence)

p = estimated prevalence (in decimal)

q = 1-p

L = allowable error (in decimal, often taken as 5% or 0.05)

So, a prevalence (p) of 50%, 95% confidence level (Z = 1.96), and an allowable error (L) of 12.25%, the calculated sample size was 64.

$$N = \frac{(1.96)^2 .(0.5).(0.5)}{(0.1225)^2} = 64$$

INCLUSION CRITERIA:

1. Adults aged 40–60 years. 2. Clinically diagnosed with stroke. 3. Post-stroke survivors who are medically stable and able to participate in physiotherapy assessment. 4. Capable enough to answer the questionnaire

EXCLUSION CRITERIA:

1. Individuals with pre-existing severe cardiopulmonary diseases unrelated to stroke 2. Patients who had recent surgery. 3. Orthopaedic or neurological conditions limiting exercise participation. 4. Unwillingness to provide informed consent.

ETHICAL COMMITTEE APPROVAL:

The study was approved by the institutional ethical committee of Krishna Vishwa Vidyapeeth (deemed to be a university) in Karad ethical committee certificate no. (424/2024-2025). Respondents were given an explanation of the study and forms, and they provided informed consent. All respondents volunteered to participate, and their confidentiality was maintained throughout the study.

QUESTINNAIRE:

This questionnaire incorporates questions regarding, Symptoms (Category 1), Health status (Category 2) and Quality of life (Category 3). The overall questionnaire score was determined, from the responses to the 3 categories. scores from the first and second categories were positive if the responses indicated symptoms and health status, if there was symptoms regarding cardiorespiratory impairment the third category score was positive. If a patient met two or more criteria, they were classified as high risk for cardiorespiratory impairment; if not, they were considered to be at moderate risk.

Questionnaire scoring

Scoring Questions: Any answer within the box outline is a positive response

Scoring Categories:

Category 1 is positive with 3 or more positive responses to questions 1-7

Category 2 is positive with 2 or more positive responses to questions 8-11

Category 3 is positive with 2 or more positive responses to questions 12-15

PROCEDURE:

This study was conducted at the OPD of Krishna College of Physiotherapy, KVV, Karad. Permission was obtained from the Institutional Ethics Committee of Krishna Vishwa Vidyapeeth, Karad. A sample size of 64 was calculated. The subjects were selected according to the inclusion and exclusion criteria. Patients with the age of 40-60 years, who were clinically diagnosed with stroke, capable enough to answer the questionnaire, and willing to provide consent were included. Patients with pre-existing cardiorespiratory disorders not related to stroke, cognitive impairments interfering with communication, or those unwilling to provide consent were excluded. The nature of the study was explained to the subjects and written consent were obtained. Participants were educated about secondary consequences they may face post stroke such as decreased functional capacity and the respiratory symptoms. Questionnaire was provided to each participant. The study findings were interpreted based on the questionnaire responses. The collected data was subsequently analysed and results were calculated to determine the prevalence of cardiorespiratory impairment among post-stroke survivors.

3. RESULTS

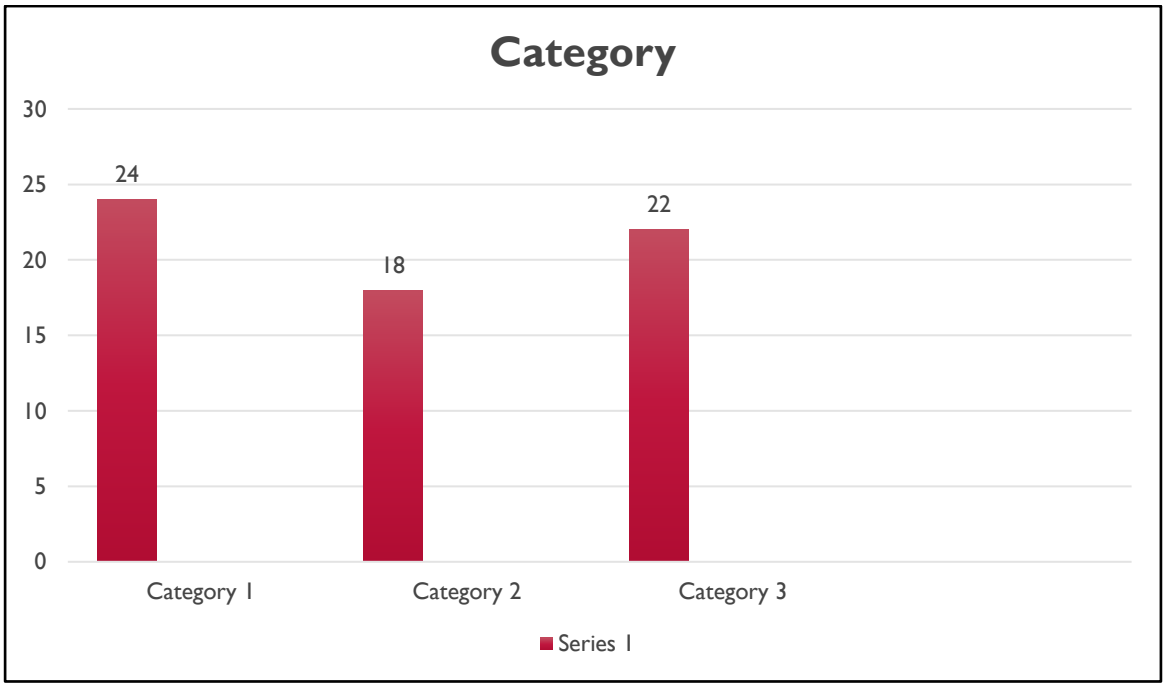
64 participants who participated in the simple random survey, of the post stroke survivors. They answered a questionnaire. The participants should be post stroke survivors and having evidence of reduced cardiorespiratory impairment (e.g. breathing issues, reduced exercise capacity). The prevalence of the suggestive diagnosis of risk of cardiorespiratory impairment among post stroke survivors was 71.8%. These findings indicate that the risk of cardiorespiratory impairment is the important factor among post stroke survivors.

Scoring Categories:

Category 1 is positive with 3 or more positive response to question 1-7 = 24 participants are positive

Category 2 is positive with 2 or more positive response to question 8-11 = 18 participants are positive

Category 3 is positive with 2 or more positive response to question 12-15 = 22 participants are positive



GRAPH FIGURE 1: Scoring Categories

Of 64 participants,

24 (37.5%) had a positive response in category 1 of the questionnaire

18 (28.1%) had a positive response in category 2 of the questionnaire

22 (34.3%) had a positive response in category 3 of the questionnaire.

INTERPRETATION:

2 or more positive categories indicated a high risk of cardiorespiratory impairment. A questionnaire consisting of questions about participants health status and symptoms was used. This questionnaire consisted of 15 questions. The questions were explained to the participants before the filling of the questionnaire was carried out. The form was filling by participants and a consent form signature was taken. The study took place after approval was taken from the Institutional ethical committee of Krishna Vishwa Vidyapeeth "Deemed To Be University"

4. DISCUSSION

Stroke is an abrupt interruption of blood flow to the brain, which causes a decline in brain function. This interruption can be caused by either a blockage in an artery that supplies blood to the brain, known as an ischemic stroke, or a rupture of a blood vessel within the brain, known as a haemorrhagic stroke.[1] Cardiorespiratory impairment in post-stroke survivors is a complex problem with significant clinical and social consequences. It is a common and clinically significant complication in post-stroke patients, contributing to reduced functional capacity, limited mobility, and poor rehabilitation outcomes.

According to our findings, cardiovascular dysfunction was prevalent among stroke survivors. A lot of participants showed symptoms like abnormal blood pressure responses, decreased heart rate variability, and elevated resting heart rate. These results closely match those of Wang et al. (2015), who discovered that autonomic nervous system imbalance is frequently the result of stroke. In terms of respiratory dysfunction, our study found that a significant percentage of participants had diminished pulmonary function, especially when measured by maximal expiratory pressure (MEP), forced vital capacity (FVC), and maximal inspiratory pressure (MIP). These findings are consistent with those of Britto et al. (2011) and Mazzù et al. (2018), who found that respiratory muscle weakness is common among chronic stroke survivors and is frequently brought on by poor postural control and decreased thoracic mobility. Our findings corroborate those of previous studies by

Ivey et al. (2006) and Billinger et al. (2012), which highlighted the substantial cardiovascular deconditioning that occurs in stroke survivors, primarily as a result of decreased mobility, muscle atrophy, and physical inactivity. These factors raise the risk of recurrent stroke and cardiac events by exacerbating autonomic imbalance and decreasing cardiovascular efficiency during rehabilitation. Our results strongly support the need for early cardiovascular screening following a stroke. Michael et al. (2005) proposed similar recommendations in their guidelines, recommending routine cardiovascular risk assessment in stroke rehabilitation settings. Despite this, such screening is frequently disregarded, especially in outpatient or low-resource settings where neuromotor recovery is still the primary focus.

Interestingly, the people with the lower functional mobility scores were those who had both respiratory and cardiovascular impairments. Physical limitations are exacerbated and functional independence is delayed when these dysfunctions co-occur. Dual-system impairments increase ADL dependency, institutionalization risk, and stroke survivors' quality of life, according to Smith et al. (2012). Our results support this, indicating that more thorough and customized rehabilitation programs are needed for patients with higher cardiorespiratory burden. During low-intensity physical tasks, we found that people with more severe respiratory muscle weakness also showed lower exercise tolerance and higher perceived exertion. This corroborates the findings of Mazzù et al. (2018), who discovered that, particularly in patients with stroke affecting the trunk and diaphragm function, inspiratory muscle dysfunction was strongly associated with decreased endurance and compromised pulmonary mechanics. Our findings are consistent with those of Michael et al. (2005), who showed that stroke patients who have both cardiovascular and respiratory dysfunctions are more likely to have early fatigue, exercise intolerance, and more limitations on their participation, all of which affect their quality of life and increase their long-term healthcare use. These impairments can lead to increased dependency, reduced participation in daily activities. Despite its prevalence, cardiorespiratory dysfunction is often under-assessed in conventional stroke rehabilitation. Physiotherapists, as integral members of the multidisciplinary healthcare team, are well-positioned to implement evidence-based interventions such as aerobic exercise, respiratory muscle training, and chest physiotherapy to improve cardiovascular and pulmonary outcomes. Addressing these impairments through comprehensive rehabilitation strategies is essential for optimizing patient recovery, promoting functional independence, and enhancing long-term health and quality of life among stroke survivors. The study was conducted to determine the prevalence of cardiorespiratory impairment in post-stroke survivor.

Among stroke survivors, cardiorespiratory impairment is a common and clinically significant complication that lowers physical performance, limits mobility, and results in worse rehabilitation. The high prevalence and severity of respiratory and cardiovascular dysfunctions in this population are highlighted in this study, along with their close correlation with reduced functional mobility and quality of life. In routine stroke rehabilitation, these impairments are frequently under-assessed despite their impact. Optimizing recovery requires early detection and focused physiotherapy interventions, such as chest physiotherapy, respiratory muscle strengthening, and aerobic training. Cardiorespiratory evaluation can be incorporated into post-stroke care to improve overall quality of life, decrease long-term disability, and increase functional independence.

5. CONCLUSION

The study's findings show that cardiorespiratory impairment is not only common, but also a significant clinical concern in people recovering from stroke. These impairments contribute significantly to a decline in overall physical functioning, limiting survivors' ability to perform daily tasks and maintain independence. Furthermore, having cardiorespiratory issues is strongly associated with a lower quality of life and an increased risk of developing additional cardiovascular complications, such as recurrent stroke events and cardiac episodes. These findings highlight the critical need for comprehensive rehabilitation programs that include both cardiovascular and respiratory conditioning. Early detection, continuous monitoring, and personalized intervention strategies are critical for reducing the impact of cardiorespiratory dysfunction, improving recovery outcomes, and promoting long-term health and well-being in stroke survivors.

6. LIMITATIONS & RECOMMENDATIONS

One of the study's many drawbacks is its small sample size, which could restrict how accurately and broadly the result can be obtained. Longitudinal designs with bigger, more varied samples from several centres should be used in future research. Use of objective instruments such as spirometry is recommended. Deeper insights can be gained by stratifying data by type and severity of stroke, and the results should guide focused rehabilitation initiatives.

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