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Influence of Vascular Territory and Socioeconomic Status on Barriers in Physical Activity Using the Barriers to Physical Activity After Stroke Scale (BAPAS) in 40-60 Years of Stroke Patients: A Cross Sectional Study

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ABSTRACT

The impairments caused by MCA, PCA and ACA involvement may be different but its effect on activities of daily living and on functional capacity of the patients is same, because while performing any activity or function the coordination of the entire body plays an important role.
Also, even though patients with low socioeconomic status face various physical, financial problems which may intensify stroke factors like severity, mortality, recurrence or increase hospital stay and lack proper healthcare facilities; personal motivators like family support can prove beneficial for stroke recovery.
The barriers to physical activities can be divided into personal and environmental barriers.
The study was conducted to analyse influence of vascular territory and socioeconomic status on barriers in physical activity in stroke patients.
Subjects were selected based on inclusion and exclusion criteria.
Subjects were assessed using Barriers to Physical Activity Scale (BAPAS) and Modified Kuppuswamy scale was used to assess socioeconomic status.
Scores were noted for the BAPAS scale.
Data analysis was done using Kruskal Wallis test by using SPSS software.
The results stated that there was no difference between the vascular territory and socioeconomic status on barriers to physical activity.
Thus, this study concluded that there was no correlation between vascular territory and barriers to physical activity or between socioeconomic status and barriers to physical activity.

Key words: Stroke, vascular territory, socioeconomic status, barriers to physical activity

INTRODUCTION

Stroke is an episode of acute neurological dysfunction presumed to be caused by ischemia or haemorrhage, persisting ≥24 hours or until death.(1) Ischemic stroke is caused by focal cerebral infarction in a defined vascular distribution. Haemorrhagic stroke occurs either due to intracerebral collection of blood or bleeding into the subarachnoid space. (1)

The currently recognized causes for ischemic stroke are embolism, decreased perfusion and thrombosis. Large arteries commonly affected by atherosclerotic plaque lesions are carotid, middle cerebral, vertebral and basilar arteries. Stenosis in these arteries when more than 70% is

associated with increased risk of distal brain infarction. Occlusion or embolism can lead to thrombosis in heart and blood vessels. Antiphospholipid antibodies present in thrombosis is associated with an increased risk for incidence and recurrence of cerebral ischemia.(2)

Clinically the most common characteristics of ACA involvement includes contralateral hemiparesis and sensory loss with greater involvement of the lower extremity (LE) than the upper extremity (UE) because the somatotopic organization of the medial aspect of the cortex includes the functional area for the LE. If corpus callosum gets involved then problems with imitation, bimanual tasks are seen along with apraxia. The clinical manifestation of middle cerebral artery involvement are contralateral spastic hemiparesis and sensory loss of the face, UE, and LE, with the face and UE more involved than the LE. Lesions of the parieto-occipital cortex of the dominant hemisphere typically produce aphasia which can be nonfluent, fluent or nonfluent with poor comprehension due to involvement of Broca's area, Wernicke's area or superior temporal gyrus respectively. Lesions of the right parietal lobe of the nondominant hemisphere typically produce perceptual deficits. When occlusion occurs proximal to the posterior communicating artery it typically results in minimal deficits owing to the collateral blood supply from the posterior communicating artery. Occlusion of thalamic branches may produce hemianesthesia or central post-stroke thalamic pain. Occipital infarction produces homonymous hemianopsia, visual agnosia, prosopagnosia, or cortical blindness if bilateral involvement is present. Temporal lobe ischemia results in amnesia. Contralateral hemiplegia occurs with involvement of the cerebral peduncle.(3)

MCA stroke is the most common type of stroke contributing to 50.8% of all stroke cases. PCA and ACA strokes are 7% and 5% respectively. Considering disability of stroke on admission to rehabilitation, MCA strokes are more severe than ACA and PCA. The FIM efficiency is lowest for MCA stroke and highest for cerebellar stroke which indicates that retraining or learning compensatory techniques may take longer which can be frustrating and hinder learning. In ACA strokes there is lower proportion of home discharges which can be due to cognitive and behavioural impairments seen in this type of stroke.(4)

Low socioeconomic status is generally associated with an increased risk of stroke in ischaemic stroke than in patients with haemorrhagic stroke and more in women than men, increased risk of in-hospital or short-term mortality, more severe stroke and poorer functional status up to 1 year after stroke, inadequate access to health care.

Low socioeconomic status in childhood is associated with stroke in adulthood.(5) Stroke patients comprising of low income groups are found to show less improvement in ADLs, gross function, leg and trunk performance and arm performance.(6) Modified Kuppuswamy's SES Scale is the most widely used scale for determining the socio-economic status of an individual or a family in urban areas.(7)

After stroke, physical activity (8)(9) and physical fitness (10) are low. Daily physical activity in chronic stroke patients leads to improvement in the motor function, ADLs, and decreases symptoms of depression which contributes to increase in health related quality of life.(11)In motor impairments, balance contributes maximum to the ability to perform ADLs whereas the least contribution is that of cognitive impairment. Upper limb function and perceptual impairments moderately affect the ability to perform ADLs.(12)

The most commonly reported barriers to physical activity after stroke are either environmental barriers or personal barriers In 2019, a 14-item questionnaire (BAPAS) is developed to measure the perceived barriers to regular PA in stroke survivors which consists of 2 subscales which are behavioural barriers and physical barriers. The behavioural barriers are divided into: fatigue and mood; motivation whereas

physical barriers are divided into: locomotor problems; comorbidities. These items are calculated using 6-level Likert scale ranging from 0 to 5 which is from strongly disagree to strongly agree. The physical and behavioural subscales each score 35, and together the total score of the questionnaire is 70. Higher the score achieved on this questionnaire higher are the barriers to physical activity. In scale validation, the questionnaire has satisfactory face validity, very good internal consistency (α=0.86), a strong construct validity with high sampling adequacy (KMO=0.82) and a strong concurrent validity with the mRS (r=0.65). (13)

In stroke, involvement of a specific vascular territory has shown to produce different clinical presentation with respect to involvement of lower extremity, upper extremity or face; and also, sensory involvement aphasia, pain, perceptual disorder, amnesia and vision. In addition, there are differences seen in stroke severity, function independence, recovery and home discharges. This is seen because each artery supplies different regions of the cerebral hemisphere. Also, the extent of this supplies to the brain plays important role, for example MCA supplies most of the cerebral hemispheres it results in more stroke severity compared to other arteries. (4)

Patients belonging to lower socioeconomic groups suffer more in terms of stroke severity, increased risk of stroke, mortality, functional status, inadequate access to health care as compared to upper and middle socioeconomic group patients.(13)

So, as the factors influencing stroke are different for different vascular territories involvement, the barriers to physical activity may also differ. Similarly difference in socioeconomic status can affect factors like stroke recurrence, mortality, risk factors and stroke severity, especially in countries like India. This might lead to difference in the barriers to physical activity faced by different socioeconomic groups. Hence, the study is aimed at finding and correlating barriers which are specific to the site of involvement and socioeconomic status of the participants.

HYPOTHESIS

The vascular territory does not have influence on the barriers to physical activity.
The socioeconomic status does not have influence on barriers to physical activity.

AIM

To analyse influence of vascular territory and socioeconomic status on barriers in physical activity in stroke patients.

OBJECTIVES

- To assess socioeconomic status.
- To assess the barriers to physical activity using The Barriers to Physical Activity After Stroke Scale.
- To analyse relationship between vascular territory and barriers to physical activity.
- To analyse relationship between socioeconomic status and barriers to physical activity.

MATERIALS AND METHODOLOGY

- Study design – Cross sectional study
- Study setting - Community and hospital
- Population – Stroke patients with low-moderate disability (mRS 0-3)
- Study Duration – 1 year
- Method of selection – Purposive sampling
- **Inclusion criteria –**

- 40-60yrs
- Both genders
- Haemorrhagic and ischemic strokes
- MCA, PCA, ACA territory involvement
- Patients with low to moderate disability (mRS)
- Willing to participate in study.
- Able to read in English/Marathi
- Able to walk 10 meters with or without walking aid
- Participants who are under physiotherapy treatment
- Poststroke duration 6 months to 2 years

- **Exclusion criteria –**

- Severe orthopaedic condition like arthritis, deformities, recent fractures.
- Severe cardio respiratory conditions like recent myocardial infarction, severe dyspnoea.
- Cognitive impairment
- Perceptual impairment
- Incomprehensive patient
- Complete hearing or visual loss
- Other vascular territory involvement

- **Withdrawal criteria-**

- Patient not willing to disclose data after assessment scores.
- Wilful withdrawal during ongoing project

- **Material required –**

- Pen
- Record sheet paper
- Chair
- Scales- BAPAS questionnaire and Modified Kuppuswamy Scale.

- **Sample size**

It was calculated using the following formula-

$n=[Z\alpha + Z\beta/ C(r)] 2$

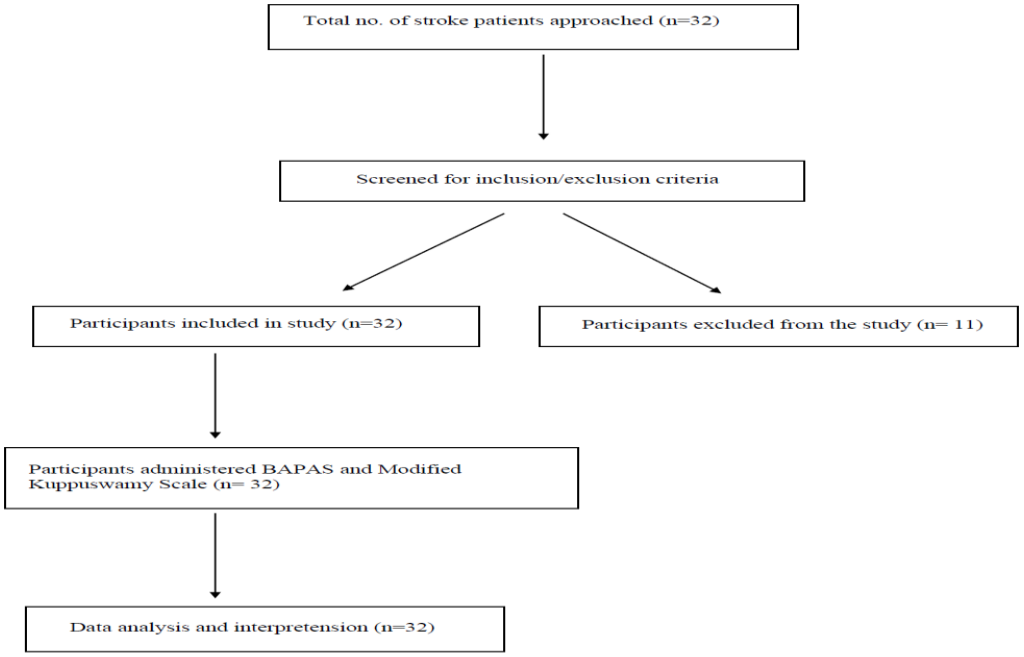
Power was 80% with significance level of 0.05

The sample size calculated was 32.

- **Research methodology specified and explained for data collection**

- The clearance from the institutional ethics committee was taken.
- The entire procedure was explained to the participants.
- The participants were screened according to inclusion and exclusion criteria.
- An informed written consent was taken from the participants.
- The region of affection i.e., vascular territory was noted with the use of medical reports.
- The socioeconomic status was measured using Modified Kuppuswamy scale.
- They were assessed for barriers in physical activity using BAPAS 14 item scale.
- The data related to vascular territory and barriers to physical activity was analysed.
- The data related to socioeconomic status and barriers to physical activity will be analysed.
- Conclusion are drawn from the analysed data.

FLOW CHART OF THE STUDY



RESULTS AND TABLES

Analysis was done using SPSS software by using Kruskal Wallis test. The obtained results after analysis are plotted in the form of tables and graphs which are as follows.

Table 1 Kruskal Wallis Test- Relationship Of Vascular Territory And Socioeconomic Status With Barriers To Physical Activity

Purpose	Kruskal Wallis significance value	P value	Interpretation
Analysis of relationship between socioeconomic status and barriers to physical activity	0.143	>0.05	Not significant
Analysis of relationship between vascular territory and barriers to physical activity	0.456	>0.05	Not significant

Table 2 And Graph 2

TABLE 2	
BAPAS SCORE DISTRIBUTION	
TOTAL SCORE	32
MINIMUM SCORE	12
MAXIMUM SCORE	63
MEAN	35.9
STANDARD DEVIATION	12.77

INFERENCE: The total score, minimum score, maximum score, mean and standard deviation for BAPAS score was 32, 12, 63, 35, 9, 12.77 respectively.

Table 3 And Graph 3

TABLE 3		
SOCIOECOMONIC STATUS DISTRIBUTION		
SOCIOECONOMIC STATUS	**NUMBER OF PARTICIPANTS**	**PERCENTAGE**
LOWER	7	21.87%
MIDDLE	21	65.62%
UPPER	4	12.5%

INFERENCE: 21.87% were lower socioeconomic status, 65.62% were middle socioeconomic status and 12.5% were upper socioeconomic status.

Table 4 And Graph 4

TABLE 4	
INDEPENDENT SAMPLE KRUSKAL WALLIS TEST FOR BAPAS SCORE AND SOCIOECONOMIC STATUS	
SOCIOECONOMIC STATUS	**INTERQUARTILE RANGE**
LOWER	37 – 43
MIDDLE	23.5 – 50
UPPER	22 - 31

INFERNCE: The interquartile ranges of the BAPAS scores for lower socioeconomic status for middle socioeconomic status and upper socioeconomic status are 37 – 43, 23.5 – 50, 22-31.

Table 5 And Graph 5

TABLE 5		
VASCULAR TERRITORY DISTRIBUTION		
VASCULAR TERRITORY	**NUMBER OF PARTICIPANTS**	**PERCENTAGE**
ACA	3	9.37
MCA	18	56.25
PCA	11	34.37

INFERENCE: 9.37% were ACA territory affection, 56.25 were MCA territory affection and 34.37% were PCA territory affection.

Table 6 And Graph 6

TABLE 6	
INDEPENDENT SAMPLE KRUSKAL WALLIS TEST FOR BAPAS SCORE AND VASCULAR TERRITORY	
VASCULAR TERRITORY	**INTERQUARTILE RANGE**
ACA	22 – 32.5
MCA	21.5 – 49
PCA	31 – 41

INFERNCE: The interquartile ranges of the BAPAS scores for ACA, MCA and PCA are 22 - 32.5, 21.5 – 49 and 31 – 41.

DISCUSSION

The current study evaluates the role played by different arteries i.e., vascular territories which are affected following an infarct or haemorrhage in stroke patients on physical and behavioural barriers faced while performing physical activity. Also, the relationship of low, middle and upper socioeconomic status group on physical and behavioural barriers faced while performing physical activity is studied. The measures used in the study for assessing socioeconomic status classifies participants in to different socioeconomic groups based on their education, occupation and monthly income.(14) The barriers to physical activities are assessed using a 6-point Likert scale which measures the extent of disagreement or agreement to a specific barrier faced by the participant.(13)

The result of this study stated that the barriers to the physical activity were same for all types of vascular territory involvement. The reason for this may be that even though the impairments are different in MCA, PCA and ACA involvement(11)the activity limitations and participation restrictions are almost same. It has been observed that stroke patients who were assessed for activity limitation using Barthel index showed almost same percentage of difficulty while doing activities like climbing stairs, toilet use, walking and feeding.(15)Now of these activities climbing stairs and walking involves more use of lower limbs as compared to feeding and toilet use where upper limb is involved. Hence, even though in ACA lower limbs are more involvement and in MCA upper limbs are more involved the activity limitation faced by patients remains the same.

In the same study, more than 50% of participants stated that while participating in functions like washing up, washing clothes, heavy household work, social occasions, travelling, gardening, house/car maintenance and reading they found difficulties.(16)If we consider the above functions, there has to be coordination of upper limb, lower limb, sensory input, vision and memory to perform the activities smoothly. Hence the participation restrictions are the same regardless of any particular area of affection like upper limb, lower limb, vision, sensations or memory. In a similar study where stroke patients were assessed for basics activities of daily living using Functional Independence Measure, majority of the participants required assistance in bathing, dressing and use of stairs, whereas in instrumental activities of

daily living maximum assistance was required in shopping, laundry, housekeeping and meal preparation.(17)

Also, in the study it was observed that there is no difference in the barriers to physical activities between the socioeconomic groups. Even though low socioeconomic group patients suffer in terms of accesses to health care and financial burden, they have a good family support in term of number of family members. In India, many people live in a joint family system where the parents, children including son and daughter-in-law reside in the same house. This ensures that every member of the family helps in caregiving to the stroke survivor which can be physical assistance, financial support, improving the environment and home chores.(18)Having joint family and good family support thus makes sure that the patient is well looked after and it proves to be a personal motivator for recovery.

Another finding in this study is that the BAPAS scores are highest for the lower socioeconomic status group as compared to upper socioeconomic status group. All the scores for lower socioeconomic group are $\geq$ 31, whereas all upper socioeconomic group scores are $\leq$ 34. It is stated that higher the number of barriers, higher is the BAPAS score(13). The reason for this can be that as the number of barriers are more for lower socioeconomic groups, the total score is higher and the modifications and adaptation can be afforded by upper socioeconomic

groups. In a study employment status and financial strain have been said to cause depression. (19)Unemployment is one of the many problems in lower income groups which leads to financial problems, this can cause psychological stress and lead to depression. Thus, the financial barriers lead to other barriers like depression, lack of motivation. Another study stated that income has effect on life satisfaction. (20) So, if a person is financially stable then he will have motivation to perform better in rehabilitation programs and recover well which will result in increase in life satisfaction thus reducing number of barriers to physical activity.

It was also seen in the study that the highest variation of BAPAS score was observed in MCA vascular territory affection compared to ACA or PCA affection. Middle cerebral artery supplies the frontal, parietal and temporal lobes.(21) If there is involvement of frontal lobe involvement the clinical presentation is contralateral hemiparesis of mainly upper extremity and face, nonfluent or motor aphasia, limb kinetic apraxia. Involvement of parietal lobe will cause contralateral hemisensory loss, fluent or sensory aphasia, perceptual deficits, sensory ataxia. If both frontal and parietal lobes are affected it will lead to global aphasia. (21)(3)Hence, as the MCA supplies large part of the cerebrum there is vast variety of clinical presentation depending on which area of the cerebrum is affected hence there may be more variations seen with respect to BAPAS scores. Least variation was seen in PCA involvement. Posterior cerebral artery supplies occipital lobes and medial and inferior temporal lobes which will cause visual impairments, memory impairments, dyslexia, agraphia, anomia. (3) Hence the severity of impairments is less in PCA involvement hence the variation in BAPAS scores may be also less.

The physical barriers assessed during this study were, presence of spasticity, paralysis, transportation, fear of fall, pain, comorbidies and speed of performing activities. Spasticity leads to abnormal resting position of the affected extremity, leading to formation of contractures and resulting in arrest of function and selfcare activities. Also, it causes inappropriate agonist antagonist coactivation causing abnormal normal movements of the affected extremity hampering daily function. (22)So, the contractures formed because of spasticity can lead to reduced range of motion available at a specific joint leading to activity limitations e.g.- If patient develops elbow flexion contracture the he/she may have difficulty in activities like grooming, bathing. Abnormal movements or synergies as a result of spasticity can lead to reduction in gait velocity. (23) This can lead to difficulties in activities like walking, transportation and cause participation restrictions.

Weakness or paresis in stroke can be because of loss or reduced firing rate of agonist motor units, inability to activate the motor units or adaptive changes in muscle following inactivity. (24) Weakness of knee extensors have been associated with alterations in gait speed. (25)(26) Also, weakness of plantar flexors causes impairments in functional mobility. (27) Isometric muscle strength of hemiparetic lower limb affects the standing performance (28)and stair climbing ability (29), transfers like sitting down on a mattress from a chair (30). Weakness of hand grip causes inability to perform hand function of the affected upper limb. (31) Hence weakness following stroke finally leads to limitations in performing activities of daily living and thus becomes a barrier to physical activity.

The risk of fall in stroke patients may be because of balance, cognitive impairments (28)and weakness. Patients with balance impairment show increased postural sway, altered weight distribution patterns, so that less weight is taken through the weak leg, and they have smaller excursions when moving their weight around the base of support, especially in the direction of the weaker leg. (32) These impairments lead to increase in the chance of a loss of balance and produces fear of falling thus hindering

physical activity. In terms of cognition, the most common impairments are of memory, orientation, language, and attention. Cognitive impairment is most commonly associated with infarcts in the left anterior and posterior cerebral artery territories. (24) This can be because anterior cerebral artery supplies frontal lobe and the prefrontal area is responsible for orientation, concentration and awareness. (21) If the inferomedial temporal lobes are involved which is supplied by posterior artery then memory is affected.(11)Cognitive dysfunction causes impairments in executive functions which are impulsiveness, inflexible thinking, lack of abstract thinking, impaired organization and sequencing, decreased insight, impaired planning ability and impaired judgement. (11) All these impairments may increase the risk of fall in stroke patients because they are unaware of the environment with respect to themselves.

Presence of comorbidities like hypertension, diabetes mellitus, hypercholesterolemia, atrial fibrillation, smoking, physical inactivity increases risk for stroke occurrence. (11)In patients with stroke, 73% have hypertension, 35% have diabetes mellitus, 51% have hyperlipidaemia, 30% are smokers, 12% have atrial fibrillation, 21% have coronary heart disease and 8% have congestive heart failure. (33)

The behavioural barriers assessed were, fear of another stroke, fatigue, depression, lack of motivation, lack of financial resources, lack of information from healthcare professionals. Depression is occurring in approximately 35% of stroke cases. (34) It is commonly seen with lesions to left frontal lobes. (35) The reason for this is the frontal lobe is responsible for depth of emotions.(21)There is an association present between depression and poor functional outcome measures. The reason for this can be that depressed patients are slower for seeking help for stroke and the longer it takes to get the proper treatment, poorer is the prognosis resulting in poor functional measures.(36)

Fatigue in stroke can be of physical and psychological nature. The neurological deficits can lead to physical fatigue whereas the attempt to mask or overcome these deficits can cause psychological stress leading to fatigue. (37)Stroke impairments like weakness, abnormal movement patterns, sensory, cognitive and balance problems may lead to increased effort and eventually cause fatigue.

Lack of financial resources may be a common barrier for patients with low socioeconomic status. (5) Finances are plays very important when it comes to getting proper medical attention on time, medicines required for recovery and good rehabilitation.

Hence, this study concludes that vascular territory does not influence the barriers to physical activity because the activity limitations and participation restrictions remain same for all types of strokes. Also, socioeconomic status does not influence the barriers to physical activity as even if the higher socioeconomic group are able to afford better treatments and modifications, the lower socioeconomic groups have greater family support.

CONCLUSION

Vascular territory does not influence barriers to physical activity in stroke patients.

Socioeconomic status does not influence barriers to physical activity in stroke patients.

Clinical Implication

Identifying barriers to physical activity will help improve the rehabilitation and improve the functional outcome and prognosis.

The participation in physical activities will increases if barriers like lack of motivation, depression are also addressed while rehabilitating the patient.

Limitations

Due to the ongoing pandemic, rehabilitation sessions for the stroke patients were

inconsistent which may have interfered with patient progress.

Stroke patients with severe disability were not assessed for barriers to physical activity.

Future Scope

Assessment of barriers to physical activity can be assessed pre and post intervention to see the effectiveness of the treatment.

Influence of other factors like age, gender can be checked on barriers to physical activity.

As a result of the ongoing pandemic patients are facing many physical, mental and financial difficulties, so barriers to physical activity can be reassessed to evaluate the effect of pandemic on barriers to physical activity

Conflict of Interest: None

Ethical Approval: Approved

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