



# “Prevalence Of Functional Scoliosis In Post Stroke Patients Using Adam's Forward Bending Test”

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**Abstract :** The spine's normal curve occur at the cervical, thoracic and lumbar regions. These natural curves position the head over the pelvis and work as shock absorbers to distribute mechanical stress during movement. CVA causes variety of focal deficits, such as paralysis (hemiplegia) or weakness (hemiparesis) on opposite the side of lesion. Pusher's syndrome characterized by active pushing with stronger extremities towards hemi paretic side. Patient experiences misperception of subjective postural vertical position, perceiving their body as vertical when it was actually tilted about 20° towards hemi paretic side. There are studies of prevalence of scoliosis in paediatric neurological conditions and NM diseases like CP, Spina bifida and DMD. Moreover it would be interesting to find prevalence of scoliosis in post stroke patients using Adams bending test which is a cost effective measure. The outcome will help estimate the risk factors and prevent scoliosis and its further complications to help patient lead a better quality of life due to early intervention and preventive measures.

## **Method :**

Ethical committee clearance obtained. Written consent which fulfil the inclusion Criteria will volunteer to participate in the study. Then berg balance scale is demonstrated on the patient and the score 45 and above are further instructed for Adams bending test along with demographic data. The patient takes off clothes so that spine is visible. The patient bends forward, starting at the waist until the back comes in the horizontal plane, feet together, arms hanging and the knees in extension. The palms are hold together. The examiner stands at the back of the patient and looks along the horizontal plane of the spine, searching for increased or decreased asymmetry of the trunk. The spine asymmetry is documented in assessment sheet.

**Results :** Among 30 subjects patients 7 were found to have structural scoliosis and 23 were observed to have functional scoliosis.

**Conclusion :** The study concludes that there is prevalence of functional scoliosis in post stroke patients using Adams forward bending test .

**Key words :** scoliosis, Adams bending test, stroke.

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## I.INTRODUCTION

Scoliosis is an abnormal lateral curvature of the spine.

The spine's normal curve occur at the cervical, thoracic and lumbar regions.

These natural curves position the head over the pelvis and work as shock absorbers to distribute mechanical stress during movement. Scoliosis is often defined as spinal curvature in the coronal plane.

While the degree of curvature is measured on the coronal plane, scoliosis is actually a more complex, three-dimensional problem which involves the following planes:

Sagittal plane ,Frontal plane<sup>(1)</sup>

Scoliosis can be classified by etiology: idiopathic, congenital or neuromuscular.

A. Idiopathic The diagnosis when all other causes are excluded and comprises about 80 percent of all cases.

1. Infantile scoliosis: Infantile scoliosis develops at the age of 0–3 years and shows a prevalence of 1 %.

2. Juvenile scoliosis: Juvenile scoliosis develops at the age of 4–10 years, comprises 10–15 % of all idiopathic scoliosis in children, untreated curves may cause serious cardiopulmonary complications, and curves of 30 and more tend to progress, 95 % of these patients need a surgical procedure.

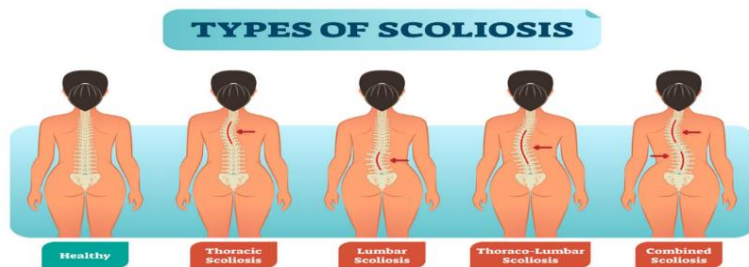
3. Adolescent scoliosis: Adolescent scoliosis develops at the age of 11–18 years, accounts for approximately 90 % of cases of idiopathic scoliosis in children.

B. Congenital scoliosis: Results from embryological malformation of one or more vertebrae.

C. Neuromuscular scoliosis Encompasses scoliosis that is secondary to neurological or muscular diseases. Includes scoliosis associated with cerebral palsy, spinal cord trauma, muscular dystrophy, spinal muscular atrophy and spina bifida. This type of scoliosis generally progresses more rapidly than idiopathic scoliosis and often requires surgical treatment. Injuries and infections to the spine can also contribute to the cause of scoliosis

The Adam forward bend test can be used to make a distinction between structural scoliosis and non-structural scoliosis of the cervical to lumbar spine. The test can be performed in the standing and sitting position.

The Adam's forward bend test has a sensitivity of 84.3%, the test has a specificity of 93.44%. These numbers are for a Cobb angle > 10°.



The Adam's forward bend test in patients with a scoliosis of 40°, has a sensitivity of 0.83 and a specificity of 0.99.<sup>(3)</sup>

Spasticity, muscle weakness, and incomplete muscle control contribute to impaired trunk control and the development of spinal deformity. Severe scoliosis may cause additional motor dysfunction, sitting and transfer problems, compromised pulmonary function, and pain with reduced quality of life<sup>(4)</sup>

According to the World Health Organisation, a Stroke is defined as an accident to the brain with rapidly developing clinical signs of focal or global disturbance to cerebral function, with symptoms lasting 24 hours or longer, or leading to death, with no apparent cause other than of vascular origin and includes cerebral infarction, intracerebral haemorrhage, and subarachnoid haemorrhage. 15% of acute strokes are haemorrhagic strokes which are caused by bursting of a blood vessel i.e. acute haemorrhage. There are two main types of haemorrhagic strokes, intracerebral haemorrhage (ICH) and subarachnoid haemorrhage which accounts for about 5% of all stroke<sup>(5)</sup>

According to the TOAST classification, there are four main types of ischemic strokes. These are:

1. large vessel atherosclerosis,
2. small vessel diseases (lacunar infarcts),
3. cardio embolic strokes and
4. cryptogenic strokes.<sup>(6)</sup>

Patients are to be assessed on the basis of following stages of recovery:

Stage1: Flaccidity.

Stage2: Spasticity Appears.

Stage3: Increased Spasticity.

Stage 4: Decreased Spasticity.

Stage 5: Spasticity Continues to Decrease.

Stage 6: Spasticity Disappears and Coordination Reappears.<sup>7</sup>

## II. METHODOLOGY

This observational study is conducted on 30 subjects at stroke rehabilitation centre, multispecialty hospital, physiotherapy clinics in PCMC and Pune for 6 months, Ethical committee clearance was obtained and permission was taken from the department. Written consent was taken from the subjects who fulfil the inclusion criteria and exclusion criteria. Data collection was done and statistical analysis and interpretation was done.



## II.A INCLUSION CRITERIA

- chronic stroke patient – stage 3 (Brunstrom stages of recovery) and above
- Berg balance score above – 41/56 (i.e. Patient is at low risk of fall)
- Both male and female patients.

## II.B EXCLUSION CRITERIA

- Congenital deformities of the foot and lower limb
- Lower limb fracture
- Limb length discrepancy
- Bilateral affection (weakness or paralysis)

## II.C OUTCOME MEASURES

- Adams forward bending test –
- the Adam's forward bend test has a sensitivity of 84.3%, The test has a specificity of 93.44%. These numbers are for a Cobb angle  $> 10^\circ$ .
- The Adam's forward bend test in patients with a scoliosis of  $40^\circ$ , has a sensitivity of 0.83 and a specificity of 0.99.

### III. STATISTICAL ANALYSIS :

Data was collected and analysed by appropriate statistical test.

### IV. RESULTS

- Graph 1 shows the number Of individuals who participated in the study. A total of 30 subjects participated with 26 males and 4females hence 83% are male and 17 % are female
- Graph 2 shows among the three main cerebral arteries 37% i.e middle cerebral artery was found to be involved in max population ,Pca – 27 % ,Aca –23% ,Other area of lesion – 13% was observed .
- Among all the participants 64 % individuals were having HTN and 20% were found to have DM. which are considered to be one of the important predisposing factors in stroke.
- Among all the participants 67% were observed to have impaired coordination and 33% were having intact coordination when coordination test were performed on UL and LL.
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### V.DISCUSSION

The study aimed to find prevalence of scoliosis in post stroke patients. Stroke is a neurological disorder characterized by blockage of blood vessels. The blood flow to the brain is carried out by two internal carotids anteriorly and two vertebral arteries posteriorly. Ischemic stroke is caused by deficiency of blood and oxygen supply to the brain; hemorrhagic stroke is caused by rupture /bleeding of blood vessels. It has been observed that afflicted patients actively push the body away with the unparalysed arm or leg to contralateral side, termed as pushers syndrome. Patients with pushers syndrome cannot correctly indicate their own body's upright against gravity.<sup>(09)</sup>

As discussed in the study held by marianne dieterich & Thomas brandt, they observed perception of verticality , which is based on integrative graviceptive canals & otolith organs(sacculus & utricle). In the study SVV(subjective visual vertical) was done and the results indicate acute unilateral vestibular dysfunctions ,the causative lesion of which extends from labyrinth to cortex. They allow precise topographical diagnosis of side & level in unilateral brainstem or peripheral vestibular disorders. svv tilts may coincide or differ from the perception of body vertical. Traditionally, PB has only been reported in stroke patients; however, it has also been described under non-stroke conditions. Previous imaging studies have suggested the posterolateral thalamus as the brain structure that is typically damaged in pusher patients. Nevertheless, other cortical and subcortical areas, such as the insular cortex and post-central gyrus, have also been highlighted as structures that are potentially involved in the pathophysiology of PB.<sup>(10)</sup>

However this continuous lateropulsion of body which has been observed in 30 patients for the study has lead to the devlopment of functional scoliosis ,As in flexor synergy pattern the unaffected side core stabilizers of trunk(transverse abdominis and multifidus,erector spinae most probably) go into shortening and begin to develop concavity on the same side, whereas the affected side muscles go into lengthened position and produce convexity in the spine curvatures. The scoliosis can be seen at lumbar, thoracic and thoracolumbar junction region.<sup>(10)</sup>

Hence, due to such muscle imbalance and prolonged abnormal posturing functional scoliosis is developed and lead to further compensatory changes. The scoliosis can be seen at lumbar, thoracic and thoracolumbar junction. It was also observed that MCA was most common pathologically affected blood vessel in the brain. As it is the largest terminating branch of internal carotid artery with the primary function of cortical branches of MCA is to supply brain parenchyma of primary motor & somatosensory cortical areas of the face, trunk and upperlimbs apart from the insular and auditory cortex. The small central branches give rise to the lenticulostriate vessels, which irrigate the basal ganglia and internal capsule. The superior division irrigates the lateral inferior frontal lobe, which involves the Broca area responsible for speech production, language comprehension, and writing. The inferior division of the MCA irrigates the superior temporal gyrus, which involves Wernicke's area responsible for speech comprehension and language development. Hence it is understood that MCA leads to the major defects involving several areas.<sup>(11)</sup>

In study conducted by Sigurd Berven, David S Bradford they have observed that Scoliosis is commonly associated with a variety of neuromuscular disorders including conditions affecting upper and lower motor neurons as well as myopathies.<sup>(12)</sup>

In the study Understanding and Treating “Pusher Syndrome” held by Hans-Otto Karnath et. al demonstrated that patients with pushers syndrome have a misperception of their upright body posture as most of them may also have visual proprioception and motor impairments which makes them difficult to perceive proper posture and balance.<sup>(14)</sup>

Also it was observed that there was resistance to passive correction of tilted posture as the non hemiparetic side push their weight towards hemiparetic side.

## VI. CONCLUSION

- The study concludes that there is prevalence of functional scoliosis in post stroke patients using Adams forward bending test .

## VII. LIMITATIONS

- The study was done only in a restricted geographical area.
- difficulty in finding bulk stroke patients.

## VIII. CLINICAL IMPLICATION

- Early identification, prevention and treatment strategies can be designed to reduce the risk of cardiovascular changes as eventually can lead to rotation and crowding of ribs which inturn will affect the lung expansion.
- The result of study can be used to plan a neuro rehabilitation towards correcting the posture and spinal changes.
- The results can be used as a basis for further interventional studies to prevent scoliosis in stroke patients.

## IX. FURTHER SCOPE OF STUDY

- On the basis of this study Degree of scoliosis, type or severity can be recognized.
- Stroke as well as head injury cases can be considered.

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