

# Role of Head Position in Stroke Outcome: An Observational Study from Tertiary Care Hospital in Pakistan

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## ABSTRACT

**Background and Aim:** Acute ischemic stroke patients mainly rely on cerebral blood flow (CBF) to sustain penumbral tissue perfusion in turn depend on arterial blood pressure in affected cerebral autoregulation. Head positioning either sitting-up or lying flat allows gravitational force to enhance leptomeningeal circulation and collateral blood flow. The present study aimed to determine the role of head position in acute ischemic stroke patients.

**Methodology:** This prospective observational study was conducted on 500 stroke patients in the Department of Neurology and Medical department of Fauji Foundation Hospital, Rawalpindi from January 2020 to December 2021. Patients with acute ischemic stroke receive care in either a lying flat on bed or sitting-up position with elevated head position at 30 to 45 degrees. The designated position was established shortly after hospital admission and was held for 24 hours. Outcomes such as pneumonia, aspiration pneumonia, and increased hospital stay, disability, and mortality were associated with flat head position and elevated head position. Modified Rankine scale (0-6) was used for assessing the degree of disability as a primary outcome in three months. Rankine scale higher score indicates the greater disability and maximum score 6 indicate mortality.

**Results:** The average time from initiation of assigned position and onset of ischemic stroke symptoms was 14 hours (IQR 5-35). Patients in the sitting position group (93%,  $p < 0.001$ ) were more likely than the lying-flat group (82%,  $p < 0.001$ ) in maintaining their position for 24 hours. Based on a modified Rankine scale, both lying flat and sitting-up position groups had no significant differences in a proportional-odds model in terms of 90-days disability outcomes distribution. The mortality rate in lying flat and sitting-up position was 6.8% and 6.9% ( $p = 0.79$ ). Also, both groups had no significant differences in terms of severe outcomes including pneumonia.

**Conclusion:** The present study found that disability outcomes in acute stroke patients were similar irrespective of their position either flat or sitting position with head elevated at 30 to 45 degree for 24 hours. The prevalence of AIS was 95.6%.

**Keywords:** Head position, Acute ischemic stroke, Outcomes

## INTRODUCTION

Acute ischemic stroke (AIS) is a major public health issue that affects human societal life [1]. In this disease, cerebral blood flow is hampered by an occluded artery from a more proximal source (i.e., cardiac or extracranial vessels). The risk of infarcted brain and ischemic penumbra is determined by the size and location of such occlusion and compensatory collateral blood flow efficiency [2]. Local CBF is thought to be passively dependent on mean systemic arterial blood pressure because autoregulation is lost in the affected region [3]. The cerebral blood flow into ischemic penumbra and collateral circulation can be increased by positioning the head of AIS patients in lying flat (0 degree). To date, there have been contradictory findings reported regarding the head position changes on cerebrovascular physiology. According to some studies, the 'lying-flat' position increases the cerebral oxygenation, cerebral perfusion pressure and velocity of cerebral blood flow in the middle cerebral artery (MCA) [4, 5]. In contrast, other found that reperfusion injury associated with intracranial hypertension could be avoided by sitting-up' position of AIS patients [6, 7].

According to a cluster-randomized study, the functional outcome in acute ischemic stroke patients had no significant association with head positioning either sitting-up or lying flat [8]. Earlier, the adverse functional outcomes of severe stroke at 90 days based on NIHSS > 16 were due to intensive mobilization and upright head positioning [9]. Prior to determining the effect of head positioning on functional outcome in AIS patients, investigation on the effect of head positioning variations on cerebral autoregulation is important. CBF is mainly protected by a mechanism known as cerebral autoregulation [10]. Previously, it has been demonstrated that reproducible significant static changes in CBFV, hemodynamic factors, and BP with head positioning varied from 0° to 30° without changes in CA in healthy groups [11]. Numerous studies revealed that blood flow through leptomeningeal recruitment and collateral arteries can be improved by vasodilation which increases the blood volume and pressure in arteries [12, 13]. However, none have

proven to be effective thus far. Despite the fact that lying flat position of AIS patients increases the cerebral blood flow to ischemic penumbra rather than in sitting up position [14]. But, the association of improving clinical outcomes is yet to be determined. The present study aimed to determine the role of head positioning in acute ischemic stroke patients and outcomes.

## METHODOLOGY

This prospective observational study was conducted on 500 stroke patients in the Department of Neurology and Medical department of Fauji Foundation Hospital, Rawalpindi from January 2020 to December 2021. Ethical approval was taken from the institute ethical committee. Patients with acute ischemic stroke receive care in either a lying flat on bed or sitting-up position with elevated head position at 30 to 45 degrees. The designated position was established shortly after hospital admission and was held for 24 hours. Outcomes such as pneumonia, aspiration pneumonia, and increased hospital stay, disability, and mortality were associated with flat head position and elevated head position. Modified Rankine scale (0-6) was used for assessing the degree of disability as a primary outcome in three months. Rankine scale higher score indicates the greater disability and maximum score 6 indicates mortality. All patients with acute stroke presenting and admitted in neurology and medical wards were enrolled. All those patient who have previous disability due to stroke, any head injury, brain tumor or any other neurological and neurosurgical pathology and patient who have metabolic encephalopathy of critical condition due to any systemic condition were excluded.

Demographic details and clinical features were gathered at the time of presentation and NIHSS; scores range from 0 to 42, with higher scores indicating greater severity of stroke) were included. A 24 hours record for individual lowest oxygen saturation, vital signs, and interlude of allocated head position were maintained. Follow-up data were gathered after 7 days that included repeat NIHSS scores, final diagnosis, and disability assessment on modified Rankine scale (0-6) where value from 0 to

6 were assigned as follows; no symptoms indicated by 0, no disability but symptoms 1, slight disability by 2, moderate disability 3, moderate severe disability 4, severe disability by 5, and mortality or death by 6 [15]. The disability level determined by modified Rankine scale at 90 days was the primary outcome. Major disability or mortality at 90 days, neurological impairment, and hospital stay duration were secondary outcomes. Acute ischemic stroke patients were distributed into two groups; lying-flat position and sitting-up position. About 250 AIS patients were assigned a sitting-up and 250 to lying flat head position. All the statistics were conducted at 90% power to determine the disability outcome at 5% level of significance.

**RESULTS**

The average time from initiation of assigned position and onset of ischemic stroke symptoms was 14 hours (IQR 5-35). Patients in the sitting position group (93%,  $p<0.001$ ) were more likely than the lying-flat group (82%,  $p<0.001$ ) in maintaining their position for 24 hours. Based on a modified Rankine scale, both lying flat and sitting-up position groups had no significant differences in a proportional-odds model in terms of 90-days disability outcomes distribution. The mortality rate in lying flat and sitting-up position was 6.8% and 6.9% ( $p=0.79$ ). Also, both groups had no significant differences in terms of severe outcomes including pneumonia. Table-I summarized the baseline characteristics of AIS patients. The overall mean age was  $66.8\pm 2.6$  years. There were 38% female and 62% males as shown in Figure-1. The mean NIHSS score was 3.8 (IQR 2-8) and duration at which onset of stroke to head position commencement was 14 hours (IQR 5-35). The presentation of head position commencement median time was 6.8 hours (IQR 2-25) in sitting-up and 6.9 hours (2-26) in lying flat group. The prevalence of medical history in both groups are shown in Figure-2. Primary outcomes of both groups are presented in Table-II. Various causes of AIS is shown in Figure-3.

NIHSS score (Median, IQR)	3.8 (2-8)	3.9 (2-8)
Median time for onset of stroke (hours)	14 (5-35)	5 (5-35)
Median time for hospital admission (hours)	6.9 (2-26)	6.8 (2-25)
Use of Aspirin or other antiplatelet agent	146 (58.4)	145 (58.0)

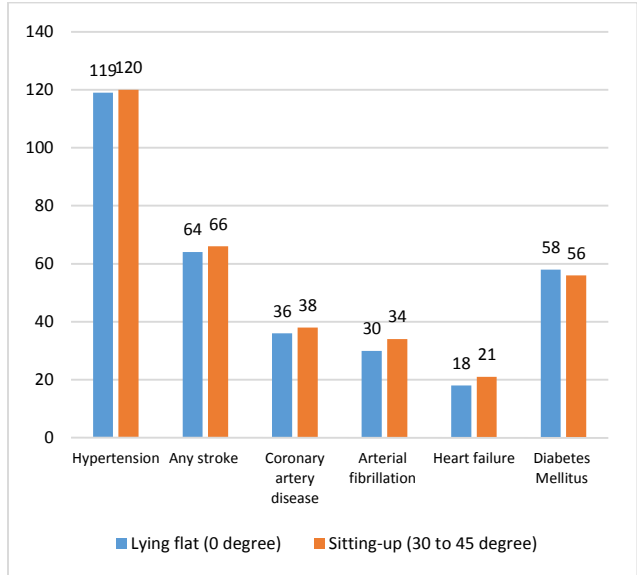


Figure-2: Prevalence of medical history of AIS patients based on head positioning

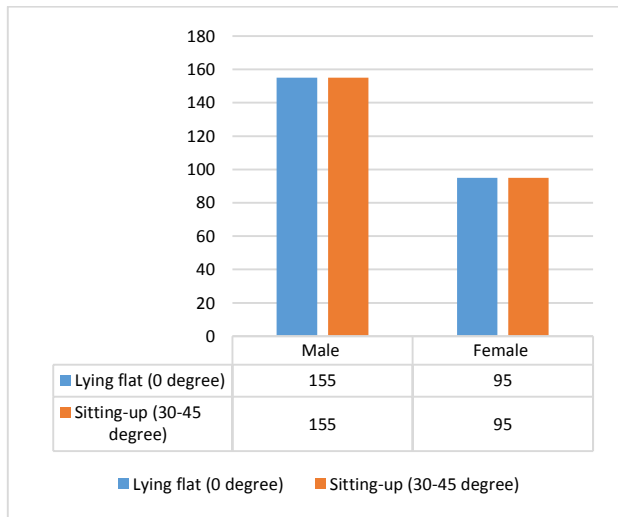


Figure-1: Gender's distribution of AIS patients

Table-1: Baseline characteristics

Parameter	Lying flat N=250 (0 degree)	Sitting-up N=250 (30-45 degree)
Age (years)	66.9±3.41	66.7±1.8
Gender Female n (%)	95 (38)	95 (38)
Final diagnosis at discharge time N (%)	6 (2.4)	8 (3.2)
Condition mimicking stroke	5 (2.0)	3 (1.2)
Transient ischemic attack	239 (95.6)	239 (95.6)
Acute ischemic stroke		
No symptoms or 0 Rankine score before stroke	150 (60.0)	152 (60.8)
Anticoagulant use	24 (9.6)	28 (11.2)

Table-2: Primary outcomes of AIS patients in both groups

Primary outcome	Lying flat N=250 (0 degree)	Sitting-up N=250 (30-45 degree)	P-value
No symptoms "0"	43 (17.2)	45 (18)	0.82
Symptomatic but no disability "1"	87 (34.8)	85 (34)	0.82
Slight disability "2"	21 (8.4)	20 (8.0)	0.82
Moderate disability "3"	38 (15.2)	40 (16)	0.82
Moderate severe disability "4"	25 (10)	23 (9.2)	0.82
Severe disability "5"	17 (6.8)	17 (6.8)	0.82
Mortality "6"	19 (7.6)	20 (8.0)	0.82

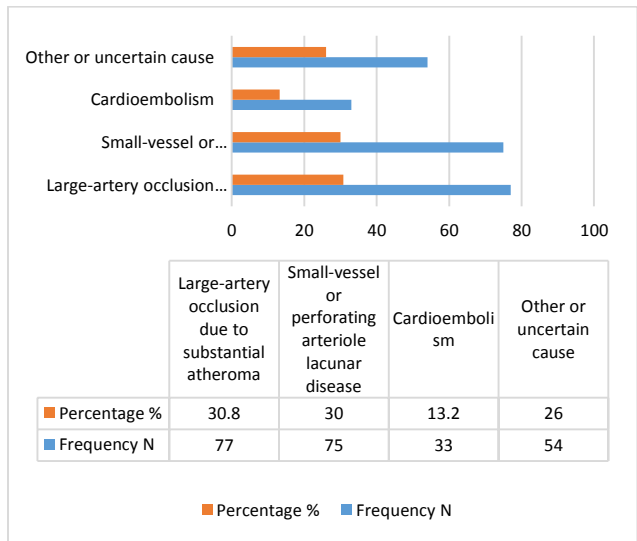


Figure-3: Causes of acute ischemic stroke

## DISCUSSION

The present study suggested that AIS patients positioning has a substantial effect on health care intervention and outcomes. In the early stage of AIS, recombinant tissue plasminogen activator and mechanical endovascular treatment are used to restore antegrade perfusion within the ischemic territory, but both approaches are limited to access barrier and potential harms. Three anatomical systems for augment cerebral perfusion is another potential therapeutic approach in the brain. The leptomeningeal collateral vessels extent envisaged by CT scan with angiography had significant association with AIS outcome [16]. A good prognosis after endovascular treatment for AIS is indicated by the presence of good collateral circulation as determined by conventional cerebral angiography [17]. An increasingly popular method of increasing cerebral blood flow is to lie patient flat in the hyper acute position to enhance cerebral collateral circulation [18, 19].

The lying position for AIS patients has increasingly become a standard practice in early stroke centers. Some observational studies demonstrated that lying flat position increased CBF in AIS patients, regardless of subtype of patients. Due to the use of simple, non-mechanical beds in low-income settings and/or countries, lying flat is widely used to prevent strokes. Patients with acute stroke may be more likely to contract pneumonia if they are nursed differently based on geography and hospital policies [20, 21].

With respect to the essential result of level of inability at 90 days, we found no noteworthy contrast between the execution of the lying-flat head position — at a middle time of 14 hours after the onset of stroke — and the sitting-up position in this randomized trial including patients with intense stroke in an assortment of wellbeing care settings. Besides, mortality rates and rates of genuine antagonistic occasions, such as pneumonia, were not essentially distinctive.

This trial's negative results suggest that head positioning initiated within 24 hours did not reduce the neurologic deficit associated with acute stroke, despite any change in cerebral blood flow that may have occurred. While we did not reach the planned sample size for the trial, an analysis of cluster relationships indicated that the trial retained power to assess the pre-specified intervention effects despite not reaching the planned sample size. A narrow confidence interval was found in the primary analysis for the intervention effect, making it unlikely that a true difference in disability outcome was missed. Despite the fact that the intervention effect was homogeneous in pre-specified subgroups with respect to the primary outcome, these analyses had low statistical power [22, 23].

A range of stroke-related causes caused mild neurological deficit in the patients in the present study after the thrombolytic or endovascular reperfusion treatment. Different results may have been obtained if the ischemic penumbra had been modulated earlier after the onset of symptoms [24].

The CBFV did not change significantly across all three visits, in either hemisphere or head position. Over repeated measurements, previous studies have reported increased [25, 26], biphasic [27], or unchanged [28] CBFV. Patients with AIS and found no significant differences in CBFV (affected or non-affected hemispheres), compared to control patients.

It has been demonstrated that early mobilization following AIS may be detrimental. Our AIS cohort had mild stroke disease (Mean NIHSS = 5). Having observed no significant changes in CBFV in our AIS cohort when they were moved from FLAT to SIT positions, and having satisfactory stroke recovery after three months. Patients with severe, but not mildly affected AIS could be affected clinically by changes in head positioning. In order to make informed personalized decisions about very early mobilization, including timing, intensity, and the maximum number of positional changes that can be tolerated, cerebral hemodynamic parameters should be monitored.

In our study, hypertension was the most prevalent medical history of acute ischemic stroke patients followed by any stroke,

diabetes mellitus, coronary arteries, atrial fibrillation, and heart failure. Similar results were reported in a study conducted on 426 acute ischemic stroke patients [29]. Despite concerns about pneumonia, a recent study found a very low prevalence of pneumonia in AIS patients lying flat after thrombolysis (4.5%-6%) [30]. In addition, non-ventilated stroke patients with acute stroke are likely to experience less aspiration pneumonia if they lie "side-lying" and avoid eating [31, 32].

Despite the absence of definitive evidence that AIS patients are at risk when lying flat, there is some ancillary concern among the health teams, reflected in the results of the present survey. Observational and quasi-experimental studies that suggest that the lying flat position may be associated with pneumonia in patients with dysphagia could explain concerns with the lying flat position. However, these studies were only performed on patients who were fed by nasogastric tubes or mechanically ventilated [33].

## CONCLUSION

The present study found that disability outcomes in acute stroke patients were similar irrespective of their position either flat or sitting position with head elevated at 30 to 45 degree for 24 hours. The overall prevalence of AIS patients was 95.6% among the studied population.

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