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Original Research Article

Investigation of Risk Factors, Clinical Characteristics, and Radiological Profile in Patients with Posterior Circulation Stroke

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Abstract:

Introduction: Stroke is the leading cause of death globally, with 1.8 million people affected annually. In India, it's the leading cause of death. Neurology is learned through stroke, with 80% due to ischemic events and 20% posterior circulation strokes. Improved understanding of risk factors should focus on prevention rather than management.

Aims and Objectives: The study aims to explore the causes and clinical manifestations of posterior circulation stroke, using imaging techniques like CT and MRI to assess the most frequently affected anatomical region.

Material and methods: The study evaluated patients with PC stroke symptoms at King George Hospital, analyzing clinical history, risk factors, presentation mode, and hospital arrival time. Ethical committee approval was taken with IEC serial no: 62/IEC/AMC/OCT /2020 and the study period was from November 2019 to Octbber2020. The study used descriptive analysis, including mean, standard deviation, frequency, and proportion, with IBM SPSS version 22 for statistical analysis, without inferential or P values.

Results: A study of 60 patients with posterior circulation stroke symptoms identified potential risk factors such as hypertension, diabetes, smoking, dyslipidemia, and coronary artery disease. Most patients initially displayed giddiness, vomiting, headaches, altered sensorium, and seizures. The study found distal territory involvement was more common, with ischemic stroke being the most common.

Conclusion: A study in a tertiary care hospital found that males are more affected by PC stroke, with hypertension being the most common risk factor. Large artery disease and cardio embolism are common causes.

Keywords: posterior circulation stroke, MRI, cardio embolism, Cardio-embolic stroke.

Introduction

Stroke is the leading cause of death globally, with 1.8 million people affected annually. In India, it's the leading cause of death. Addressing gaps in awareness and thrombolysis is crucial.[1]C. M. Fisher explains that neurology is learned through stroke, with 80% of strokes due to ischemic events. 20% are posterior circulation strokes, causing high morbidity and mortality, often misdiagnosed or undiagnosed. [2]Over the past 15 years, clinical studies and brain imaging have significantly improved understanding of posterior circulation stroke, which is often attributed to large artery disease or penetrating artery disease. Cardio-embolic stroke is now more common, accounting for 20-50% of PC strokes. [3-5]With a better understanding of various risk factors causing the stroke, the goal should be prevention rather than management.

Aims and Objectives

- The objective is to investigate the causes and different clinical manifestations of posterior circulation stroke.
- Assess the most often affected anatomical region using imaging techniques such as CT and MRI.

Material and Methods

The study examined patients with PC stroke symptoms at King George Hospital, Andhra Medical College, Vishakhapatnam, from November 2019 to Octbber2020 with IEC serial no: 62/IEC/AMC/OCT /2020

Patients with posterior circulation stroke were evaluated in the emergency department, including CT scan, ECG, CXR, ECHOCARDIOGRAM, 4-Vessel Doppler, and Fasting Lipid Profile, and MRI brain scans in selected cases.

Inclusion Criteria: The study included patients with symptoms and signs of posterior circulation stroke and radiological evidence of the stroke.

Exclusion Criteria: Patients with clinical and neurological features of labyrinthine and vestibular disorders, as well as those with subarachnoid, extra Dural, or subdural hemorrhage.

This study analyzed clinical history, risk factors, presentation mode, and hospital arrival time, focusing on age, sex, hypertension, diabetes, dyslipidemia, cardiac disease, smoking, and alcohol intake. The clinical examination of the cardiovascular system was primarily focused on examining rhythm disturbances, valvular heart disease, and cardiac failure.

A comprehensive neurological examination was conducted on patients with posterior circulation stroke, including blood hemogram, hematocrit, lipid profile, renal function tests, electrocardiogram, patent foramen ovale, and vegetation, and radioamaging studies.

The structured proforma was utilized for the analysis of patients.

1. The study examines demographics and stroke risk factors such as hypertension, diabetes, smoking, alcohol consumption, obesity, dyslipidemia, cardiac diseases, migraine, oral contraceptive use, neck trauma hyperhomocysteinemia, and antiphospholipid antibody syndrome.
2. The study focuses on clinical characteristics, neuroimaging and vascular studies results, infarct location, and vascular territory involvement.

- Hypertension is defined by the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.
- Diabetes mellitus (DM) is defined by elevated fasting blood glucose ≥126 mg% or HbA1c ≥7%, or previously on insulin injections or oral hypoglycemia.
- Dyslipidaemia is defined by serum triglyceride, cholesterol, and high-density lipoprotein concentrations exceeding 150 mg/dl, 200 mg/dl, and less than 40 mg/dl in males and 50 mg/dl in females.
- Obesity is defined as a body mass index of more than 25 kg/m2.
- Smoking was defined as daily usage of over 10 cigarettes for over a year, while daily consumption of 30g of ethanol was considered alcoholic.

The study examined patients without common risk factors for heart disease, assessing serum homocysteine levels and antiphospholipid assays.

CT and MRI scans were used to determine infarct location, and stroke events were classified according to TOAST classification.

Large-vessel atherosclerosis, small-vessel disease, cardioembolism, other determined causes, or undetermined causes are all potential causes of heart disease.

Patients with stroke were categorized into five subgroups based on vascular territory involvement and infarct distribution on neuroimaging. They were also categorized based on proximal-distal extent of infarction.

Statistical analysis: The study used descriptive analysis, including mean, standard deviation, frequency, and proportion, with IBM SPSS version 22 for statistical analysis, without inferential or P values.

Results

The study involved 60 patients with posterior circulation stroke symptoms, with 42 males (63.75%) and 18 females (36.25%), as per the frequency distribution.

Table 1: Gender wise distribution of patients

Sex	No Of Cases	Percentage
Male	42	70
Female	18	30
Total	60	100

Age incidence: Table 2 shows age distribution with a mean age of 56.31 ± 2.6, with most cases between 50 and 60, followed by 60 to 70, and 2 patients below 40 years.

Table 2: Age group distribution among patients

Age In Years	<40	41-50	51-60	61-70	> 70
No Of Cases	2	14	22	16	6
Percentage	3.3	23.3	36.7	26.7	10

Risk factors: The study identified potential risk factors in 60 patients, including hypertension, diabetes, smoking history, dyslipidemia, and coronary artery disease, as shown in table 3.

Table 3: Various risk factors and their frequency distribution

Risk Factors	No Of Cases	Percentage
Hypertension	46	76.6
Smoking	25	41.7
Diabetes	22	36.6
Dyslipidemia	18	30
CAD	8	13.3
Alcohol	7	11.7
Obesity	6	10
Atrial fibrillation	3	5
CRHD.	2	3.3
CKD	1	1.6
Hyperhomocysteinemia	1	1.6

Clinical features: The study found that most stroke patients initially displayed giddiness and vomiting, with 22 experiencing headache, 6 experiencing altered sensorium, and 8 experiencing seizures.
Clinical features included homonymous hemianopia, temporal lobe signs, cerebellar signs, motor weakness, sensory disturbances, and cranial nerve neuropathy, often a combination of symptoms.

Table 4: various clinical features and frequency distribution

Vertigo	38 (63.3%)
Ataxia	32 (53.3%)
Motor weakness	30 (50%)
Vomiting	28 (46.7%)
Headache	22 (36.7%)
Cranial neuropathy	18 (30%)
Visual field defects	18 (30%)
Dysphagia	13 (21.7%)
Sensory loss	12 (20%)
Seizures	8 (13.3%)
Altered sensorium	6 (10%)
Combination	28 (46.7%)

Anatomical areas involved: The NEMC posterior circulation registry categorizes posterior circulation strokes into proximal, middle, and distal intracranial arteries, using clinical features and neuroimaging to identify infarct locations.

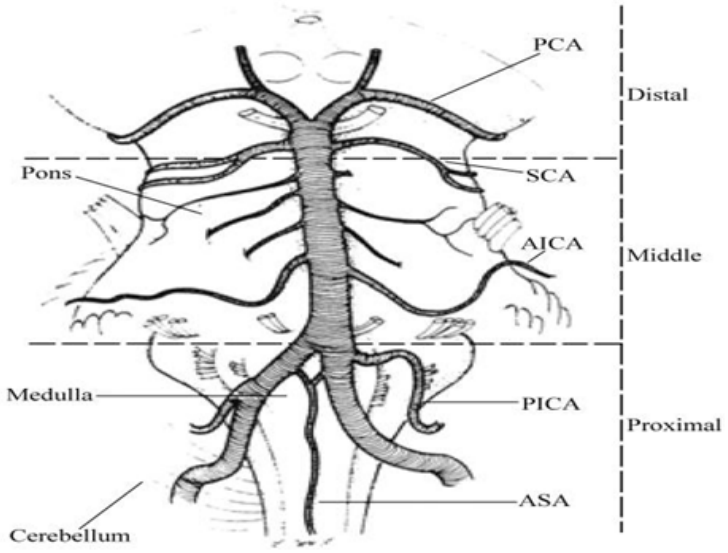

Figure 1: Base of the brain showing the intracranial vertebral and basilar arteries and their branches

The intracranial territories are divided into proximal, middle, and distal territories, with the anterior spinal artery (PICA), posteroinferior cerebellar artery (AICA), anteroinferior cerebellar artery (SCA), superior cerebellar artery (PCA), and posterior cerebral artery. The study found that distal territory involvement was more common in 60 patients, followed by proximal involvement, with isolated middle involvement less common.

Table 5: Distribution of patients based on the location of territory involvement

Territory involved	Frequency	Percentage
Distal	24	40
Middle	3	5
Proximal	20	33.3
Combination	13	21.7

Distribution of patients based on anatomical location: Out of 60 patients, 46 had ischemic strokes and 14 hemorrhagic strokes, with most ischemic strokes involving supra and infra tentorium, cerebellar location, and most hemorrhagic strokes involving cerebellum.

Table 6: Distribution of patients based on anatomical location

Features	Ischaemic stroke (76.7%)		Hemorrhagic stroke (23.3%)	
	No of patients	Percentage	No of patients	Percentage
Infra tentorial	**13**	**21.7**	**5**	**8.3**
Medulla	1	1.7	1	1.7
Pons	2	3.3	1	1.7
Midbrain	3	5	--	--
Cerebellum	6	10	3	5
Supra tentorial	**8**	**13.3**	**2**	**3.3**
Thalamic and Medial temporal	3	5	1	1.7
Occipital	5	8.3	1	1.7
Combination	**26**	**43.3**	**7**	**11.7**

Stroke subtype: The study revealed that 73.3% of patients had large artery disease, 3.3% had small vessel disease, 11.7% had cardio-embolic stroke, and 10% had an undetermined cause.

Table 7: various stroke subtypes and their distribution among patients

Stroke Subtype	No. of Patients
Large artery disease	44 (73.3%)
Small-vessel disease	2(3.3%)
Cardioembolic stroke	7 (11.7%)
Other determined causes	1 (1.6%)
Undetermined causes	6 (10%)

A patient with top of basilar artery syndrome or Locked-in syndrome, typically following a brainstem stroke, experiences paralysis of all voluntary muscles except eyes and speech, with preserved consciousness. [6]

Figure 10: MRI Brain T2 weighted image showing acute infarct in Right PICA territory

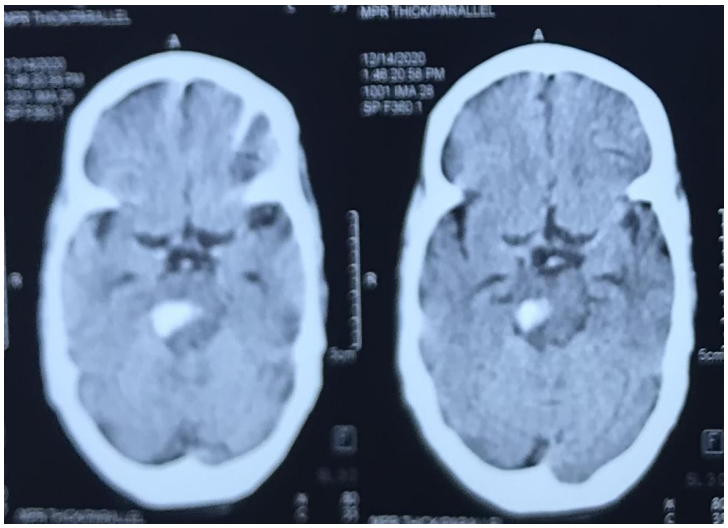

Figure 11: CT Brain showing hemorrhage in Pons and Midbrain

Discussion

Posterior circulation strokes account for 10-15% of strokes, with 80% being ischemic. Studies show a prevalence of 26.7% and 26%, respectively, and 39.8% of all ischemic strokes. The study found that 70% of patients were male, with 58% male and 42% female, consistent with previous studies indicating a higher incidence of posterior circulation stroke in males. [7]

The study found that 60% of patients with posterior circulation stroke were aged 40-60 years, with a mean age of 56.31 ± 2.6. The New England Medical Centre Posterior Circulation Registry showed that most patients were aged between 66-75 years. This may be due to lower life expectancy in developing countries.

Rawat et al. [8] found maximum patients 41-70 years old, with a median age of 56.5, while Sundar et al. found maximum patients 40-55 years old, similar to the present study. The study compares risk factors for posterior circulation stroke with other studies, identifying modifiable and non-modifiable factors such as age, gender, race, family history, diabetes, hypertension, dyslipidemia, and smoking. The study found that hypertension, a common risk factor for stroke, was present in 76.6% of patients, similar to previous studies involving 69.9%, 61%, and 60.5% of patients. Smoking was the second most common cause of posterior circulation stroke, followed by diabetes and dyslipidemia. Tobacco abuse was the most common risk factor, followed by hypertension. Less common risk factors included dyslipidemia (10%), diabetes (5%), rheumatic heart disease (5%), and Ischaemic heart disease (5%). High tobacco abuse in certain regions may be due to its prevalence.

The study found that less common risk factors included alcohol, coronary artery disease, and obesity. Atrial fibrillation was present in 5% of

cases, and rheumatic heart disease was found in 3.3%, more common in developing countries like India.

Table 8: Comparison of risk factors among various studies

Risk factors	Present Study	NEMC- PCR [9]	Lee et al. [10]	Uma et al. [11]	Kora et al. 12
Hypertension	76.6	61	69.9	21	37
Diabetes	36.6	25.4	30.2	35.5	05
Smoking	41.7	35.7	32.4	35.5	–
Alcohol	11.7	31.1	–	19.7	21
Dyslipidemia	30	24.7	24.2	44.4	10
Coronary artery disease	13.3	34.7	–	17.1	05
Rheumatic heart disease	3.3	–	–	10.5	05
Atrial fibrillation	5	–	–	–	–
Obesity	10	17.3	–		–
Migraine	0	11.5	–	11.8	–

Posterior circulation stroke presents with various clinical presentations, with vertigo being the most common, occurring in 63.3% of patients. This is due to the vestibular nucleus or its connections, and is often accompanied by other cranial nerves or long tracts. Vertigo episodes lasting more than 3 weeks are rarely caused by vertebra-basilar disease. Other common presentations include ataxia, cranial nerve involvement, and motor disturbance.

Table 9: Comparison of clinical features among various studies

Clinical features	Present study	Shi et al. [14]	Patrick et al. [13]	Kora et al. [12]
Vertigo	63.3%	33.8%	30%	42%
Ataxia	53.3%	30%	36%	36%
Motor weakness	50%	81.9%	43%	63%
Visual field defects	30%	42%	13%	47%

The study found ataxia (53.3%) in posterior circulation strokes, primarily due to cerebellum involvement. In contrast, anterior circulation strokes had frontal, ipsilateral headaches, while posterior circulation strokes had occipital headaches due to more intense nociceptive afferents. Additionally, motor weakness was observed in 50% of cases.

A Chinese study found dizziness in 33.8% of patients with posterior circulation stroke, ataxia in 30%, and motor weakness in 81.9%, compared to the present study's findings due to fewer infarctions.

A study found that 30% of patients with posterior cerebral artery infarct had visual field defects or loss, with 84% experiencing visual field loss. Altered sensorium was observed in 10% of patients.

The study found that 10% of patients with a condition had altered sensorium at the onset, with distal and middle territories most affected by the ascending reticular activating system. [15] Coma was more common in posterior hemorrhagic stroke (23.3%) and patients involving the Infratentorial region, including pontine bleed patients, due to involvement of the reticular activating system. In a study, 30% of participants experienced cranial neuropathy, leading to horizontal gaze disruptions, sixth nerve palsy, INO, horizontal gaze palsies, or "one and a half syndrome."

The study found that 73.3% of patients had large artery disease, with 11.7% having a cardioembolic source. Asians had a higher incidence of large artery involvement. In HSR, 5.2% had cardioembolism, with large artery disease being the most common stroke subtype. Cardioembolism is associated with cardiac diseases.

The study found that 76.7% of patients had an ischemic stroke, while 23.3% had a hemorrhagic stroke. This is consistent with previous studies, which found that ischemic strokes were more common (76.7%). [11, 8]

Table 10: Comparison of ischemic and hemorrhagic strokes among various studies

Features	Present study	Rawat et al. [8]	Uma Sundar et al. [11]
Ischemic stroke	76.7%	63.15%	77.6%
Hemorrhagic stroke	23.3%	38.85%	22.4%

The cerebellum was the most common site of infarct in posterior circulation stroke, followed by the occipital lobe and pons, with 5% of bleeds occurring in this area.

Artery of Percheron occlusion, a rare cause of ischemic stroke, is characterized by bilateral paramedian thalamic infarcts, presenting with mental state disturbances, hypersomnolence, aphasia, amnesia, and ocular movement disorders.The study found that 40% of patients had distal vascular territory involvement, 33.3% had proximal location, 21.7% had multiple vascular locations, and 5% had middle intracranial territory involvement.

The study found a lower occurrence of distal infarction in the middle intracranial location, followed by proximal intracranial in posterior circulation stroke, compared to the NEMC registry. [9] the most common infarct location in HSR (36.5%) was in the middle territory, possibly due to different stroke etiologies.

Table 11: Comparison of vascular territory involvement with NEMC registry

Territory	Present study	NEMC registry [8]
Distal only	40%	40. 9%
Proximal only	33.3%	18. 2%
Middle only	5%	16. 1%
Combination	21.7%	24.8%

Summary

This observational study in a tertiary care hospital found that males were more affected than females, with the most common age group being between 40-60 years. Hypertension was the most common risk factor for PC stroke, followed by smoking and diabetes. The most common clinical presentation was vertigo, ataxia, and motor weakness. Distal territory involvement was most common, followed by proximal and middle vascular territories.

In posterior circulation stroke, ischemic was more common than hemorrhagic, with the cerebellum being the most common site of involvement. Large artery disease and cardioembolism were found as causes of posterior circulation stroke. MRI is superior to CT for imaging acute PC infarcts, but may rarely miss small infarcts early on. More studies on PCS clinical profile and outcomes are needed to establish appropriate management strategies.

Conclusion

This observational study in a tertiary care hospital found that males were more affected than females, with the most common age group being between 40-60 years. Hypertension was the most common risk factor for PC stroke, followed by smoking and diabetes. The most common clinical presentation was vertigo, ataxia, and motor weakness.

Distal territory involvement was the most common, followed by proximal and middle vascular territories. In posterior circulation stroke, ischemic was more common than hemorrhagic, with the cerebellum being the most common site of involvement. Large artery disease and cardioembolism were found to be the most common causes of posterior circulation stroke.

MRI is superior to CT for imaging acute PC infarcts but may rarely miss small infarcts early on. More studies on PCS clinical profile and outcomes are needed to establish an appropriate management strategy. The study also found a higher percentage of large artery disease as a cause of posterior circulation stroke with distal territory involvement.

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