



## STUDY OF RISK FACTOR, CLINICAL AND RADIOLOGICAL PROFILE IN POSTERIOR CIRCULATION STROKE

### General Medicine

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### ABSTRACT

Posterior circulation stroke account approximately 15% of all stroke with diverse clinical presentation. They are different from anterior circulation stroke with reference to risk factor, clinical features, management strategy and prognosis. We conducted a study in tertiary care teaching hospital to understand the clinical profile and radioimaging correlation of patients with posterior circulation stroke.

### KEYWORDS

#### INTRODUCTION-

STROKE is defined as abrupt onset of neurological deficit that is attributable to focal vascular cause<sup>1</sup>. Stroke syndromes are classified into 1. Anterior circulation stroke and 2. Posterior circulation stroke based on the blood supply. The internal carotid artery and its branches comprise the anterior circulation. Stroke syndromes of the posterior circulation account for approximately 20% of all strokes.

The posterior circulation consists of the paired vertebral arteries, the basilar artery, the paired posterior cerebral arteries and their branches. These arteries, through short penetrating branches and circumferential branches, supply the brainstem (medulla, pons, and midbrain), the thalamus, the hippocampus, the cerebellum and parts of the occipital and temporal lobes including the visual cortex. There is marked variability in the exact arterial anatomy of the posterior circulation<sup>2</sup>.

The posterior circulation is constructed quite differently from the anterior circulation and consists of vessels from each side which unite to form midline arteries that supply the brainstem and spinal cord. Within the posterior circulation, there is a much, higher incidence of asymmetric, hypoplastic arteries, of variability of supply and of retention of fetal circulatory patterns.

The posterior circulation, unlike the intracranial portions of the anterior circulation, is prone to atherosclerosis much as are others systemic arteries<sup>3</sup>. In the case of one vertebral artery being occluded, collateral flow comes from the opposite vertebral artery, from muscular cervical artery branches, and from posterior communicating artery.

The vertebral arteries originate from the subclavian arteries and course through the vertebral foramina of C6-C2, around the atlas, and through the foramen magnum. At the Ponto medullary junction both vertebral arteries join to create the basilar artery.

The vertebral arteries supply the medulla, the pons, and the cerebellum. The distal vertebral arteries and the basilar artery give rise to the arteries that supply the cerebellum: the superior, anterior, posterior, and inferior cerebellar arteries.

The vertebral arteries are prone to atherosclerotic changes at their origin, and at the junction with the basilar artery.

The basilar artery and its branches supply the pons and the cerebellum. Distally the basilar artery divides into the posterior cerebral arteries and then the posterior communicating artery in the Circle of Willis. Atherosclerotic lesions can occur anywhere along the trunk of the basilar artery.

The posterior cerebral artery (PCA) supplies portions of the midbrain, the thalamus, the hippocampus, the medial temporal lobe, and the occipital lobe, including the visual cortex.

Posterior circulation ischemia can range from fluctuating brainstem symptoms, caused by intermittent insufficiency of the posterior circulation (so-called VBI), to the "locked-in syndrome," which is caused by basilar artery or bilateral vertebral artery occlusion.

#### AIMS AND OBJECTIVES-

- To study the various clinical stroke syndrome of posterior circulation stroke.
- To analyse the pattern of infarcts and their regional distribution based on radioimaging.

#### MATERIALS AND METHODS-

Present study was conducted in patients admitted in MICU and medical ward of tertiary health care Centre Dr. V.M.G.M.C. Solapur

- Type of study – Prospective observational study
- Sample size – 30

#### Sampling Criteria-

##### Inclusion Criteria:

- Patient who had signs and symptoms of posterior circulation stroke
- Age > 18 years
- Patients who had radiological evidence of posterior circulation stroke

##### Exclusion Criteria:

- Age < 18
- Radio imaging study suggestive of anterior cerebral or middle cerebral circulation stroke.

#### OBSERVATION AND RESULTS-

The study group included 30 patients. There were 20(66.66%) male and 10(33.33%) female patients. The ratio of male to female is 4:1. The age distribution ranged from as low as 30 years to upto 80 years, with the majority being males of elderly age group.

#### The age distribution is shown in the below table

Table 5. 1 Age Distribution

| Age group In years | Males (n=20) | Females (n=10) |
|--------------------|--------------|----------------|
| <30                | 0            | 0              |
| 31-40              | 3            | 1              |
| 41-50              | 0            | 1              |
| 51-60              | 6            | 4              |
| 61-70              | 6            | 2              |
| >70                | 5            | 2              |

#### Risk Factor Profile-

The risk factor profile was analyzed in the 30 patients and the observation are shown in decreasing order of frequency in this Table 5.2.

Table 5. 2 Risk Factor

| RISK FACTOR             | Male (%) n=30 | Female (%) n=30 |
|-------------------------|---------------|-----------------|
| Diabetes mellitus       | 11(55%)       | 04(40%)         |
| Hypertension            | 10(50%)       | 03(30%)         |
| Alcoholism              | 07(35%)       | 02(20%)         |
| Coronary artery disease | 04(20%)       | 04(40%)         |
| Smoking                 | 04(20%)       | 01(10%)         |

#### Clinical Patterns-

In The 30 Patients 23(76.66%) Patients Had Ischemic Infarct And 07(23.33%) Had Hemorrhage. The Symptoms Analysis In This Group

Revealed The Following Characteristics In Decreasing Order Of Frequency

**Table 5.3 Clinical symptoms**

The clinical examination revealed the following findings in decreasing order of frequency

| CLINICAL FINDINGS                | NO OF PATIENTS (%) |
|----------------------------------|--------------------|
| Combination of clinical findings | 22(73.3%)          |
| Cerebellar signs                 | 14(46.6%)          |
| Visual field defects             | 14(46.6%)          |
| aHemisensory loss                | 11(36.6%)          |
| Motor weakness                   | 08(26.6%)          |
| Multiple cranial nerve palsy     | 07(23.3%)          |

**Table 5.4 Clinical Findings**

The radiological evaluation revealed the following findings in decreasing order of frequency.

| RADIOLOGICAL FINDING  | NO OF PATIENTS (%) |
|-----------------------|--------------------|
| Cerebellar infarct    | 11(36.9%)          |
| Medullary infarct     | 07(23.3%)          |
| Brain stem infarcts   | 4 (13.3%)          |
| Occipital hemorrhage  | 3(10%)             |
| Cerebellar hemorrhage | 2(6.6%)            |
| Brain stem hemorrhage | 1 (3.3%)           |

**Table 5.5 Radiological finding**

In the 30 patients 23(76.66%) patients had ischemic infarct and 07(23.33%) had hemorrhage Among the 20 male patients 16 had infarcts and 4 patient had hemorrhage and among 10 female patient 7 had infarct and 3 had hemorrhage.

## DISCUSSION-

In the present study, out of 30 patients, there was a male preponderance with a ratio of 2:1 as against in TUFTS posterior circulation registry where there was 1:1 ratio. Similar results were obtained from Ma Cristina Let al, R.B.Libman et. al, Kora SA et. al studies.

**Table 6.1 Comparison Of Sex Ratio**

| Gender | Present Study | Tufts-New England Medical Center | Mohanty et.al | TUFTS posterior circulation registry | Corrado Argentino, et. Al |
|--------|---------------|----------------------------------|---------------|--------------------------------------|---------------------------|
| MALE   | 66.6%         | 58%                              | 75%           | 50%                                  | 80%                       |
| FEMALE | 33.3%         | 42%                              | 25%           | 50%                                  | 20%                       |

Posterior circulation stroke was common among individuals above 50 years. The mean age in the study group was 55 years. Similar result were seen in Caplan et al, Patrick et al.

**Table 6.2 Comparison Of Mean Age**

| STUDIES                                                                           | MEAN AGE( IN YEARS) |
|-----------------------------------------------------------------------------------|---------------------|
| Present Study                                                                     | 53-57               |
| New England Medical Centre Posterior Circulation Registry (NEMC-PCR) JNNP in 2011 | 66-75               |
| Rawat et. al                                                                      | 51-59               |
| Sundar et.al                                                                      | 40-45               |
| Mehendiratta et.al                                                                | 40-60               |
| Mohanty et.al                                                                     | 48-52               |
| Kora SA et.al                                                                     | 55-65               |
| Ratnavalli et.al                                                                  | >65                 |

The ratio between ischemic stroke and hemorrhagic stroke was 3:1 (23/07). This ratio was slightly higher when compared to anterior circulation stroke.

**Table 6.3 Comparison Of Stroke Type**

| Type               | Present Study | Rawat et.al | Uma Sundar |
|--------------------|---------------|-------------|------------|
| Ischemic Stroke    | 66.6%         | 63.15%      | 77.9%      |
| Hemorrhagic Stroke | 33.3%         | 36.85%      | 22.4%      |

In females, out of the ten patients, three had hemorrhagic stroke (30%).as against in males where 16 out of 20 had ischemic infarcts predominantly (80%). In the females however there was history of oral anticoagulant use in one patients for known rheumatic heart disease

induced atrial fibrillation.

As far as the symptomatology was concerned, giddiness and vomiting, incoordination were the leading complaints during presentation occurring in almost half of the patients. Headache and seizures were present in 30 and 26.6 percent of patients and unilateral headache was striking feature in patients with cerebellar hemorrhage. In a study by R.B. Libman, et al<sup>10</sup> it was found that headache was more common among posterior circulation stroke patients, present in 30% of patients.

**Table 6.4 Comparison Of Clinical Features**

| Clinical Features | Present Study | Patrick et.al | Kora et.al | Shi et.al | Rawat et.al |
|-------------------|---------------|---------------|------------|-----------|-------------|
| Giddiness         | 60%           | -             | -          | 33.8%     | -           |
| Vomiting          | 46.6%         | -             | -          | -         | 62.6%       |
| Incoordination    | 46.6%         | -             | -          | 30%       | 70%         |
| Motor Weakness    | 26.6%         | -             | 63%        | -         | -           |
| Alter Sensorium   | 13.3%         | 47%           | 63%        | -         | -           |

Altered sensorium was present in thirteen percent of patients. In a study by Timothy et al<sup>14</sup>, vertigo without hearing loss was the commonest symptom in brain stem stroke syndromes. In this study also dizziness associated with vomiting was the commonest symptom.

In twenty-six percent of patients presented with motor weakness, it mimicked anterior circulation stroke clinically. This finding went hand in hand with the results of study by Corrado Argentino<sup>5</sup>, et al which showed that shortly after onset the clinical discrimination between Anterior and atypical Posterior circulation infarcts is not reliable, which explains the frequent occurrence of this misdiagnosis.

In such cases, emergency CT scan helps in the differential diagnosis only when it demonstrates an early focal hypodensity within the carotid territory. In the study by Huan et al<sup>35</sup>, more than half of the patients had hemiparesis (58%).

A previous history of posterior circulation TIA was present in 12.3 percent and there were two patients who had previous anterior circulation stroke within a period of five years. This was in contrast to the study by Huan et al which reported an incidence of TIA as 50% and Chagging Zhang study which reported previous history of stroke as 48%.

The cerebellar syndrome was the most common clinical presentation present in about 46.6 percent of individuals. Visual field defects including diplopia, hemianopia were present in 46.6 percent of patients. Similar findings were seen in Kora SA et.al and Patrick et.al study. Hemisensory loss was present in about 36.6 percent (11 patients) in whom two had clinical features of lateral medullary syndrome. Multiple cranial nerve involvement was the presenting feature in twenty-three percent of patients. The common cranial nerves affected include III, IV, V, VII, IX, X.

Two patients presented with complex oculomotor involvement as the sole presentation and MRI revealed cerebellar infarcts in those patients. In the NEMC posterior circulation registry less than one percent of the 407 patients had only one complaint as presenting symptom<sup>6</sup>.

One patient had simultaneous involvement of anterior and posterior circulations.

Diabetes Mellitus topped the risk factor with 50 percent followed by hypertension, alcoholism and coronary artery disease in 36.6, 30 and 26.6 percent of patients respectively.

Embolism from heart and coronary artery disease were present in about 20.6 and 26.6 percent respectively. This was comparable to NEMC Posterior circulation registry data where embolism from heart was demonstrated in 24%.

In the study of the six patients who had embolism from the heart, two had preexisting rheumatic heart disease and two had systemic hypertension and one had atrial fibrillation. Of the six patients, two were on oral anticoagulant use.

In the study, among eight patients who had coronary artery disease as risk factor, five had extensive anterior wall myocardial infarction and one had inferior wall myocardial infarction pattern ECG wise which was confirmed by regional wall motion abnormalities in ECHO. Comparison of risk factors in present study with other study

**Table 6.5 Comparison Of Risk Factor**

| Risk Factor             | Present Study | HUAN et.al | Lee et.al | Caplan et.al | Rawat et.al | PK Mohanty | Kora et.al |
|-------------------------|---------------|------------|-----------|--------------|-------------|------------|------------|
| Diabetes Mellitus       | 50%           | 19%        |           | -            | -           | -          | -          |
| Hypertension            | 36.6%         | 71%        | 69.9 %    | 61%          | 60.5 %      | 41.9%      | -          |
| Alcoholism              | 30%           | 23%        |           | -            |             | 23.6%      | 52%        |
| Coronary Artery Disease | 26.6%         | 10%        |           | -            | -           | -          | -          |
| Smoking                 | 16.6%         | 39%        |           | -            | -           | -          | 41.7 %     |

Of the one patient who had posterior circulation infarcts within 40 years, one presented with diabetic ketoacidosis and he had bilateral occipital hemorrhage, which is quite rare presentation.

One male patient presented with multiple infarcts in brainstem and cerebellum had elevated fasting homocysteine levels

Bilaterality of involvement was seen among patients who had hematological and metabolic disorders.

Alcoholism was strikingly prevalent among male patients who had cerebellar infarcts (seven of those twenty had a strong history of alcoholism). Among females infarcts involving the cerebellum accounted for almost half of all strokes.

Patients who had massive cerebellar infarcts and hemorrhages reported headache and had signs suggesting increased intracranial pressure. One patients with cerebellar bleed was successfully operated and other three conservatively managed.

In the study population 14 patients had clinical features suggesting cerebellar involvement and the radiological investigations demonstrated isolated cerebellar involvement in fourteen patients ( 11 had infarcts and 02 had hemorrhage).

Of the eight patients suspected to have lateral medullary syndrome clinically, six had medullary infarcts and the other two had medullary and pontine infarcts.

Five patients suspected to have brainstem involvement had brainstem infarcts in four patients and bleed in 1 patient.

**Table 6.6 Comparison Of Radiological Findings**

| Radiological Findings | Present Study | Kora et.al | Kavita et.al |
|-----------------------|---------------|------------|--------------|
| Cerebellar Infarct    | 36.9%         | 33%        | 37%          |
| Medullary Infarct     | 23.3%         | 26%        | 25%          |
| Occipital Hemorrhage  | 10%           | 6%         | 4%           |
| Brain Stem Infarct    | 13.3%         | 6%         | 12.5%        |

In this study the observed mortality rate was 6.6 % (2/30). In general the rate of death immediately after posterior-circulation stroke is approximately 3 to 4 percent.

In the NEMC-PCR, 3.6 percent of patients died, and 18 percent of patients had a major disability.

It was obvious that an intensive search for factors other than routine risk factors for stroke should be carried out, especially in individuals less than forty years.

### Summary-

From the present study following conclusions were derived.

- Male sex was the predominant population affected by posterior circulation stroke.
- Most commonly, people above 50 years were affected.
- Diabetes Mellitus, uncontrolled hypertension and alcoholism were the major risk factors for posterior circulation stroke

followed by coronary artery disease.

- Alcoholism was a major risk factor for cerebellar infarcts.
- Elderly females had a predilection to cerebellar hemorrhages for unknown reasons.
- Giddiness, vomiting and incoordination were the major presenting symptom of posterior circulation stroke.
- Clinical features suggesting anterior circulation stroke can occur with posterior circulation stroke and careful visual field testing helps in clinical differentiation of both.
- Aggressive search for treatable risk factors should be made in younger patient

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