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# Prospective Study of Correlation of Clinical Features, MRI Brain–MRA Intracranium, Carotid Vertebral Arterial Doppler Study in Ischemic Stroke

[1]Dr. Rajeev Kumar, MBBS, MD (Medicine) Student, Department of General Medicine, Patna Medical College and Hospital, Patna.

[2]Dr. (Prof.) Kaushal Kishore, MBBS, MD (Medicine), DMRD Professor, Department of General Medicine, Patna Medical College and Hospital, Patna.

[3]Dr. Devendra Kumar Sinha, MBBS, MD (Medicine), Assistant Professor, Department of General Medicine, Patna Medical College and Hospital, Patna.

**Corresponding Author:** Dr. Rajeev Kumar, MBBS, MD (Medicine) Student, Department of General Medicine, Patna Medical College and Hospital, Patna

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**Conflicts of Interest:** Nil

## Abstract

**Introduction:** Stroke is a global health issues. In this study defined the risk factors, clinical features and their correlation with Magnetic Resonance Imaging (MRI) brain including Magnetic Resonance Angiogram (MRA) and Carotid Verteberal (CV) Doppler findings in patients. Stroke is the primary cause of disability, the second cause of dementia, and the third cause of death in developed countries. Worldwide, stroke ranks as the fourth most prevalent cause of disability and the second most common cause of death.

**Methods:** The study was based on prospective collection of data of patients aged between 40-80 years diagnosed as ischemic stroke. 75 Patients admitted at PMCH, Patna diagnosed with ischemic stroke confirmed with MRI – MRA imaging at admission and meeting the inclusion criteria as mentioned above, during the study period of January 2023 to June 2024 were taken into consideration for the study.

**Result:** According to MRI 36% of patients had intracranial and 21% had extracranial and 19% had both.

**Conclusion:** The study provides a comprehensive analysis of stroke patients, revealing a higher prevalence among males (73%) compared to females (27%). The most prevalent age range affected was 40 to 80 years old, with diabetes mellitus and hypertension being the most common systemic disorders.

**Keywords:** Carotid Verteberal, Ischemic Stroke, MRI, MRA, MCA.

**Introduction**

Stroke is a global health issue. Every year, almost 200 lakh individuals will experience a stroke, of whom 50 lakhs will not survive. Stroke is the primary cause of disability, the second cause of dementia, and the third cause of death in developed countries. Worldwide, stroke ranks as the fourth most prevalent cause of disability and the second most common cause of death. In highly developed nations, stroke is a major contributor to seizures, falls, and depression. It also causes a significant number of functional impairments; 20% of survivors need hospital and nursing care for longer than three months, and 15% to 30% of patients experience permanent disability. A stroke can alter one's physical and financial circumstances. Strokes cause trauma not just to the victims but also to those close to them.

Global Stroke estimates

- 400-800 strokes per 100,000 (6)
- 57 lakh Deaths (7)
- 160 lakhs new acute strokes every year (1)
- 28,500,000 DALYs (disability adjusted life-year)
- 28–30-day case fatality ranges from 17%-35%Stroke

Morbidity and Mortality in India

- Prevalence 90-222 per 100,000 (2)
- 102, 620 deaths (10)
- 14,40,000-16,00,004 cases of new acute strokes per year (11, 12)
- 6,398,000 DALY's (13)
- 12 percentage of strokes occur in the population aged <40 years (14)
- 28–30-day case fatality ranges from eighteen to forty-one percentage.

Acute disruption of blood flow to the brain region it supplies, typically due to a blood artery burst or obstruction by a thrombus or emboli, is the cause of a stroke. This stops the brain's supply of essential nutrients and oxygen, resulting in an accumulation of free radicals that harm the brain's tissue. Within four to ten minutes, brain tissue can die from an abrupt total obstruction of the brain's blood arteries. The fast onset of clinical signs and symptoms of a localised neurological impairment lasting more than 24 hours or resulting in death with no evident cause other than vascular origin is the WHO's clinical definition of stroke. Ischemic strokes account for 50%–85% of CVA cases. Subarachnoid haemorrhage and intracerebral haemorrhage make up 1%–7% and 7%–27%, respectively, of all strokes that occur globally. According to a study, the death rate for hemorrhagic stroke is substantially higher than that of ischemic stroke.

Brain imaging plays a pivotal role in diagnosis, prognosis, management of stroke patients. Various modalities of imaging such as

- CT scan, CT angiography, CT perfusion studies
- MRI, MRA, MRI – DWI, MRI-PWI
- Carotid and vertebral duplex, transcranial Doppler (TCD), combined duplexand TCD.

**Aims and Objectives**

The aims of the study include

- Percentages of intracranial, extracranial or both involvement in stroke.
- Percentages of anterior and posterior circulation strokes in Patna Medical College andHospital, Patna
- Most commonly involved arteries

The objectives of this study are:

**Primary Objective**: To study whether strokes are intracranial, extracranial or both in origin.

**Secondary Objective**: To analyze which areas of the brain is most commonly affected. To determine clinical correlation with the area of infarct in the brain.

**Materials and Methods**

**Type of Study**: This is a Prospective and Observational study.

**Study Place:** The study was conducted in the Department of Medicine at Patna Medical College and Hospital, Patna.

**Study Period:** This study was conducted from January 2023 to June 2024.

**Sample:** 75 Patients

**Study volunteers**: Specific population & age group: Patients between 40-80 years admitted with ischemic stroke of both sexes.

**Inclusion Criteria**

- Age between 40-80 years
- Patients admitted in general medical ward/neurology ward with ischemic stroke

**Exclusion Criteria**

- Age < 40years
- Age > 80years
- Venous strokes
- Cardio embolic strokes

**Methodology**

The study was based on prospective collection of data of patients aged between 40-80 years diagnosed as ischemic stroke who got admitted in medical ward or neurology ward in a tertiary care center where systematic computer coding for registry was used.

Patients admitted at PMCH, Patna diagnosed with ischemic stroke confirmed with MRI – MRA imaging at admission and meeting the inclusion criteria as mentioned above, during the study period of January 2023 to June 2024 were taken into consideration for the study. A proforma was made which included detailed history, baseline NIHSS admission, clinical examination and requisite investigations available in the hospital. After informed consent from patients, history and risk factors attributable to the stroke were collected in detail. Investigations like complete hemogram, routine urine analysis, blood sugar, serum electrolytes, serum creatinine, blood urea, chest X-ray, FLP, ECHO, electrocardiogram, MRI –MRA intracranial brain, CV Doppler were done in all patients. HbA1C was done if patient was found to be Diabetic based on RBS.

**Statistical tools**

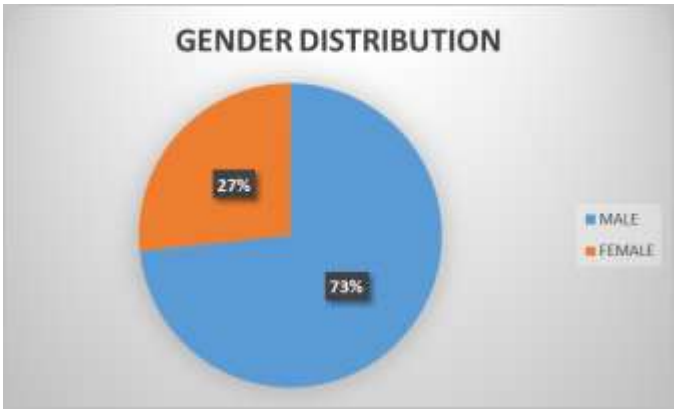
The data collected from the patients admitted with acute stoke and relevant information was tabulated using Microsoft Excel. The patients were admitted in Neurology and General Medicine. The data were reported as the mean +/- SD or the median, depending on their distribution. Frequencies were reported / documented in percentages. The differences in quantitative variables between groups was assessed by means of the unpaired t test. Non parametric test Wilcoxon signed test was used to assess the qualitative variables. To assess the difference in categoric variables between groups chi square test was used. Two tailed tests were considered significant for all statistical tests when p value is **<0.05**. The confidence interval (CI) used for this study is 95%. All data were analyzed with a statistical software package (SSPS version 24.0 for Microsoft windows).

**Results**

Table 1: Gender

| Gender | Patient Count | Percentage |
|---|---|---|
| Male | 55 | 73 |
| Female | 20 | 27 |

Graph 1:




The study cohort comprised 55 male (73%) and 20 female (27%) patients, reflecting a higher representation of males. This gender difference could be attributed to various factors, including the prevalence of cerebrovascular diseases in males, differences in healthcare-seeking behavior, and possibly, the study's specific demographics.

Table 2: Age

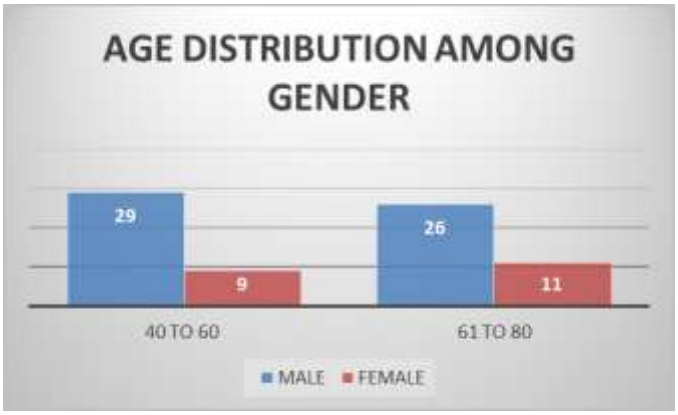
| Age (Years) | Patient Count | Percentage | Mean ± S.D |
|---|---|---|---|
| 40 To 60 | 38 | 51 | 60 ± 10.12 |
| 61 To 80 | 37 | 49 | |

The majority of patients fell within the 40 to 60 age group (51%), with a mean age of 60 ± 10.12 years, indicating that cerebrovascular diseases affect primarily middle-aged to older individuals. The 61 to 80 age group accounted for the remaining 49% of patients, highlighting the significant burden of these diseases in the elderly population.

Table 3: Age Distribution Among Genders

| Age (Years) | Male | Female | Total | Percentage |
|---|---|---|---|---|
| 40 to 60 | 29 | 9 | 38 | 51 |
| 61 to 80 | 26 | 11 | 37 | 49 |
| Total | 55 | 20 | 75 | 100 |

Graph 3:

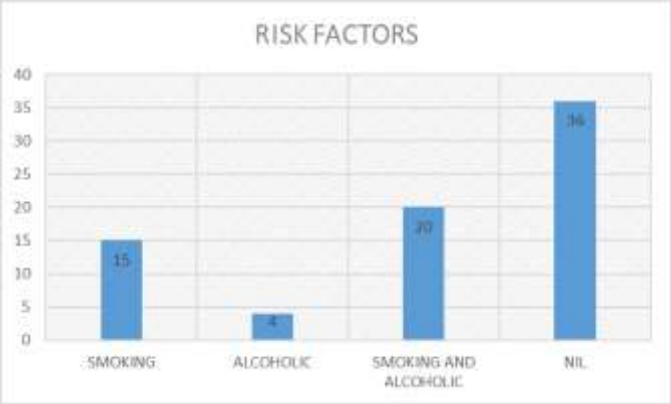



Both genders showed a similar distribution across age groups, with the majority of males (52%) and females (55%) falling in the 40 to 60 age group. This suggests that age may be a more significant factor than gender in the prevalence of cerebrovascular diseases in this population.

Table 4: Risk Factors

| Risk Factors | Patient Count | Percentage |
|---|---|---|
| Smoking | 15 | 20 |
| Alcoholic | 4 | 5 |
| Smoking And Alcoholic | 20 | 27 |
| Nil | 36 | 48 |
| Total | 75 | 100 |

Graph 4:

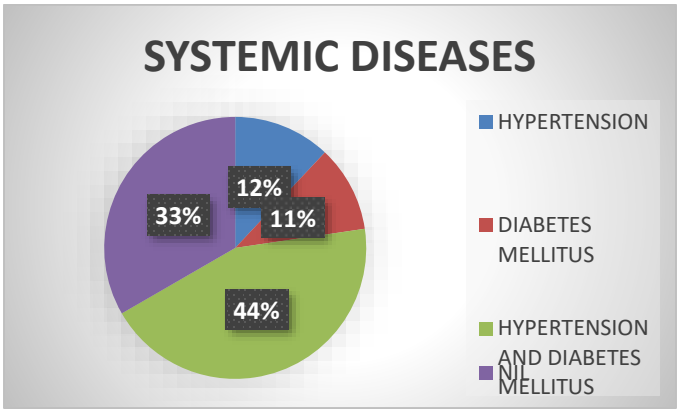



Smoking and alcohol consumption were prevalent risk factors, with 20% of patients reporting smoking, 5% reporting alcohol consumption, and 27% reporting both. However, a significant portion of patients (48%) had no identified risk factors, indicating the need for further research into other potential risk factors or genetic predispositions.

Table 5: Systemic Diseases

| Systemic Diseases | Patient Count | Percentage |
|---|---|---|
| Hypertension | 9 | 12 |
| Diabetes Mellitus | 8 | 11 |
| Hypertension And Diabetes Mellitus | 33 | 44 |
| Nil | 25 | 33 |
| Total | 75 | 100 |

Graph 5:

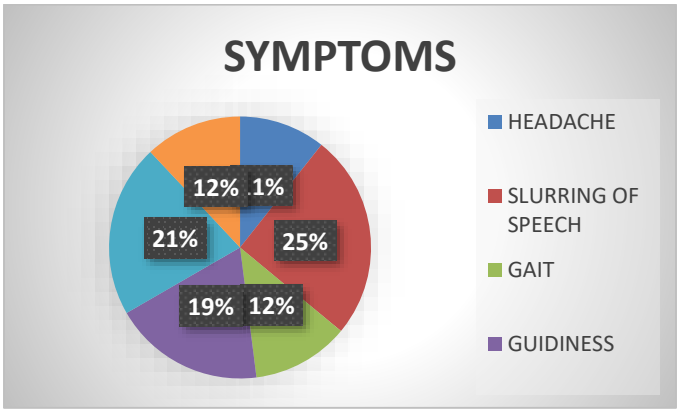



Hypertension and diabetes mellitus were the most common systemic diseases, with 12% of patients having hypertension, 11% having diabetes mellitus, and 44% having both conditions. This underscores the importance of managing these comorbidities to reduce the risk of cerebrovascular diseases.

Table 6: Symptoms

| Symptoms | Patient Count | Percentage |
|---|---|---|
| Headache | 8 | 11 |
| Slurring Of Speech | 19 | 25 |
| Gait | 9 | 12 |
| Guidiness | 14 | 19 |
| Deviation Of Mouth | 16 | 21 |
| Weakness | 9 | 12 |

Graph 6:

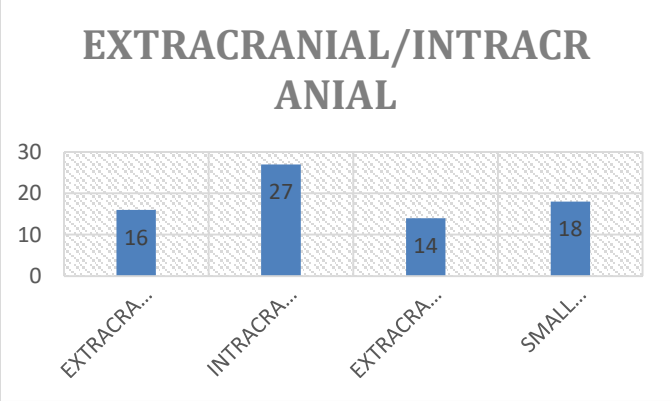



The most common symptoms reported by patients were slurring of speech (25%), deviation of the mouth (21%), and dizziness (19%). These symptoms are indicative of possible stroke or transient ischemic attack (TIA) and highlight the importance of prompt diagnosis and management.

Table 7: Extracranial, intracranial or both

| Extracranial/Intracranial | Patient Count | Percentage |
|---|---|---|
| Extracranial | 16 | 21 |
| Intracranial | 27 | 36 |
| Extracranial And Intracranial | 14 | 19 |
| Small Vessel Ischemia | 18 | 24 |

Graph 7:

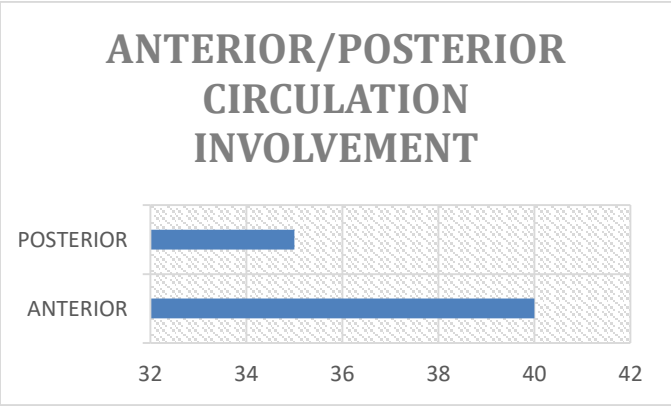



The majority of patients had either intracranial (36%) or extracranial (21%) involvement, indicating the diverse nature of cerebrovascular diseases and the need for comprehensive diagnostic approaches.

Table 8: Anterior and posterior circulation involvement

| Anterior/Posterior Circulation Involvement | Patient Count | Percentage |
|---|---|---|
| Anterior | 40 | 53 |
| Posterior | 35 | 47 |

Graph 8:

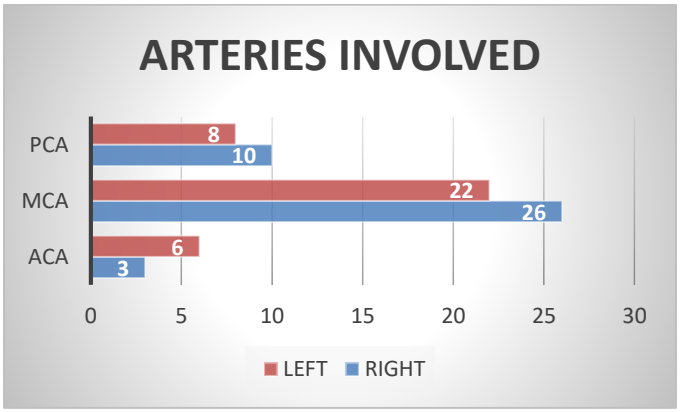



Anterior circulation was more commonly involved (53%) than posterior circulation (47%), which is consistent with the typical patterns seen in cerebrovascular diseases affecting different parts of the brain.

Table 9: Most commonly involved arteries

| Arteries Involved | Right | Left | Total | Percentage |
|---|---|---|---|---|
| ACA | 3 | 6 | 9 | 12 |
| MCA | 26 | 22 | 48 | 64 |
| PCA | 10 | 8 | 18 | 24 |

Graph 9:

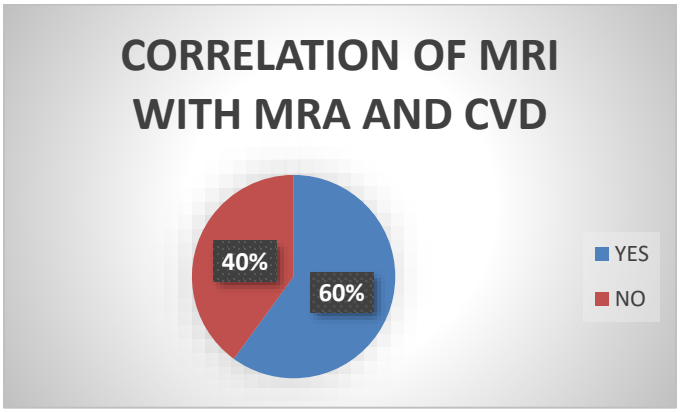



The middle cerebral artery (MCA) was the most frequently involved artery (64%), followed by the anterior cerebral artery (ACA) (12%) and posterior cerebral artery (PCA) (24%). These findings align with the known distribution of arterial territories in the brain and can help guide treatment and management strategies.

Table 10: Correlation of MRI with MRA and CVD

| Correlation of MRI With MRA And CVD | Patient Count | Percentage |
|---|---|---|
| Yes | 45 | 60 |
| No | 30 | 40 |

Graph 10:




A majority (60%) of patients showed a correlation between MRI, magnetic resonance angiography (MRA), and cerebrovascular disease (CVD), highlighting the importance of multimodal imaging in assessing cerebrovascular diseases and guiding treatment decisions.

**Discussion**

Adult stroke rates have been rising sharply in recent years. For AIS patients, a thorough clinical history, an understanding of risk factors, tests, and appropriate stroke therapy are crucial. This investigation included 75 acute ischemic stroke patients:

**Gender Distribution**: According to the data, men are more likely than women to have a stroke (73% vs. 27%). This disparity in gender is consistent with the body of research indicating that males are more likely than women to have strokes and to die from them.

**Age Distribution**: The majority of stroke patients are between the ages of 40 and 80, with the 40 to 60 age group having the biggest percentage (51%) of stroke patients. This result is in line with the established notion that the risk of stroke increases with age, especially after the age of 55.

**Risk Factors**: Alcohol intake and smoking are two important risk factors for stroke, with a sizable percentage of patients (27%) reporting both behaviors. It is crucial to manage diabetes mellitus and hypertension in order to reduce the risk of stroke. These illnesses also greatly increase the risk of stroke.

**Symptoms**: Speech slurring, mouth deviation, and abnormalities in gait are the most often reported symptoms by stroke victims. These signs point to a variety of stroke symptoms, such as difficulties speaking and moving.

**Arterial Involvement**: Sixty-four percent of stroke patients have involvement in the middle cerebral artery (MCA), making it the most frequently implicated artery. This result is in line with the MCA's involvement in blood supply to critical brain regions involved in motor and sensory processes.

**Imaging Results**: The extracranial or intracranial arteries are involved in most patients (36% and 21%, respectively), indicating the variety of anatomical locations associated with stroke.

**Correlation between MRI findings and Magnetic Resonance Angiography (MRA) and cerebrovascular disease (CVD):** The data point to a moderate (60%) correlation between MRI findings and MRA and CVD, highlighting the significance of utilising multiple imaging modalities for a thorough assessment of stroke.

**Strengths of the study**

- Comprehensive Approach: The study offers a thorough examination of acute ischemic stroke (AIS) by analyzing various facets, including gender distribution, age demographics, risk factors, symptoms, arterial involvement, imaging results, and the correlation between clinical presentations and MRI data.
- Data Quality: The study presents data from 75 AIS patients, providing a substantial dataset for analysis

and interpretation.

- Insightful Findings: By examining multiple aspects of AIS, the study offers valuable insights into the characteristics and presentation of the disease.

**Limitations of the study**

- Sample Size: The study's sample size of 75 patients might not adequately represent the entire population of AIS patients, potentially limiting the generalizability of the findings.
- Retrospective Nature: The retrospective design of the study could introduce bias or result in incomplete data collection, impacting the validity of the conclusions.
- Lack of Outcome Data: The study does not include information on treatment outcomes or long-term follow-up, which could provide important insights into AIS management and prognosis.

**Conclusion**

The study provides a comprehensive analysis of stroke patients, revealing a higher prevalence among males (73%) compared to females (27%). The most prevalent age range affected was 40 to 80 years old, with diabetes mellitus and hypertension being the most common systemic disorders. Significant risk variables were alcohol consumption and smoking; 20% of patients reported smoking, 5% reported being an alcoholic, and 27% reported using both.

Clinical symptoms varied, but the most common ones were speech slurring (25%), mouth deviation (21%), and dizziness (19%). According to MRI results, 19% of patients had both extracranial and intracranial involvement, whereas 36% of patients had both. 64% of the time, the most frequently affected artery was the middle cerebral artery (MCA).

Clinical presentations and MRI results showed a high association (93%) that suggests the utility of MRI in the diagnosis of stroke. The study emphasises how crucial it is to identify risk factors early and take immediate action to lower the incidence and consequences of stroke.

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