Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/22251
DOI URL: http://dx.doi.org/10.21474/IJAR01/22251

ISSN (O): 2320-5407
ISSN (P): 3107-4928

RESEARCH ARTICLE

ROLE OF MRA BRAIN IMAGING IN THE MANAGEMENT OF STROKE PATIENTS

Sujoy Tontubay[1] and Sathi Barman[2]

1. Assistant Professor, School of Allied Healthcare and Science, JAIN (Deemed-to-be-University), Whitefield, Bengaluru, India.
2. MRIT, Department of Allied Health Science, Brainware University, India.

Manuscript Info

Manuscript History
Received: 14 September 2025
Final Accepted: 16 October 2025
Published: November 2025

Key words:-
MRA, MRI, Brain imaging, radiology, loss of consciousness, angiography, Stroke Management, Cerebral Vasculature, Diagnostic Imaging, Cerebrovascular Conditions, Diagnostic comparison.

Abstract

Background:MR angiography (MRA) assesses blood arteries and assists in identifying anomalies using radio waves, a computer, and a strong magnetic field. It is essential for stroke patients because it gives doctors comprehensive information about the brain's blood arteries, which enables them to determine the position and extent of vascular blockages that could be the cause of the stroke.

Methods: A total of 100 patients were carried out and categorized into Age/Sex, Patient History, Impressions, Image parameters. Standardized imaging protocol were followed to obtain Magnetic Resonance Angiography Brain Images for each patient. History was taken from the patients or informant. Neurological clinical examination was conducted to define the cerebral artery territory affected. MRA findings were recorded and correlated with distribution of signal abnormalities seen in the MRI sequences.It was a Retrospective Cross-sectional Study.

Results: Our study shows on MRA Brain Imaging, male have higher number of stroke patient compare to female. Out of 100 patients, 72(72.00%) were male and 28(28.00%) were females, with ages ranging from 11 years to 76 years (average age: 55 years). Clinical indications varied, with the most common being Hemiparesis, Hypertension, slurring of speech, Heaviness of Head, Loss of Consciousness, Aneurysm, infarct, lesion and stenosis. For MRI Brain angiography imaging, in males, 66 (91.66 %) of patient had hemiparesis, 57(79.16%) had hypertension, 28(38.88%) had slurring of speech, 43(59.72%) had heaviness of head, 70(97.22%) had loss of consciousness, 7(9.72%) had aneurysm, 49(68.05%) had infarct, 3(4.16%) had lesion and 44(61.11%) had stenosis. And in females, 16 (57.14 %) of patient had hemiparesis, 18(64.28%) had hypertension, 11(39.28 %) had slurring of speech, 13(46.42 %) had heaviness of head, 25(89.28 %) had loss of consciousness, 2(7.14 %) had aneurysm, 20(71.42 %) had infarct, 0(0.00%) had lesion and 14(50.00 %) had stenosis.

Conclusions: The study concludes that male have higher number of stroke patient compare to female along with Loss of Consciousness was the most common clinical symptom. In conclusion, the role of MRA brain imaging in the management of stroke patients is highly significant, offering a superior prognosis in detecting brain strokes.

Corresponding Author:-Sujoy Tontubay
Address:-Assistant Professor, School of Allied Healthcare and Science, JAIN (Deemed-to-be-University), Whitefield, Bengaluru, India.

Introduction:-

Magnetic resonance imaging (MRI) has been shown to be an excellent method for the detection of acute stroke as well as for the evaluation of intracranial and cervical arterial anatomy.[1-3]Magnetic resonance angiography (MRA) is a non-invasive imaging technique based on magnetic resonance imaging (MRI) used for the study of the arterial and venous systems.[6] It offers advantages over traditional angiography, such as non-invasive image-forming, the possibility of non-contrast imaging and high-resolution volumetric imaging. Gadolinium contrast material used in MRA is less likely to induce allergic reactions than iodinated contrast material used in CT scans. The MRA uses a powerful magnetic field, radio waves and a computer to create detailed images of blood vessels, helping to diagnose diseases such as strokes, tumors and heart disease. Techniques such as Time of Flight (TOF) allow visualization of high flow vessels, which is particularly useful for studies of intracranial circulation.

The Loop of Willis, an arterial ring at the base of the brain, plays a critical role in maintaining blood flow during vascular occlusion, demonstrating the usefulness of MRA in assessing the collateral circulation. Although MRI is more accurate than CT in detecting certain brain abnormalities, caution should be exercised in patients with metal implants and contrast agents based on gadolinium should be avoided during pregnancy. MRI and MRA can assess brain damage and its reversibility as well as the risk of complications from the stroke.[4] MRI can also provide guidance for thrombolytic treatment but is not suitable for persons with cardiac pacemakers or certain other metal or electronic devices implanted in their bodies.[4]Magnetic resonance imaging (or MRI) is a test the provides very accurate pictures of the brains and arteries. MRIs are useful for detecting a wide array of blood vessel and brain abnormalities, and is the most accurate technique to determine which areas of the brain have been irreversibly damaged by ischemic stroke.[5] In addition to stroke, MRIs can be used to diagnose several other abnormalities, such as tumors, blood clots, infections and even disorders like multiple sclerosis.[5]

Materials and Methods:-

This Retrospective Cross-sectional Study was meticulously conducted at the Department of Radiology, Spandan Diagnostic, Kolkata, spanning six months from August 26th, 2024, to February 26th, 2025. The study aimed to evaluate and analyze the diagnostic utility of Magnetic Resonance Angiography (MRA) of the brain across a diverse patient population. A total of 100 patients were systematically enrolled, all of whom were referred specifically for MRA Brain examinations based on their clinical indications.Stringent inclusion and exclusion criteria were established to maintain the study's validity and reliability. The study excluded individuals who were pregnant, had metallic implants, experienced claustrophobia, or were deemed uncooperative, ensuring both patient safety and the acquisition of high-quality imaging data. All eligible participants were thoroughly briefed on the study's objectives, procedures, and potential benefits, providing informed consent prior to their inclusion.The standardized imaging protocol involved advanced MRA Brain imaging techniques, conducted under uniform settings to minimize variability. Comprehensive data collection was undertaken, encompassing demographic details such as age and gender, as well as pertinent clinical histories and detailed radiological impressions. The collected data aimed to contribute valuable insights into the clinical efficacy of MRA in diagnosing cerebrovascular conditions, potentially guiding future diagnostic and therapeutic strategies.

This study utilized a 1.5 Tesla SIEMENS MAGNETOM Sola MRI system with a dedicated head coil. All patients were positioned supine, head-first, with the laser beam localizer centered over the glabella for initial setup. A 3 mm slice thickness was employed for all sequences. The imaging protocol consisted of five sequences: LOCALIZE 3PLANE(axial, sagittal, and coronal), T2 TSE TRA(T2-Weighted Turbo Spin Echo Transverse), TOF 3D AXI MULTY-SLAB(Time of Flight 3D Axial Multi-Slab), DIFFUSION TRA(Diffusion-Weighted Imaging Transverse), and GRE TRA(Gradient Echo Transverse), performed for each participant.The collected data underwent systematic analysis using Microsoft Excel for statistical purposes. Excel's built-in functions and tools, like tables, charts, and graphs, were used to visually present the findings. This approach enabled a clear comparison and interpretation of the data. Moreover, correlation analyses were conducted as needed to assess the connections between various clinical variables and imaging results. This supported a thorough comprehension of the study outcomes.

Results and Observation:-

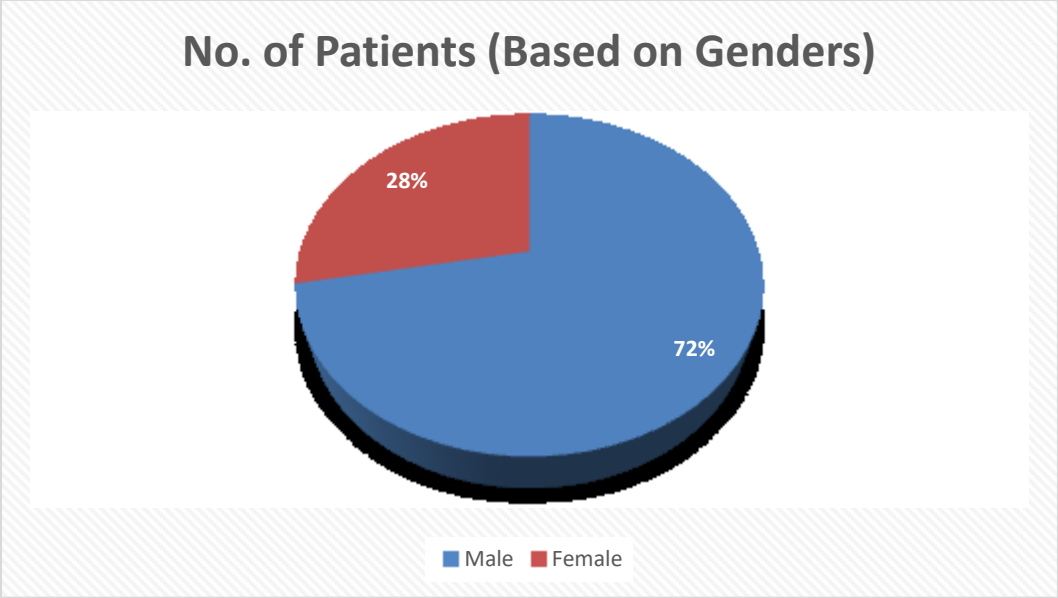
The study involved 100 cases where brain imaging was performed using MRI based on clinical indications. The findings were categorized as follows:

The study population comprised 100 patients, with a male predominance of 72 (72.00%) and 28 (28.00%) females. The age of participants ranged from 11 to 76 years, with a mean age of 55 years. Age distribution was as follows: 12

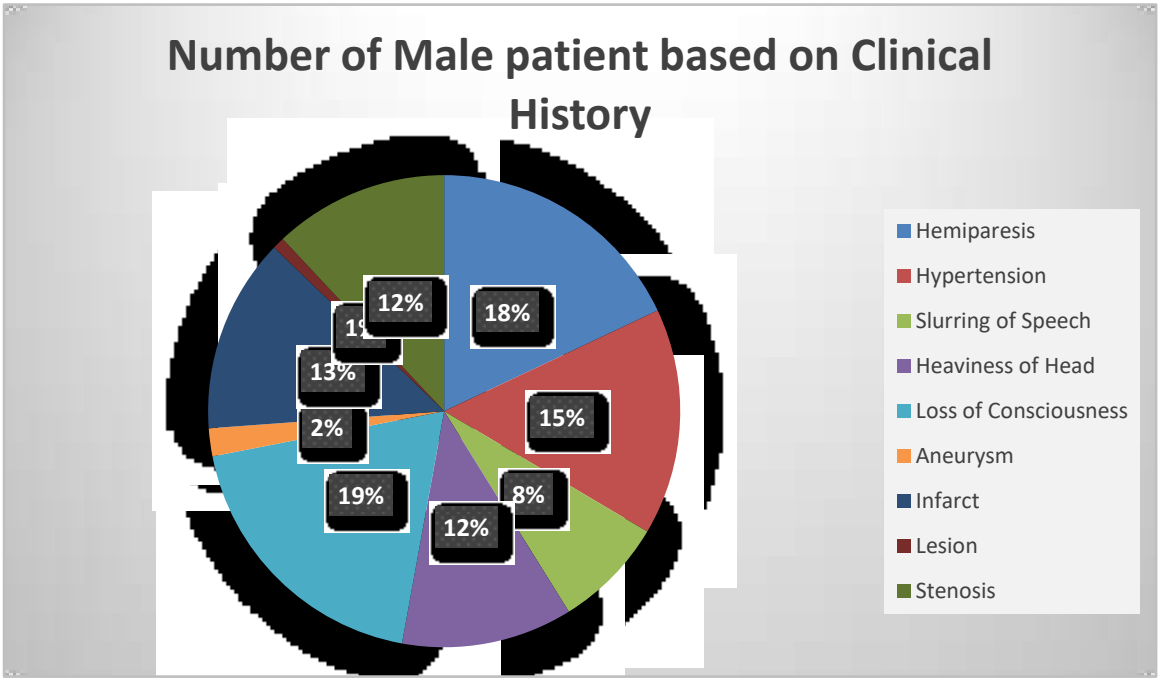
patients (12.00%) were aged 1-20 years, 20 patients (20.00%) were aged 21-40 years, 46 patients (46.00%) were aged 41-60 years, and 22 patients (22.00%) were aged 61-90 years. Among the 72 male patients, the most prevalent clinical histories were loss of consciousness (97.22%), hemiparesis (91.66%), and hypertension (79.16%), followed by heaviness of head (59.72%), stenosis (61.11%), infarct (68.05%), slurring of speech (38.88%), aneurysm (9.72%), and lesion (4.16%). In the 28 female patients, the most common clinical histories were loss of consciousness (89.28%), infarct (71.42%), hypertension (64.28%), hemiparesis (57.14%), stenosis (50.00%), heaviness of head (46.42%), slurring of speech (39.28%), and aneurysm (7.14%); no female patients presented with a clinical history of lesion.

Clinical Indications in Male Patients:
Hemiparesis (91.66%): Predominantly observed in male patients, suggesting a high incidence of motor function impairment.
Hypertension (79.16%): Common among male patients, highlighting a significant risk factor for stroke.
Slurring of Speech (38.88%): Indicates a considerable occurrence of speech difficulties.
Heaviness of Head (59.72%): Reflects a frequent symptom experienced by male patients.
Loss of Consciousness (97.22%): Almost all male patients experienced loss of consciousness, indicating severe stroke episodes. **Aneurysm (9.72%)**: Less common but still present among male patients.
Infarct (68.05%): A substantial number of male patients had infarcts, correlating with stroke incidence.
Lesion (4.16%): Rare but present.
Stenosis (61.11%): Indicates significant vascular narrowing in male patients.

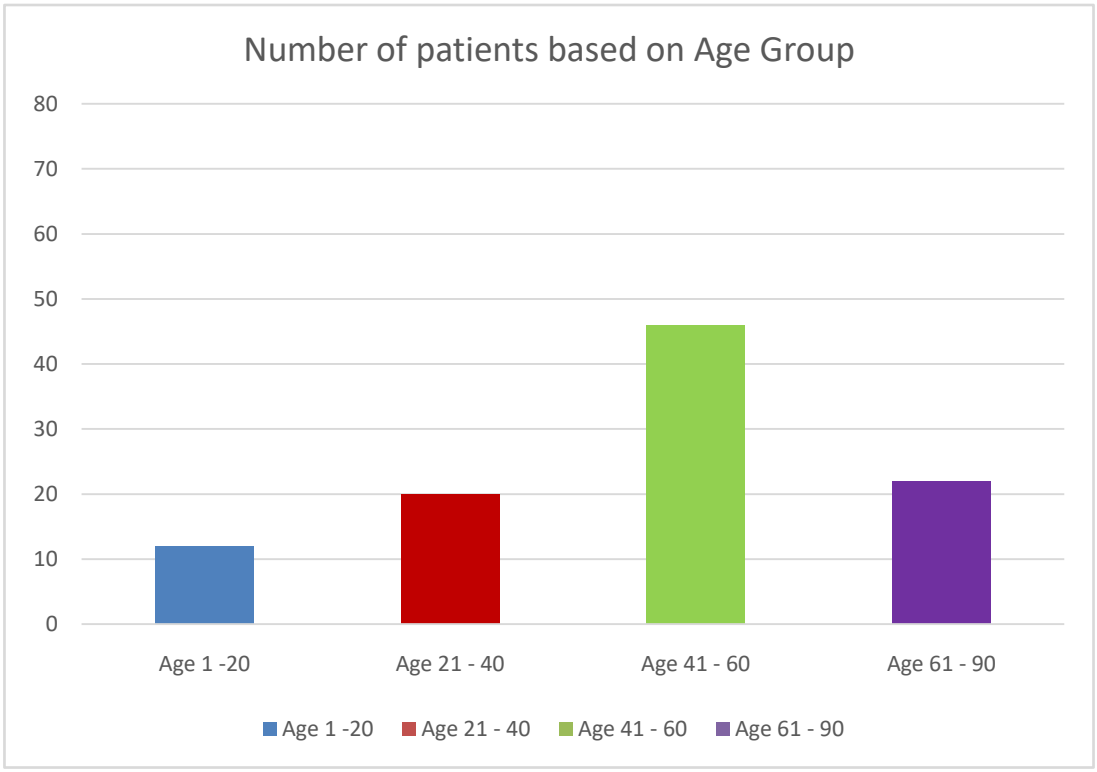
Clinical Indications in Female Patients:
Hemiparesis (57.14%): Less prevalent than in males but still significant.
Hypertension (64.28%): A common risk factor among female patients, though lower than in males.
Slurring of Speech (39.28%): Similar to the prevalence in male patients.
Heaviness of Head (46.42%): A frequent symptom, albeit less than in males.
Loss of Consciousness (89.28%): High prevalence, though slightly lower than in males.
Aneurysm (7.14%): Rare but present.
Infarct (71.42%): Slightly higher than in males, indicating a significant occurrence.
Lesion (0.00%): Not observed in female patients.
Stenosis (50.00%): Less prevalent than in males but still significant.



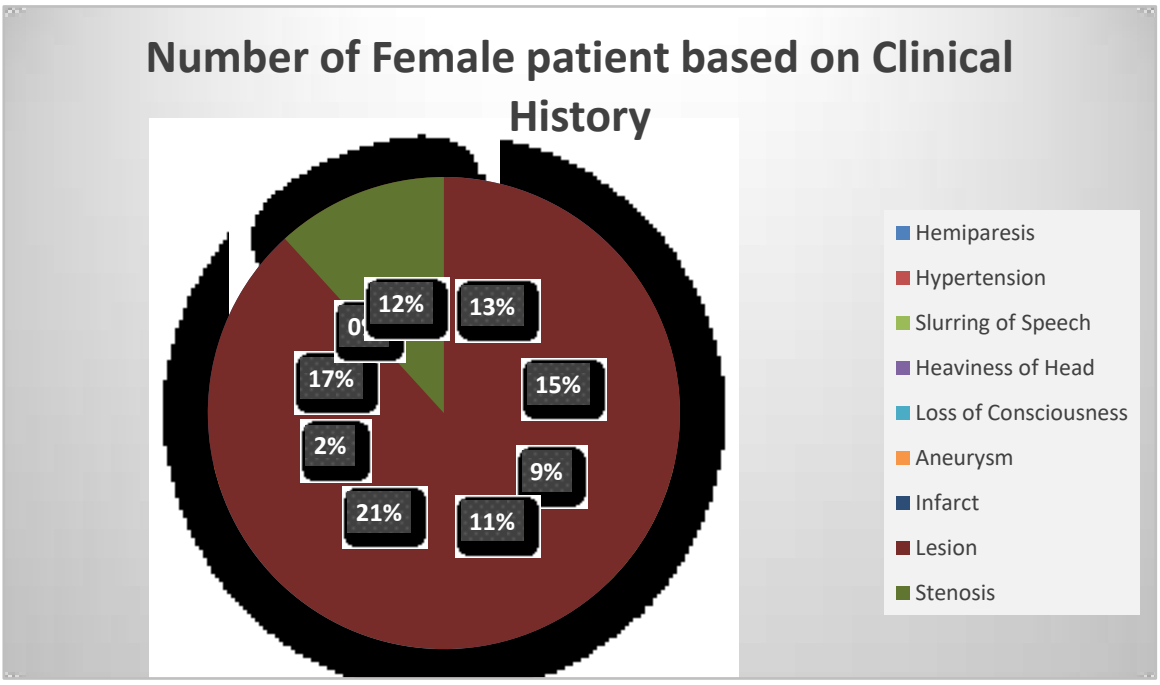
Pie Chart 1. Number of patients based on Gender



Pie chart 2. Number of Male patients based on Clinical History



Graph 1. Number of patients based on Age Group



Pie chart 3. Number of Female patients based on Clinical History

Conclusions:-

The research explored the incidence of stroke in male and female patients through MRA brain imaging among 100 patients aged between 11 to 76 years with a mean age of 55 years. The results revealed a greater proportion of male patients (72%) than female patients (28%). The significant gender imbalance with 72% males and 28% females among the stroke population indicates a huge difference in the incidence of stroke between the genders. This finding is consistent with the literature, which frequently cites higher rates of stroke in men, especially among younger populations.[7-9] A number of factors could explain this difference, such as differences in lifestyle, risk factor prevalence, and biological differences. The mean age of 55 years among stroke patients in this research reveals that stroke frequently occurs in middle-aged and older adults. The broad range of ages (11 to 76 years) demonstrates that stroke can happen to anyone at any age, and it highlights the need for vigilance and precautions in all ages. The research identified various clinical indications with stroke, which included hemiparesis, hypertension, speech slurring, heaviness in the head, loss of consciousness, aneurysm, infarct, lesion, and stenosis.

Male and female patients differed in their prevalence of the conditions, yielding information on gender-specific clinical presentation.[7-9] The findings show that both sexes have a high rate of hemiparesis, hypertension, and infarcts, but the males are at a higher risk of having hemiparesis, hypertension, heaviness of head, and stenosis. The females have a higher rate of infarcts. The much greater incidence of loss of consciousness among both sexes shows it to be an important symptom of stroke severity. The lack of lesions in females and the diminished frequency of stenosis as compared to males could reflect gender-related differences in vascular pathology and etiology of stroke. They point to gender-related differences calling for gender-oriented diagnostic and treatment strategies.In conclusion, the application of Magnetic Resonance Angiography (MRA) brain imaging plays a pivotal and highly significant role in the comprehensive management of stroke patients.[10] Its capacity to provide detailed, non-invasive visualization of cerebral vasculature offers a distinct advantage in the timely and accurate detection of stroke, ultimately contributing to a superior prognosis.[11]

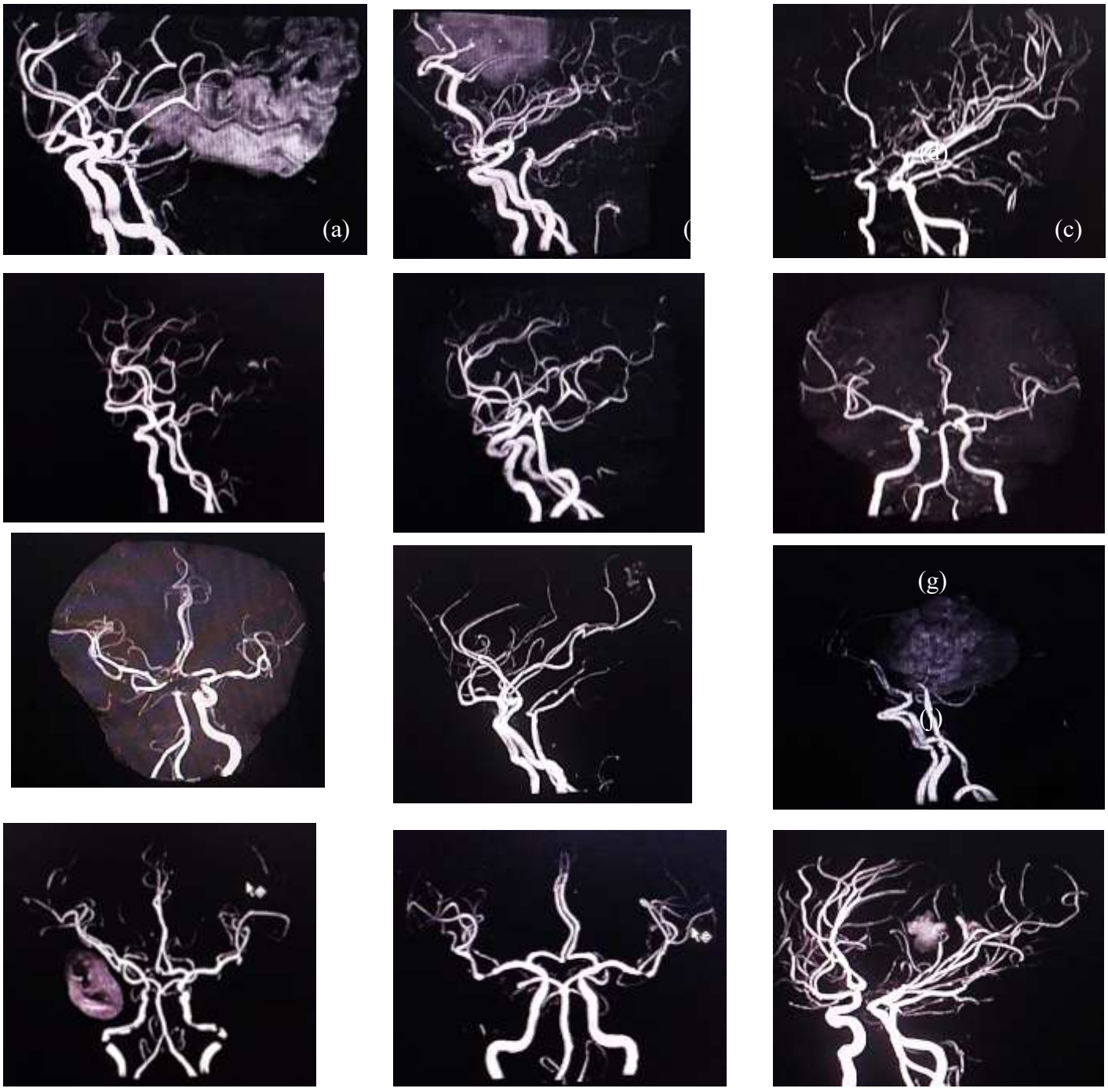


Figure 1 (a to l): MRI brain imaging comparing different stroke patients based on age, sex, medical history, and pathological findings.

(a) Age/Sex - 73y/M, Patient Medical History - Right sided hemiparesis, slurring of speech, HTN+, Pathological Findings - Paucity of the M2 and M3 segment of left cerebral artery. (b) Age/Sex - 26y/M, Patient Medical History - Left sided hemiparesis, HTN+ (Hypertension), Slurring of speech, Pathological Findings - Hypertrophied A2 and A3 segment of the right anterior cerebral artery feeding the nidus of the arteriovenous malformation in right frontal lobe. (c) Age/Sex -12y/M, Patient Medical History - Right sided weakness, LOC (Loss of Consciousness), headache, Pathological Findings - Narrowing of the supraglenoid segment of the left internal carotid artery with

presence of multiple collaterals in the region of left ganglion-capsular region extending along the course of M1 and M2 segment of the middle cerebral artery. (d) Age/Sex -18y/F, Patient Medical History - Left sided hemiparesis, CVA (Cerebral Vascular Accident), Headache, neck pain. Pathological Findings - Attenuated caliber of the M2, M3 segment of the right middle cerebral artery. (e) Age/Sex - 76y/M, Patient Medical History - Weakness, slurring of speech, 2 times CVA, HTN+, Pathological Findings - Diffuse dilated Virchow robin spaces seen in bilateral cerebral hemispheres, basal ganglia and anterior midbrain. Chronic lacunar infarcts are noted in bilateral corona radiata and basal ganglia regions. (f) Age/Sex - 60y/M, Patient Medical History - 3 times CVA, HTN+, Pathological Findings – Chronic lacunar infarcts are seen in bilateral corona radiata in the fronto-patretal regions. There is presence of T2 FLAIR (T2-weighted and Fluid-Attenuated Inversion Recovery) and diffusion hyperintense area seen in left corona radiata which does not show low value on ADC (Apparent diffusion coefficient) map.

A1 segment of right anterior cerebral artery is hypoplastic. Left vertebral artery is hypoplastic in V4 segment. (g) Age/Sex - 60Y/M, Patient Medical History - Left sided hemiparesis, CVA 2 months ago, HTN+. Pathological Findings – Non visualized of right internal carotid artery up to its bifurcation into ACA (Anterior cerebral artery) and MCA (Middle cerebral artery) suggestive of occlusion. Paucity of branches of right ACA and MCA is comparison to their counter parts on the left side. (h) Age/Sex - 11y/M, Patient Medical History - Right sided weakness, LOC few days back, Abnormal behaviors, Pathological Findings – Enlarged left cerebral artery with feeding artery reaching up to the nidus and enlarged draining vein draining into the superior sagittal sinus. (i) Age/Sex - 62y/M, Patient Medical History - CVA, 2 weeks back, HTN+, slurring of speech. DM+, Pathological Findings – Acute intraparenchymal hematoma in early sub-acute stage. Consistent with small vessel chronic ischemic changes. (j) Age/Sex - 20y/F, Patient Medical History - LOC, Seizure, HTN+, Left sided weakness, Pathological Findings – There is a well-defined heterogenous signal intensity lesion of approximately 20 x 20 mm seen in right temporal region. This lesion reveals internal flow voids and is hyperintense on T2 – T1 and FLAIR. It shows internal diffusion restriction with areas of extensive blooming on GRE sequence. It appears to be in continuity with the M2 segment of right MCA. These findings are suggestive of aneurysm. (k) Age/Sex - 60y/M, Patient Medical History - Mild CVA 2days back, weakness, slurring of speech, Pathological Findings - Mild circumferential thickening of the wall of the bilateral common carotid artery extending into the bilateral internal carotid artery – Mild atherosclerotic changes, (l) Age/Sex - 26Y/F, Patient Medical History - Seizure, LOC (Loss of Consciousness), HTN+, Headache, Pathological Findings - A well define SOL (Space Occupying Lesion) noted in left lateral ventricle. Neurocytoma.

Conflict of Interest:
The authors declare that there are no conflicts of interest related to the research, authorship, or publication of this study.

References:-

1. Chalela JA, Kidwell CS, Nentwich LM, Luby M, Butman JA, Demchuk AM, et al. Magnetic resonance imaging and computed tomography in emergency assessment of patients with suspected acute stroke: a prospective comparison. The Lancet [Internet]. 2007 Jan 1;369(9558):293–8. Available from: https://doi.org/10.1016/s0140-6736(07)60151-2
2. Heiserman JE, Drayer BP, Keller PJ, Fram EK. Intracranial vascular stenosis and occlusion: evaluation with three-dimensional time-of-flight MR angiography. Radiology [Internet]. 1992 Dec 1;185(3):667–73. Available from: https://doi.org/10.1148/radiology.185.3.1438743
3. Birenbaum D, Bancroft LW, Felsberg GJ. Imaging in acute stroke. West J Emerg Med 2011 Feb;12(1):67-76. PMID:21694755
4. Pluta RM, Lynm C, Golub RM. Stroke Imaging. JAMA [Internet]. 2011 Sep 20;306(11):1277. Available from: https://doi.org/10.1001/jama.306.11.1277
5. Northwestern Medicine. Magnetic resonance Imaging (MRI/MRA) for stroke [Internet]. Northwestern Medicine. Available from: https://www.nm.org/conditions-and-care-areas/tests/magnetic-resonance-imaging-for-stroke
6. Piyavisetpat N. Magnetic Resonance Angiography (MRA) [Internet]. MedPark Hospital. 2024. Available from: https://www.medparkhospital.com/en-US/disease-and-treatment/mra-magnetic-resonance-angiography
7. Norman K, Eriksson M, Von Euler M. Sex Differences in ischemic stroke within the Younger Age Group: a Register-Based Study. Frontiers in Neurology [Internet]. 2022 Feb 14;13. Available from: https://doi.org/10.3389/fneur.2022.793181

8. Ospel J, Singh N, Ganesh A, Goyal M. Sex and Gender Differences in Stroke and Their Practical Implications in Acute Care. Journal of Stroke [Internet]. 2023 Jan 31;25(1):16–25. Available from: https://doi.org/10.5853/jos.2022.04077
9. Marzo-Ortega H, Navarro-Compán V, Akar S, Kiltz U, Clark Z, Nikiphorou E. The impact of gender and sex on diagnosis, treatment outcomes and health-related quality of life in patients with axial spondyloarthritis. Clinical Rheumatology [Internet]. 2022 Jun 28;41(11):3573–81. Available from: https://doi.org/10.1007/s10067-022-06228-6
10. Alikiotis A. Imaging techniques for stroke patients: What works best? [Internet]. MedShun. 2024. Available from: https://medshun.com/article/what-type-of-imaging-would-you-for-a-stroke-patient
11. Donnelly J, Budohoski KP, Smielewski P, Czosnyka M. Regulation of the cerebral circulation: bedside assessment and clinical implications. Critical Care [Internet]. 2016 May 4;20(1). Available from: https://doi.org/10.1186/s13054-016-1293-6