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ISCHEMIC STROKE: RELEVANCE OF MAGNETIC RESONANCE ANGIOGRAPHY (MRA) FINDINGS AND CORRELATING THE CHANGES WITH VARIOUS CONVENTIONAL AND NONCONVENTIONAL RISK FACTORS

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ABSTRACT

Objective: This study aims to correlate the magnetic resonance angiography (MRA) changes in ischemic stroke (IS) patients to identify various conventional and nonconventional risk factors.
Material & Methods: Total 100 cases with Ischemic stroke (IS) were clinically evaluated including body mass index, dietary habits, and family history of stroke. MR imaging, MRA, and testing for blood sugar and lipid profile were carried out.
Results: The MRA abnormality positively correlated with low density lipids (LDL), Cholesterol and diabetes, and negatively with alcohol consumption and high density lipids (HDL). Out of total 100 patients, 50% were normal, 35% had significant stenosis and 15% had total occlusion. Males have equal incidence of Intracranial stenoses (ICS) and Extracranial stenoses (ECS) but Females are more likely to have ICS. The patients having age <60yrs more likely to have intracranial stenosis & those having age >60yrs are more likely to have extracranial stenosis. Middle cerebral artery (MCA) was the most common arterial territory involved in all stages of infarct. Posterior cerebral artery (PCA) was the next common arterial territory to be involved. Single stenoses are more common in intracranial atherosclerosis (ICAs) and multiple stenoses are more common in extracranial atherosclerosis (ECAs).
Conclusion: MRA is a robust imaging technique for determining the severity of stenosis, vascular occlusion, and collateral flow and in the determination of stroke etiologies.
Keywords: Extracranial, Ischemic stroke, Lipid profile, Magnetic resonance angiography, Stenosis.

INTRODUCTION

The term "stroke" according to WHO is defined as rapidly developing clinical symptoms and or signs of focal and at times global cerebral functions with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin.

A focal neurologic deficit less than 24 hours is defined as a transient ischemic attack (TIA) and when it exceeds 24 hours and resolves within one week, termed reversible ischemic neurologic deficit (RIND).

Approximately 75% of all strokes are ischemic in origin. Out of these, four fifth by atherosclerosis and about one fifth cases by thromboembolism from heart. Very few cases of ischemic stroke can also result from fibro muscular dysplasia, intracranial dissection, Moya-Moya disease, or vasculitis (Takayasu disease, giant cell arteritis, collagen vascular diseases, systemic necrotizing vasculitis, granulomatous angiitis of the nervous

system). A reduction in blood flow that lasts for several seconds or minutes causes Cerebral ischemia and if the cessation of blood flow lasts for more than 5 minutes 'infarction of brain' tissue results.

Risk factors for carotid disease are : age, cigarette smoking, alcohol consumption, hyperlipidemia, hypercholesteremia, hypertension, diabetes mellitus, obesity, type A personality, insufficient physical exercise, newer risk factor like homocystiene and lipoprotein (a) etc., contributes to development of plaque formation and subsequent narrowing of the lumen of the vessels.

Angiography, especially the three-dimensional time-of-flight technique, is very helpful non-invasive diagnostic tool for early identification of suspected steno-occlusive disease either extracranial or intracranial. In the studies of Masaryk[2] *et al* and Heiserman[1] *et al*, the findings of MRA and conventional angiography were well correlated as about 80% to 98% in diagnosis of ECCA diseases. Overall sensitivities of 85% and 88% and specificities of 96% and 97% for ICCA and middle cerebral artery, respectively, have been reported.[1,2] However the studies regarding the Indians are incomplete.

Our purpose is to evaluate the location and distribution of severe atherosclerotic stenosis in Indian patients by using MR angiography & to correlate the changes with various risk factors.

MATERIALS AND METHODS

A total of 100 patients belonging to all age & sex groups with H/O focal neurological deficit with suspected stroke underwent MR angiography study by using 3-D time of flight technique on a 1.5T machine with a standard head coil. According to clinical history all the extracranial angiography findings were grouped into symptomatic side and contralateral side. Results that were 50% were recorded as significant stenosis.

Pre Procedural Work up of patients:

A detailed history has been taken from all patients and they underwent a thorough neurological examination and designated as having

(l)TIA (2) RIND (3) Stroke in evolution (4) Completed Stroke

Patients are designated as having ischemic stroke by following criteria:

1. Patients have stroke as indicated by clinical examination, and CT scan / MR document the presence of infarction.
2. Patients have stroke as indicated by clinical examination, with a normal CT scan / MRI study (hemorrhage ruled out).

Scanning parameters taken are shown in Table I.

H / O alcohol consumption recorded.

Other Investigations

Along with baseline investigations, blood sugar & lipid profile was done to estimate LDL, HDL & Cholestrol levels.

RESULTS

In all the patients, Vessels are classified as

(1) Normal or clinically non significant stenosis (ie, <50% stenosis),

(2)Clinically significant stenosis (>50% stenosis),

(3) Total occlusion on the symptomatic side and the contralateral side respectively.

Table II shows that patients having age <60yrs more likely to have intracranial stenosis & those having age >60 yrs are more likely to have extracranial stenosis. Also Males have equal incidence of ICS & ECS but Females are more likely to have ICS.

MCA was the most common arterial territory involved in all stages of infarct. (Figure I &III).

PCA was the most common arterial territory to be involved next to MCA. ACA & MCA both were involved in 6% of cases. (Figure II &IV).

The commonest presenting symptom in patients with cerebral infarction was hemiparesis (52.6%), right being slightly more common (30.7%) than left (21.9%)

Headache was seen in 17.5% cases. Cerebellar symptoms were noted in 13.2% of cases. Monoparesis was found in 9% of cases.

Single stenoses are more common in ICAs & multiple stenoses are more common in ECAs. However ICAs are more likely to have stenoses.

Table III shows that increased LDL, Cholesterol & blood sugar level & decreased HDL level are associated with increased frequency of stenoses.

DISCUSSION

The present study was undertaken to evaluate the location & distribution of vascular lesions in cerebrovascular steno-occlusive diseases in Indian patients with the use of Magnetic Resonance Angiography. A total of 100 patients were included in the study. Out of total, 50% are either normal or having clinically non-significant stenosis (<50% stdnosis), 35% are having clinically significant stenosis (>50% stenosis), 15% are having total occlusion of the vessel.

In this study, 45 patients are having age <60yrs. Out of these 15(15%) patients are normal, 10(10%) have ECS & 20(20%) have ICS. 55 patients are of age >60yrs. Out of these, 20(20%) have ECS & 15(15%) have ICS. So, the patients having age <60yrs more likely to have intracranial stenosis & those having age >60yrs are more likely to have extracranial stenosis. These findings correlate well with G. Neil Thomas et al[19] .

The study group comprised of 65 males & 35 females. Out of these, 50 males & 15 females have stenotic lesions. Males have equal incidence of ICS (25%) & ECS (25%) but Females are more likely to have ICS(10% ICS & 5% ECS). Similar findings were observed in study done by Tatjana Rundek[18].

The commonest presenting symptom was hemiparesis in 60(52.6%) patients, right sided being slightly more common (30.7%) than the left (21.9%). Truwit et al and Winer et al also reported a similar incidence of hemiparesis in their studies. Monoparesis was seen in 10 (9%) patients, headache in 20(17.5%) patients and cerebellar symptoms were noted in 15(13.2%) patients.

MCA was the most common arterial territory to be involved in all stages of infarcts 34(34%). PCA was the next most common 10(10%) to be involved.These findings correlate well with study done by Hossein Zarei *et al*[15].

The present study shows single stenoses are more common in ICAs (25%) & multiple stenoses are more common in ECAs (15%). Findings were similar to the study done by Dae Chul Suh et a1[16].

The study shows increased LDL (>l30mg/dl), Cholesterol level (>200mg/dl), blood sugar (> 120 mg/dl) & decreased HDL (<30mg/dl) level are associated with increased frequency of stenoses. Similar findings were noted by Ellisiv B. Mathiesen[17] et al & G. Neil Thomas et al[19].

CONCLUSION

In acute stroke cases, the study of cerebral vasculature is very important for management of it, the usefulness of MRA is proved for determine vascular occlusion, collateral flow and the severity of stenosis. Intracranial proximal stenoses and occlusions are accurately evaluated by three-dimensional TOF MRA and for determining collateral blood flow patterns in the circle of Willis, Two-dimensional PC MRA is more useful.MRA is also helpful in the recognition of stroke aetiologies such as dissection, fibromuscular dysplasia, vasculitis, and moya moya. The relatively insensitiveness of MRA to detect of the stenoses in distal intracranial vessels is also useful for development of new MR software and hardware. Also correlation of lipid profile with stroke may be used in the future to monitor response to lipid-lowering drug therapy.

REFERENCES

1. Heiserman JE, Drayer BP, Fram EK, Keller PJ, Bird R, Hodak JA, Flom RA. Carotid artery stenosis: clinical efficacy of 2D TOF MR Angiography. Radiology, 1992:182:761-768

2. Masaryk AM, Ross JS, DiCello MC, Modic MT, Paranandi L, Masaryk TJ. 3D TOE MR Angiography of carotid bifurcation: potential & limitation as screening examination. Radiology, 1991; 1 79:797-804.
3. S Warach, W Li, M Ronthal and RR Edelman Acute cerebral ischemia: evaluation with dynamic contrast-enhanced MR imaging and MR angiography Radiology, Vol 182, 41-47.
4. Yang Janice J. ; Hill Michael D. ; Moorish William F. Hudon Mark E. ; Barber Philip A.; Demchuk Andrew M. Sevick Robert J. ; Frayne Richard. Comparison of Pre- and postcontrast 3D time-of-flight MR angiography for the evaluation of distal intracranial branch occlusions in acute ischemic stroke. Amer journal of neuroradiology 2002, vol. 23, no.4, pp. 557-567.
5. Nicoletta Anzalone, MD, Francesco Scomazzoni, MD, Renata Castellano, MD, Laura Strada, MD, Claudio Righi, MD, Letterio S. Politi, MD, Miles A. Kirchin, PhD, Roberto Chiesa, MD and Giuseppe Scotti, MD Carotid Artery Stenosis: Intraindividual Correlations of 3D Time-of-Flight MR Angiography, Contrast-enhanced MR Angiography, Conventional DSA, and Rotational Angiography for Detection and Grading Radiology 2005;236:204-213.
6. Michel Nonent, MD, Jean-Michel Serfaty, MD, PhD, Norbert Nighoghossian, MD, Francois Rouhart, MD, Laurent Derex, MD.Concordance Rate Differences of 3 Noninvasive Imaging Techniques to Measure Carotid Stenosis in Clinical Routine Practice Stroke. 2004; 35:682.
7. Luca Remondaa, Pascal Sennb, Alain Barthb, Marcel Arnoldc, Karl Olof Lovbladа and Gerhard Schroth Contrast-Enhanced 3D MR Angiography of the Carotid Artery: Comparison with Conventional Digital Subtraction Angiography .American Journal of Neuroradiology 23:213-219, February 2002.
8. Mirco Cosottini, MD; Alessandro Pingitore, MD, PhD; Michele Puglioli, MD; Maria Chiara Michelassi, MD; Giancarto Lupi, M DContrast-Enhanced Three-Dimensional Magnetic Resonance Angiography of Atherosclerotic Internal Carotid Stenosis as the Noninvasive Imaging Modality in Revascularization Decision Making. Stroke. 2003;34:660
9. Nederkoorn PJ, Mali WP, Eikelboom BC, Elgersma OE, Buskens E, Hunink MG, Kappelle U, Buijs PC, Preoperative diagnosis of carotid artery stenosis: accuracy of noninvasive testingStroke. 2002 Aug;33(8):2003-8.
10. Tomanek Al, Coutts SB, Demehuk AM, Nudon ME, Morrish WE, Sevick RJ, MR angiography compared to conventional selective angiography in acute stroke Can J Neurol Sd. 2006 Feb;33(1):58-62
11. Sarah M. Debrey, BA; Hua Yu, MD; John K. Lynch, DO, MPH; Karl-Olof LOvblad, MD; Violet L. Wright, RN; Sok-Ja D. Janket, MD, MPH Alison E. Baird, FRACP, PhD Diagnostic Accuracy of Magnetic Resonance Angiography for Internal Carotid Artery Disease 2008.
12. TS Riles, EM Eidelman, AW Lift, RS Pinto, F Oldford and GW Schwartzenberg Comparison of magnetic resonance angiography, conventional angiography, and duplex scanning 1992.
13. C.G. Choia, D.H. Leea, J.H. Leea, H.W. Pyuna, D.W. Kangb, S.U. Kwonb, J.K. Kimc, S.J. Kima and D.C. Suh Detection of Intracranial Atherosclerotic Steno-Occlusive Disease with 3D Time of-Flight Magnetic Resonance Angiography with Sensitivity Encoding at 3T 2007.
14. L Remonda, 0 Heid and G Schroth Carotid artery stenosis, occlusion, and pseudo-

occlusion: first-pass, gadolinium-enhanced,three-dimensional MR angiography--preliminary study 1998 Vol 209, 95-102.

15. Hossein Zarei(1), Hosseinali Ebrahimi(2), Kaveh Shafiee(3), Mehrdad Yazdani(4), Kazem Aghili intracranial stenosis in patients with acute cerebrovascular accidents.
16. Dae Chul Suh, Soo-Hyun Lee, Kyung Rae Kim, Sung Tae Park, Soo Mee Urn, Sang Joon Kim, Choong Gon Choi and Ho Kyu Lee Pattern of Atherosclerotic Carotid Stenosis in Korean Patients with Stroke: Different Involvement of Intracranial versus Extracranial Vessels 2003.
17. Ellisiv B. Mathiesen, Oddmund Joakimsen, Kaare H. Bønaa Prevalence of and Risk Factors Associated with Carotid Artery Stenosis: The Tromsø Study 2001.
18. Tatjana Rundek, MD, PhD Do Women Have Worse Outcome After Stroke Caused by Intracranial Arterial Stenosis 2007.
19. G. Neil Thomas et al Increasing Severity of Cardiovascular Risk Factors With Increasing Middle Cerebral Artery Stenotic Involvement inType 2 Diabetic Chinese Patients With Asymptomatic Cerebrovascular Disease 2004.

Table I: Scanning Parameters

Patient Preparation	Extracranial MRA
Plane	Axial
Mode	3D
Pulse Sequence	3D FFE
Imaging Options	Fast
TE	3.9
TR	20
Flip Angle	22
Bandwidth	31.25
Frequency	256
Phase	192
NSA	2
FOV	15
Slice thickness	1.0
Spacing	0
Scan Time	5.3

Table II Age & Sex Distribution of cases

Site of Stenotic Lesion	Age		Sex	
	< 60 yrs	>60 yrs	Male	Female
Normal	**15**	**20**	**15**	**20**
ECS	**10**	**20**	**25**	**05**
ICS	**20**	**15**	**25**	**10**

Table III Correlation between LDL, HDL, Cholesterol level , blood sugar & frequency of Stenoses

Particulars	Normal level in no. of patients	Abnormal level in no. of patients	No. of stenotic patients
LDL	55	Increased in 45	40
HDL	70	Decreased in 30	25
Cholestrol	60	Increased in 40	30
Blood sugar	40	Increased in 60	47

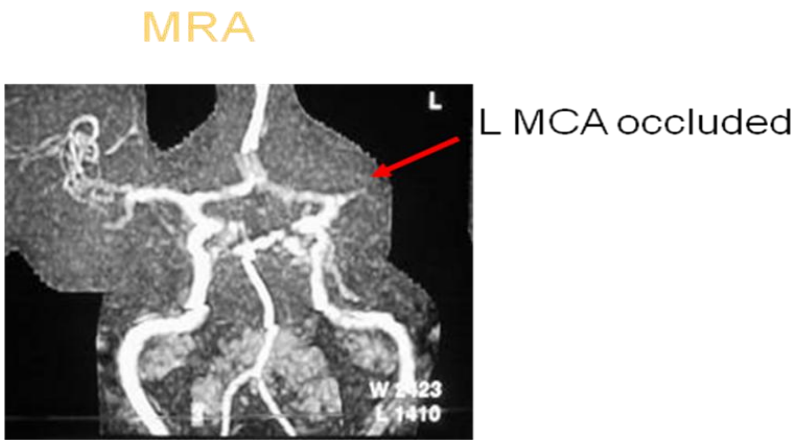

Figure I: Hyperacute Mca Infarct

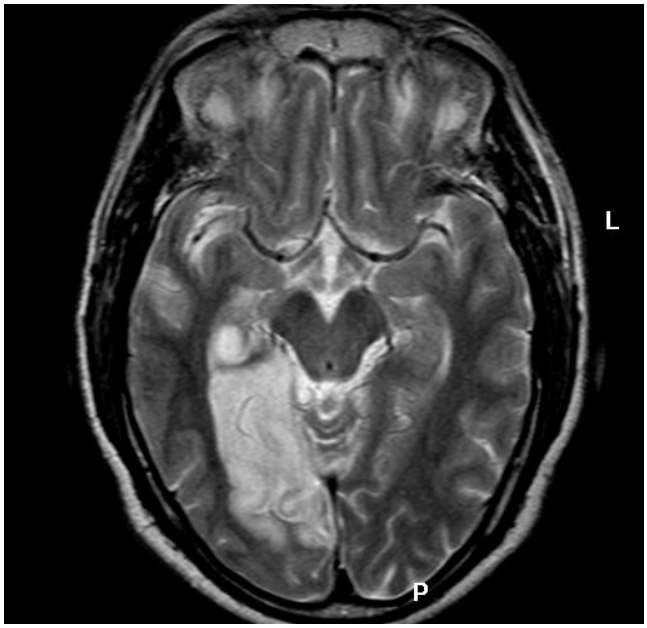

Figure II : PCA INFARCT

Figure III: Subacute Mca Infarct

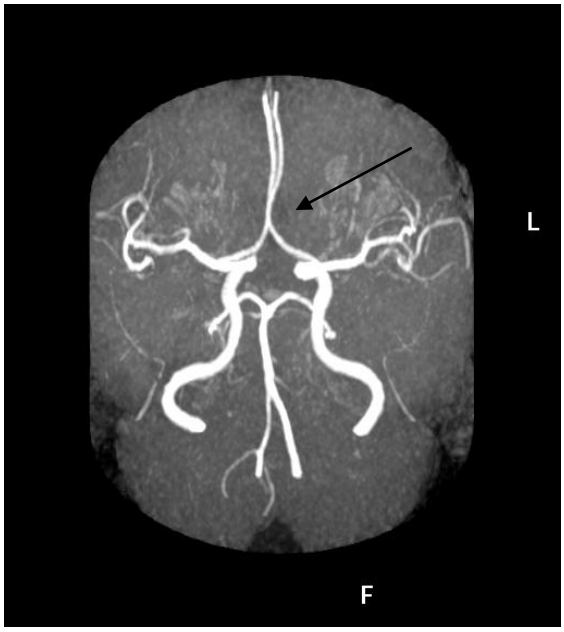

Figure IV: Aca Infarct