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 et al and Heiserman 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.

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 (1) 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% stenosis), 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 Rundek18.

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 al15.

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 al16.

The study shows increased LDL (>130mg/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. Mathiesen17 et al & G. Neil Thomas et al19.

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 moyamoya. 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.

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Table I: Scanning Parameters

<table>
<thead>
<tr>
<th>Patient Preparation</th>
<th>Extracranial MRA</th>
</tr>
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<tbody>
<tr>
<td>Plane</td>
<td>Axial</td>
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<tr>
<td>Mode</td>
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<tr>
<td>Pulse Sequence</td>
<td>3D FFE</td>
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<td>Imaging Options</td>
<td>Fast</td>
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<tr>
<td>TR</td>
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<td>Flip Angle</td>
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<td>Scan Time</td>
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Table II Age & Sex Distribution of cases

<table>
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<th>Site of Stenotic Lesion</th>
<th>Age</th>
<th>Sex</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 60 yrs</td>
<td>&gt;60 yrs</td>
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<tr>
<td>Normal</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>ECS</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>ICS</td>
<td>20</td>
<td>15</td>
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</table>
Table III Correlation between LDL, HDL, Cholesterol level, blood sugar & frequency of Stenoses

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Normal level in no. of patients</th>
<th>Abnormal level in no. of patients</th>
<th>No. of stenotic patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL</td>
<td>55</td>
<td>Increased in 45</td>
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<tr>
<td>HDL</td>
<td>70</td>
<td>Decreased in 30</td>
<td>25</td>
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<tr>
<td>Cholesterol</td>
<td>60</td>
<td>Increased in 40</td>
<td>30</td>
</tr>
<tr>
<td>Blood sugar</td>
<td>40</td>
<td>Increased in 60</td>
<td>47</td>
</tr>
</tbody>
</table>

Figure I: Hyperacute Mca Infarct

Figure II: PCA INFARCT
Figure III: Subacute Mca Infarct

Figure IV: Aca Infarct