"MRI Evaluation of Ischemic Lesions of Brain"

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Abstract:

Introduction: Stroke has been recognised as an important cause of disability and rehabilitation of survivors and is a great socioeconomic challenge because the treatment is costly and of prolonged duration.

Study design: This prospective observational study was undertaken in patients suspected / detected to have cerebrovascular accidents. The present study included 220 cases of ischemic stroke, amongst them 84.10 % patients had arterial infarcts and 15.90% patients had venous infarcts. The male: female ratio of 1.44: 1 was seen in the patients with stroke.

Observations & Results: The mean age of arterial ischemic stokes was 60.1 years, and maximum number of cases were noted in seventh decade (36.22%). The incidence of stroke was increasing with age. Out of total 185 cases detected of having Arterial infarcts, 10 had Hyperacute infracts; 114 had Acute infracts; 9 had Sub acute infracts; 19 had Old infracts and 33 had both Acute as well as Old infracts.

The commonest site of involvement by ischemic stroke was in the middle cerebral artery (65.40%), followed by posterior cerebral artery (26.48%). Supratentorial compartment was predominantly involved in 76.75% of patients and infratentorial compartment was involved in 11.35% of patients. 11.89% patients had involvement of both supra as well as infratentorial compartments. 38 (20.54%) patients had infarctions in either or both of the cerebellar hemispheres and 10 patients (5.40%) had brain stem infarcts. Diffusion weighted images were very sensitive in detecting ischemic lesions and it detected 290 lesions out of 290 lesions.

Conclusion: In hyperacute infarcts only Diffusion sequences were able to detect the lesions as opposed to other routine MRI sequences.

Keywords: Stroke, Ischemic lesions of brain, Magnetic Resonance Imaging, Diffusion MRI

Introduction:

Today all over the world, stroke is a leading cause of death and disability. Earlier, the diagnosis of stroke was largely dependent on bedside clinical evaluation. Knowledge of the localization and the nature of underlying pathologic process could only be verified independently at post-mortem; which seriously hampered initial attempts at developing and implementing appropriate therapeutic interventions. Advances in neuroimaging technology has lead to a much better understanding of Cerebrovascular and tissue pathology, creating a wide array of opportunities for acute treatment and secondary prevention. Advances include early and accurate detection of ischemic and infarcted tissue and also the ability to reveal hypoperfused tissue at risk. Clinicians are increasingly able to noninvasively detect embolic and atherothrombotic intravascular lesions.¹

In majority of patients with ischemic stroke, cranial Computerised Tomography (CT ) scan is used to
confirm the diagnosis and to rule out cerebral haemorrhage or other diseases that may present with similar symptoms.²
But the sensitivity of CT is less in the earlier phase of the ischemic insult causing a delay in the diagnosis. Magnetic Resonance Imaging (MRI) shows the abnormalities suggestive of cerebral ischemic damage earlier than CT.³
Although strokes are more common in the older age group; stroke can also occur in young adults.⁴ Most strokes occurring in this age group are ischemic in origin.
CT in hyperacute stroke is the standard of care, an accurate detection of infarct location and a rough estimation of infarct size (more or less than one third of the MCA territory) is achieved in only 50% to 67% of patients in an early time window.⁵ Therefore, CT does not meet the present requirements of diagnostic sensitivity in hyperacute stroke patients to allow optimal patient selection for thrombolytic therapy or more invasive means to achieve recanalization. Detection of vessel occlusion with Doppler sonography is time consuming, highly dependent on examiner experience, and may technically not be possible, whereas a short fast MR angiography sequence offers this information within 3 minutes.⁶
Data on patterns of stroke from rural areas in India is limited. Hence this study was undertaken to fill this void.

Materials and Methods:
This prospective study was officially permitted by the Institutional Ethical Committee. A prospective study of 220 cases suspected / detected to have cerebrovascular accidents was conducted during the period from August-2010 to July-2012. All patients with neurological deficit coming to radiology department for Magnetic Resonance Imaging were included in study. Patients with normal MRI and having intracranial haemorrhages were excluded from the study. Patients who were imaged with MRI for other indications but were positive for ischemic type of stroke were also included in study. Indoor as well as OPD cases selected irrespective of age and sex.
The MRI scan was performed using PHILIPS ACHIEVA High gradient MRI Scanner. This scanner possesses a superconducting magnet with magnetic field strength of 1.5 Tesla. Standard head coils (SENSE-HEAD-8 and SENSE-NV-8) were used for the acquisition of images. Conventional spin echo sequences, T1, T2 axial and sagittal images, FLAIR axial and coronal images, GRE axial, DW and ADC axial images were taken. Additional MR Angiography and MR Venography sequences were also taken.

Results:
Out of the 220 cases, 185 had arterial ischemic stroke and 35 had venous infarcts. There were 130 males and 90 females in the study.
In arterial infarcts, Hyperacute infarcts were seen in 5.40% cases, Acute infarct in 61.62%, Sub acute infarct in 4.86%, Acute as well as Chronic infarcts in 17.83% cases. Distribution of arterial infarcts is as shown in Figure 1.

Region or location wise distribution of ischemic stroke (n=185) from arterial causes is shown in Figure 2. In this study; Supratentorial lesions were seen in 76.75% cases, Infratentorial in 11.35% and both supra as well as infratentorial lesions were seen in 11.89% cases.

Stroke due to venous occlusions was seen in 35 cases. Region or location wise distribution of ischemic stroke (n=35) from venous causes is shown in Figure 3. Superior Sagittal Sinus was occluded in 68.57% cases, Lateral sinus in 60%, Straight sinus in 8.57% and Cerebral veins were occluded in 5.71% cases.
Figure 1: Distribution of arterial infarcts observed in this study

Figure 2: Region or location wise distribution of ischemic stroke (n=185) from arterial causes

Figure 3: Region or location wise distribution of ischemic stroke (n=35) from venous causes
Discussion:
Among the various causes of stroke arterial ischemic stroke is the most common, followed by venous infarcts, intraparenchymal bleed and subarachnoid hemorrhage. Among the different vascular territories involved in ischemic stroke, middle cerebral artery involvement is the most common, followed by posterior cerebral artery involvement. Posterior fossa involvement is relatively rare.

The present study included 220 cases of ischemic stroke, amongst them 84.10% patients had arterial infarcts and 15.90% patients had venous infarcts. In our study, 130 out of 220 patients having ischemic stroke were male and 90 patients were females with male : female ratio of 1.44 : 1. This is correlated with study of A. Shuaib et al and Andrew Kertesz et al. Also in P. M Dalal study male to female ration was 1.4 : 1. Few of the other series had a male preponderance greater than that in our study.

The mean age of arterial ischemic strokes was 60.1 years, with age range from 13 years to 99 years. The maximum number of cases were noted in seventh decade (36.22%) with more than 56% patients were >60 years of age. The incidence of stroke was increasing with age. This may be direct consequence of prolonged exposure to previously recognized risk factors or development of new risk factors arising as a part of aging process. This also correlated with study of Venketswamy P et al, who had reported a mean age of onset of 56.9 years.

In our study, supratentorial compartment was predominantly involved in 76.75% of patients and infratentorial compartment was involved in 11.35% of patients. 11.89% patients had involvement of both supra as well as infra tentorial compartments. In the study conducted by Andrew Kertesz et al 88% had supratentorial and 12% had posterior fossa involvement. So we found relatively increased incidence of infratentorial strokes. This was due to the fact that, in our institution there is an increased incidence of referral for MR imaging for suspected posterior fossa infarcts, as compared to supratentorial infarcts, where the primary imaging modality is CT followed by MRI.

Most common presentations of the patients with cerebellar infarction were ataxia, vertigo, vomiting gait disturbance and headache. These observations correlate with Tohgi et al who observed that most common clinical presentations were with vertigo, vomiting and headache. Diffusion weighted images were very sensitive in detecting ischemic lesions. DW images detected 290 lesions out of 290 lesions. In hyperacute infarcts only DW sequences were able to detect the lesions as opposed to FLAIR, T2W and T1W images where the lesions were not seen. These findings were correlated with Gilberto Gonza et al in which DW sequences were highly sensitive (88-100%) and specific (86-100%) in the detection of hyperacute and acute infarction. Rima et al also reported the role of diffusion weighted MR images in early diagnosis of cerebral infarction.

For venous infarcts, In the present study, the superior sagittal sinus is most commonly involved accounting for 68.57% followed by lateral sinus with 60% comparable with other studies like Strolz E et al (72.2%) and Ameri et al (72%). The limitations of the study are that non co-operative patients, patients with contraindications for MRI and those who could not afford the cost of MRI could not be evaluated. Hence, this study reflects the spectrum of stroke as seen on patients referred for MRI in this particular rural setup.
Conclusion:
Excellent gray white matter resolution and multiplanar imaging capability of MRI helps in detection of subtle lesions. Diffusion weighted image is most sensitive sequence in the detection of infarction and when combined with ADC maps age of the infarct can be calculated. Thus, it has a definite role in the diagnosis and management of stroke. MRI findings were helpful in differentiating arterial ischemic stroke from venous occlusions and thus helping the clinicians in proper management of stroke patients. MRI is better in evaluation of posterior fossa stroke which is its biggest advantage over CT scan.

The helpful diagnostic study can be performed with shortest possible time which can be modified according to the condition of the patient.

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References: