Role of MRI in cerebral ischemic stroke

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1. Role of MRI in detection of cerebral ischemic stroke.
2. Age and sex distribution of infarcts in an Indian population.
3. To determine the location and the territory of the involved blood vessels.
4. Incidence of negative cases (stroke mimics).

Key words: Cerebral ischemic stroke, Haemorrhage, Stroke mimics, MRI.

Abstract:

Cerebral ischemic stroke remains the leading cause of death and disability in many countries. The objective are:

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Introduction

Cerebral ischemic stroke remains the leading cause of death and disability in many countries [1]. Analysis of community surveys from different regions of India shows a annual stroke incidence(per 100,000 persons) of about 124 in rural areas and 145 in urban areas [2]. Stroke specifically the type due to cerebrovascular disease is defined as a sudden, non-conclusive focal neurological deficit. The terms “apoplexy” originating from the Greek and insult from the Latin “insults” described stroke phenomenon in ancient times. The term cerebrovascular disease designates any abnormality of the brain resulting from a pathologic process of the blood vessels. Pathologic process is given an inclusive meaning – namely, occlusion of the lumen by embolus or thrombus, rupture of a vessel, an altered permeability of the vessel wall, or increased viscosity or other change in quality of blood flowing through the cerebral vessels. The vascular pathologic process may be considered not only in it grosser aspects – embolism, thrombosis, dissection or rupture of vessel – but also in terms of more basic / primary disorder, i.e., atherosclerosis, hypertensive arteriosclerotic change, arteritis, aneurysmal dilatation and developmental
malformation. Secondary parenchymal changes in the brain result from vascular lesion – ischemia with/without infarction and hemorrhage [3]. Historically CT was in more widespread use for the evaluation of the hyper acute and acute stroke patient. However, there is an emerging body of 2 literature pointing to advanced MR techniques as having far greater sensitivity for defining the presence of early infarction than conventional CT; beyond that, these MR techniques provide unique information that is likely to be highly important to early stroke management [4]. MR imaging in stroke is targeted towards assessment of four P’s – Parenchyma (assess early signs of acute stroke, rule out haemorrhage), Pipes (assess extra cranial and intracranial circulation for evidence of IV thrombus), Perfusion (assess CBV, CBF and MTT), and Penumbra (assess tissue at risk of dying if ischemia continues without recanalization of IV thrombus) as described by Rowley [5]. This approach enables the detection of intracranial hemorrhage, differentiation of infarcted tissue from salvageable tissue, identification of intravascular thrombi, selection of the appropriate therapy, and prediction of the clinical outcome.

MATERIALS AND METHODS:
All patients referred to the Department of Radio-diagnosis with clinically suspected cerebral ischemic stroke in a period of 2 years from 2010 to 2012. The main source of data for the study are patients from the following teaching hospitals attached to Maharaja institute of medical sciences, vijayanagaram. All MRI scans were performed on a 0.2 T Hitachi AIRSMATE scanner. Sequences used are T2WI axial and coronal, flair axial, gradient echo axial, T1WI axial, DWI axial and ADC maps. MRA (TOF) – circle Willis (neck).

DISCUSSION
This study was directed to evaluate the role of MRI in patients presenting with cerebral ischemic stroke and also to differentiate from haemorrhage and other stroke mimics and also to study the common vascular territory involvement in ischemic stroke and to note the common age group and sex in ischemic stroke, haemorrhage and other stroke mimics.

A 50 patients clinically suspected of stroke were submitted for MRI scan of brain, among these, 16 (77.33%) had cerebral infarction and 15 (10.33%) had intracerebral haemorrhage. According to Mumbai stroke registry, 80.2% (366 out of 407) had ischemic stroke and 17.7% (81 out of 401) had haemorrhagic stroke which is similar to our study [5]. Lacunar stroke registry also showed 82.2% infarcts [6].

CASE DISTRIBUTION: Our study showed 77.33% of infarction; 10.33% of intracerebral haemorrhage; 5.31% of cortical venous thrombosis; 4% of subarachnoid hemorrhage; 3.03% of tumours. Framingham study showed 85% cases of ischemic stroke secondary to cerebral atherothrombosis and cardio embolism; 7.3% of subarachnoid hemorrhage; 6.7% of parenchymal haemorrhage; 1.70% of other types of hemorrhage [7].

CLINICAL PRESENTATION: In our study of 150 cases, 45.33% of them presented with hemiplegia, 16% of gait disturbance, 5.33% of facial palsy, 15.33% of vertigo, 12.0% of aphasia, 10.67% of vomiting, 10.67% of visual disturbances and 11.33% of headache.

AGE AND SEX: The age structure of the study population in this series varies from the 2nd to 9th decade. The youngest patient was 21 years old and the oldest was 89 years old. Maximum number of cases was noted in the 60-69 years of the total 116 cases of infarcts, the mean age at imaging was 64.6 years. This correlated with study of A. Shuaib et al, who had reported a similar mean age of onset of 66 years [8] and with the study of Hideo Tohgi et al who reported a mean age of 65.6 years [9]. Regarding cerebral haemorrhage, the maximum incidence was found to be between 60-69 years in our series. This is slightly higher than the study by Harrison et al, where maximum cases were between 50-59 years (33.33%).

In a review of stroke epidemiology by Feigin; they concluded that the average age of patients affected by stroke is 70 years in men and 75 years in women. Our statistics show a similar age reflection. Among our 150 cases, 114 (76.0%) were males and 36 (24%) were females. In our study, out of 116 cases of infarction; 88 (75.86%) were males and 28 (24.14%) were females. A distinct male preponderance was noted in our study. This correlated with the study of Hideo Tohgi et al and A. Shuaib et al. [8,9]. But the noteworthy point is that amongst the female population evaluated, our study shows women in older age group to suffer more from ischemic stroke which is similar to statistics by Reid JM et al. Gender specific risk factors of women showing increased preponderance of stroke are puerperal period and in those who are obese and using oral contraceptive pills.

RISK FACTORS: The various stroke sub types have unique risk factors during to their individual pathophysiologival characteristics. In our study, the common risk factor associated was hypertension (57.33%), followed by diabetes mellitus (52%), smoking (41.33%), and hypercholesteremia (32%). Cardiovascular disease and atrial fibrillation contributed for about 17.33%. This observation correlated closely with Andrew Kertesz et al, and Hideo Tohgi et al. But the incidence of diabetes mellitus was found to be higher (52%) in our study group. Kuller LH et al, study showed stroke was 2.5 – 4 times more common in diabetics. In our study both diabetes mellitus and hypertension were found in about 34.67%, which suggests a multi factorial risk etiology.
Case 1: Subacute to chronic Right MCA Territory infarct with occluded Rt MCA and nonvisualisation of RT PCA and RT vertebral artery.

Axial T2WI showing Rtparietal hyperintensities noted with partial loss of sulcal spaces

Diffusion Weighted Image (DWI) shows some amount of restriction noted in Right and left parietal lobes

MR Angiography (MRA) Shows occluded RT MCA M3 segment and nonvisualisation of Distal RT vertebral artery and RT PCA

Case 2: Acute infarct in left occipital lobe with occluded Left PCA

AXIAL T2WI appears normal

DWI showing restricted diffusion

MRA reveals occluded Left PCA territory
Results:
The results obtained from our study are well comparable with other stroke surveys. Differences in pattern of stroke may be related to genetic, environmental or sociocultural factors and to differences in the control of risk factors [3].

MRI is non invasive and there is no radiation hazard. Excellent grey – white matter resolution and multiplanar imaging capability of MRI helps in detection of subtle lesions. Sensitivity of MRI to altered water content allows earlier detection of infarcts [4].

Our study observed that diffusion weighted imaging add sensitivity and specificity to the standard MR evaluation. DWI makes an important contribution to stroke management. DW imaging with restricted diffusion helped in the evaluation of acute infarcts in the setting of multifocal infarcts, lacunar infarcts and white matter ischemic changes responsible for the patients symptomatology and in distinguishing acute from subacute and chronic infarcts. 5.

Though CT is considered as the imaging modality widely available at affordable cost, multimodal MRI has carved a niche as the feasible, cost effective and time saving initially ‘state of the art’ imaging modality in cerebral ischemic stroke and has a definite role in the diagnosis and management of the same. The limitation of this study is its lack of systematic follow-up neuroimaging. Another constraint is a selection bias; since not all patients clinically diagnosed as cerebrovascular accident routinely undergo DW MR imaging.

REFERENCES