

Role of computed tomography (CT) in cerebrovascular accidents: A tertiary care hospital based study

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Abstract

Background: Stroke specifically the type due to cerebrovascular disease is defined as a sudden, non-convulsive focal neurological deficit. The terms “apoplexy” originating from the Greek and insult from the Latin “insultus” described stroke phenomenon in ancient times. Cerebrovascular accident is a leading cause of death and disability throughout the world. It is a common cause of death after heart disease and cancer in India. Accurate and early diagnosis can improve the morbidity and mortality rates, as newer and more effective therapies are currently being instituted. Since computed tomography imaging is widely available, cost effective and less time consuming, it plays the role of first line imaging modality.

Aims and objectives: The purpose of the present study is to document the presence or absence of haemorrhage or infarcts, to determine the location and reasonably assessing the territory to blood vessels involved and to detect the incidence of negative cases of clinically suspected stroke.

Materials and Methods: A prospective study of 62 cases admitted to Department of Radiodiagnosis, Government Medical College, Baramulla, Jammu and Kashmir, India with the clinical diagnosis of acute stroke were taken up for the study. Data for my study is collected by sampling referred cases with a clinical history of stroke.

Results: Out of 62 patients clinically suspected of CVA submitted for CT scan study of the brain. 40 patients i.e., 64.5% had infarcts. 15 patients i.e., 24.2% had haemorrhage, 3 patient i.e., 5% had S.D.H., 2 patients i.e., 3.33% had C.V.T. 1 patient i.e., 1.6 % had tumour and 1 patient i.e., 1.6% had normal scans. Infarcts formed the major group of the CVA cases i.e., 64.5%, involving most commonly the R.M.C.A. territory in patients i.e., 26.31%. Haemorrhage formed the second major group of the CVA cases i.e., 25%, involving most commonly the L.M.C.A. territory in patients i.e., 26.66%.

Conclusion: In our study observed that diffusion weighted imaging add sensitivity and specificity to the standard MR evaluation. Result of the study showed that there is a preponderance of ischemic CVA over hemorrhagic CVA. There is also a male preponderance in the incidence of both hemorrhagic and ischemic CVA. C.T. Scanning is a “Gold Standard” technique for the diagnosis of acute stroke and management of stroke depends upon “accurate

diagnosis” and should be ideally done in all cases.

Keywords: Computed tomography (CT), cerebrovascular accident (CVA), cerebral infarction, intracranial haemorrhage, traumatic, venous thrombosis, imaging

Introduction

Stroke specifically the type due to cerebrovascular disease is defined as a sudden, non-convulsive focal neurological deficit. The terms “apoplexy” originating from the Greek and insult from the Latin “insultus” described stroke phenomenon in ancient times. Stroke is defined as an acute loss of focal at times global cerebral functions, the symptoms lasting more than 24hours or leading to death with apparent cause than that of vascular origin. 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 an annual stroke incidence (per 100,000 persons) of about 124 in rural areas and 145 in urban areas ^[2]. 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. Cerebrovascular accidents are one of the leading causes of death after heart disease and cancer in the developed countries and one of the leading causes of death in India. The exact prevalence rate of this disease in the Indian population is not known, although it accounts for about one percent of admissions to general hospital ^[3]. The incidence rate and the death rate from stroke increases dramatically with age. About 15 to 30% of patients die with each episode of cerebral infarction and 16 to 80% with cerebral haemorrhage. Those who survive are usually left with permanent disability. Thus, stroke becomes a great medical and social problem. Accurate and early diagnosis may improve the morbidity and mortality rates in the future as newer and more effective therapies are currently being instituted ^[4]. The advent of CT in early 1970s greatly facilitated the diagnosis and management of stroke and added significantly to our understanding of Pathophysiological brain alterations in case of humans ^[5]. With CT it is now possible for the first time to noninvasively and reliably diagnose and distinguish between stroke due to cerebral infarction and stroke due to haemorrhage. In addition, other brain lesions, at times, may clinically present as stroke like syndromes such as primary or metastatic brain tumour or subdural hematoma that can usually be clearly differentiated by CT examination. However, it is a relatively new and scarcely available facility in rural population of developing country like India. Its use is further restricted by patient’s economic status ^[6]. Despite many improvements in MR technology, CT is still the method of choice for more of the patients being evaluated for cerebrovascular accidents because of its fast acquisition. CT is a good diagnostic instrument even in early phase of acute ischemic stroke ^[7]. In combination with new helical CT technique (CT angiography) all important decisions regarding early therapeutics can be answered. Clinical approach to stroke has undergone many changes in the past few years. CT scan has become an essential and integral part of the assessment and has given a more objective basis to management and use of the IV contrast material. After non contrast CT and the availability of follow up studies in many instance significantly aids in the determination of the correct vascular aetiology of the stroke, as does correlation of CT changes with patient’s age, sex, history and neurological deficit ^[8].

Material and Methods

A prospective study of 62 cases admitted to Department of Radiodiagnosis, Government Medical College, Baramulla, Jammu and Kashmir, India with the clinical diagnosis of acute

stroke were taken up for the study. Data for my study is collected by sampling referred cases with a clinical history of stroke. Patients were subjected to computed tomography scan of the head using siemens6 slice helical computed tomography scan. The imaging protocol consists of acquisition of contiguous axial sections with a maximum thickness of 5mm without intravenous contrast material administration. Images will be evaluated with brain window settings. Clinical details and the computed tomography findings of the case will be recorded as per the proforma. No attempt will be made to compare computed tomography with other imaging modalities like M.R.I, Angiography or Doppler.

Exclusion criteria

Patients with neurological deficiency due to obvious cause other than vascular, such as hypoglycemia, diabetic keto acidosis and traumatic cause were excluded in this study. Modern gantries are wide enough to permit coronal or near coronal section to be obtained directly. Patient is supine or prone with hyper extended neck; section is perpendicular to orbitomeatal line. Sagittal or near sagittal section can also be obtained in most cases; however these projections are obtained by computer reconstruction of the stacked axial slices (reformat).

Results

Table 1: Distribution of the cases of clinically suspected CVA on CT.

CT Findings	Cases	%
Infarcts	40	64.5
Haemorrhage	15	24.2
Sah	3	5
Tumor	1	1.6
CVT	2	3.2
Normal	1	1.6

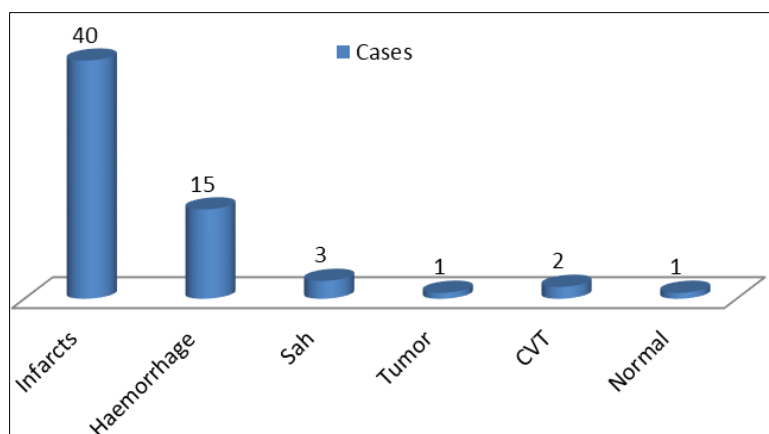


Fig 1: Distribution of the cases of clinically suspected CVA on CT

Table 2: Incidences of intracerebral brain hemorrhage (ICH) in different parts of brain in 15 cases of intracerebral haemorrhage.

	Cases	%
Putamen / external capsule	7	46.66
Thalamus	3	20
Cerebellum	2	13.33
Pons	1	6.6
Miscellaneous	2	13.33

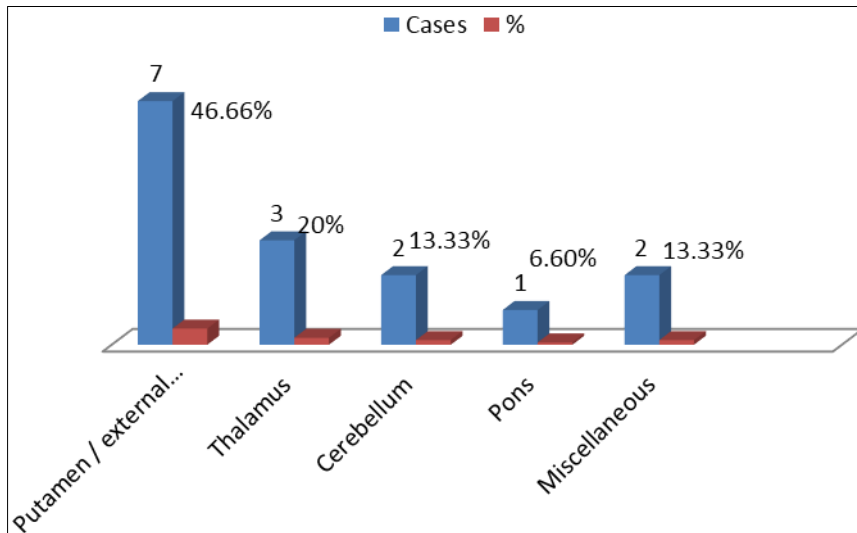


Fig 2: Incidences of Intracerebral brain hemorrhage (ICH) in different parts of brain in 15 cases of intracerebral haemorrhage

In our study Putamen/External capsule involves 7 cases (46.66%) In our study thalamic involvement seen in 3 cases (20%) In our study Cerebellar involvement seen in 2 cases (13.33%) In our study Pontine hemorrhage seen in 1 case (6.6%) In our study Intraventricular extension was noted in 6 cases accounting for 40% which had bad prognosis. As in Figure 2. Table 1, Table 2, Figure 3, 4, 5.

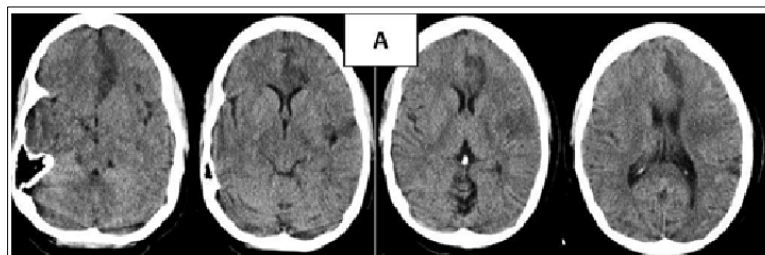


Fig 3: A CT scan demonstrated an acute infarct of the left MCA and ACA at 36 hours.

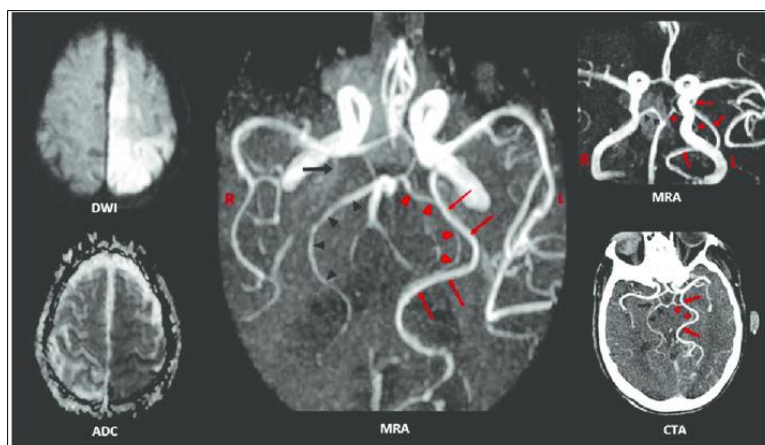


Fig 4: Acute infarcts in the left ACA, MCA, and PCA territories (hyperintense DWI, low ADC).

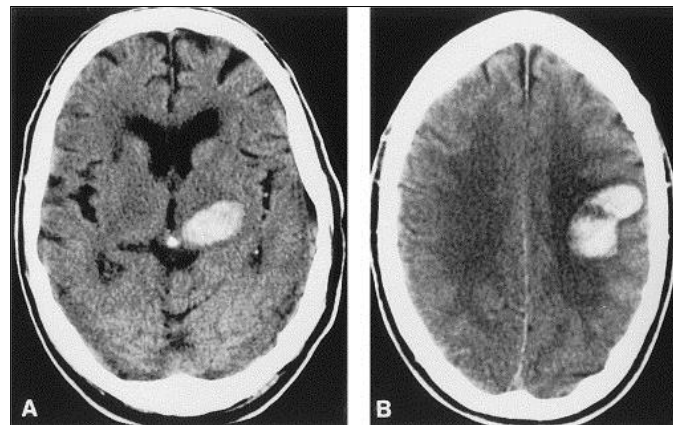


Fig 5: A and B: Intracerebral hemorrhage.

Discussion

MR imaging in stroke is targeted towards assessment of four P's –Parenchyma (assess early signs of acute stroke, rule out hemorrhage), Pipes (assess extra cranial and intracranial circulation for evidence of IV thrombus), Perfusion (assess Cerebral Blood Volume, Cerebral Blood Flow and Mean Transit Time), and Penumbra (assess tissue at risk of dying if ischemia continues without recanalization of IV thrombus). This study was directed to evaluate the role of CT scan in patients presenting with acute cerebrovascular accident in differentiating between haemorrhage, infarct and other causes of stroke^[9]. Before the advent of CT scan and in places where CT scan was available, physicians were mainly dependent on the history, physical findings and the Allen's method of scoring system to differentiate between haemorrhage and infarct using this scoring system^[10]. Allen studied 174 cases of acute stroke and was able to make an accurate diagnosis in 90% of cases. However, the scoring system had certain limitations as it is dependent on the history given by the relatives of patients and sometimes they are not able to give a clear description of signs and symptoms due to poor literacy level which correlated with the scoring system. 100% accuracy in distinguishing haemorrhage from ischemic stroke based on clinical findings was not possible^[11]. Previous studies have reported the usefulness of CT scan in patients suffering from stroke by ability to differentiate between haemorrhage and infarct and other causes of stroke and thus aiding in the clinical management. Oxfordshire Community Stroke project that assessed 325 consecutive patients of acute stroke highlighting the role of usefulness of CT scan^[12]. Previously, CT was considered insensitive in the evaluation of acute ischemic stroke patient; however, more recently detection of early CT findings has proved to be of prognostic value in the evaluation of these patients^[13]. The use of CT coupled with early acute phase therapy of stroke such as thrombolytic therapy has shown to improve outcome in the acute stroke patients. Cerebral CT is a mainstay in emergency diagnostic work up of acute stroke patients and conveys important information within a few hours after the ictus^[14]. Ike SO et al., found that in a recent series of patients with MCA territory infarctions the incidence of positive findings was 68% in cerebral CT scans performed within 2 hours of stroke onset increasing to 89% within 3 hours, thus emphasizing the great value of emergency cerebral CT scanning in acute stroke management, which is superior to MRI^[15]. In the present study 60 patients of stroke were analyzed and of them 38 patients had infarct i.e., 63.33%, 15 patients had haemorrhage. I.e., 25%, 2 patients had CVT i.e., 3.33%, 1 patient had tumor i.e., 1.6%, 3 patients had SAH i.e., 5% and 1 patient had normal scan i.e., 1.6%. In studies done from India^[16]. Razzaq AA reported an incidence of 60% infarcts and 30% haemorrhage, 8% subarachnoid haemorrhage in a case study of 50 patients^[17]. Provenzole J. Pin a study of 30 patients with stroke had reported an incidence of infarct in 33.3% of cases and intracerebral

haemorrhage in 60% of cases ^[18]. In this study that had a different experience in the severity, the incidence of haemorrhage is seen to be higher than that of infarction. Out of 60 cases of clinically suspected CVA subjected to CT study, 1 case turned out to be normal accounting for 1.6%. This case is taken as negative cases ^[19]. There are technical problems to detect infarction but certainly the haemorrhage is ruled out in all cases. Jehangir Khan reported 3 patients with mass lesions (one subdural haematoma, one hydrocephalus and one metastasis) from 197 patients who had presented with acute stroke ^[20]. In the Oxfordshire community stroke project five non stroke lesions were detected by CT (2 gliomas, one metastasis, and 2 subdural hematomas) among 325 patients who were clinically diagnosed as having a definite stroke. In the present study of 60 patients, 1 case of tumour, 2 cases of CVT, 1 case of SAH and 1 case had normal scan in the patients presenting with acute stroke like symptoms ^[21, 22].

Conclusion

In 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 patient's symptomatology and in distinguishing acute from sub-acute and chronic infarcts. CT scanning is the "Gold standard" technique for diagnosis of acute stroke as the rational management of stroke depends on "Accurate diagnosis" and should be ideally done in all cases. The results and factors obtained from our study correlates well with studies done in different parts of the world. Since risk factors such as hypertension, diabetes and previous episodes of stroke play major role in the evolution of cerebrovascular accidents, it is suggested that. Such patients should be investigated carefully. Sudden onset of neurological deficit or unexplained headache should further be investigated for the possibility of CVA. If treatment is given early some of the cases of CVA could be saved from life threatening problems.

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Conflict of Interest: None.

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