Original Research Article

A study on CT correlation with prognosis in stroke

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Abstract

Background: The imaging work up of patient with acute neurologic deficits should begin with Non contrast CT to exclude intracerebral hemorrhages. Early computed tomography signs of stroke signify major arterial occlusion, with hyperdense MCA sign being the most predictive of a MCA occlusion. Computed tomography will differentiate infarct from hemorrhage up to at least five days after stroke. Recent hemorrhages are of high density and usually rounded and space occupying a vascular territory with some swelling. **Methodology:** All the patients admitted in with a clinical diagnosis of stroke in the acute medical care unit or emergency medicine department were included in this study, and formed our study material. All the patients underwent a CT study of the brain on admission. Contrast is administered only in few cases. Other relevant laboratory and special investigations were done as deemed necessary. **Results:** In majority of the cases, hypodensity of brain parenchyma and sulcal effacement was present accounting 92.30% and 57.69% of 52 infarct cases respectively. Hyperdense MCA artery sign was present only in 1 case. **Conclusion:** Hypodensity of lentiform nucleus and mass effect (edema) were present in only 8 patients .In minority of patients multiple CT signs of ischemia were present

Keywords: Stroke, Hypodensity, Intracerebral hemorrhage.

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INTRODUCTION

Cerebral ischemia results in significantly diminished blood flow to ail arts (global) or selected areas (regional or focal ischemia) of the brain. The effects of the ischemia are determined by amount of flow reduction, the volume 2nd location of tissue rendered ischemic, and the duration of the event creating ischemic state.[1]Normal mean regional cerebral blood flow is approximately 54±12 ml per . Between 10 and 23 ml per 100gmimin, ischemic injury begins with loss of neurologic function. White matter is more resistant to schema than grey matter.[2] Global cerebral ischemia is the diffuse diminution of cerebral blood flow. Focal cerebral ischemia indicates compromise or occlusion of the arterial inflow to specific area of cerebral tissue. With vascular occlusion, the central zone of the vascular territory suffers the most profound and prolonged ischemia and is vulnerable to cell death (cerebral infarction). In the peripheral zones, an ischemic penumbra exists where regional cerebral blood flow is reduced. Ischemic penumbra is a term utilized to indicate the area of vulnerable, but potentially salvageable, ischemic brain tissue that pill return to normal function following restoration of cerebral blood flow. in areas of ischemia, not only there is loss of autoregulation but there is also dysfuncton of the on Transport and ATP pumps leading to water accumulation –cytotoxic edema. At 3 to 6 hours following the onset of ischemia, cytotoxic oedma is evident. Ischema leads to endothelial cell necrosis and compromise of the blood brain barrier with resultant leakage of water and plasma proteins into the extracellular space, referred to as vasogenicoedma. [3,4,5] Vasogenicoedma begins to develop at 3 to 6 hrs following the onset of significant ischemia and becomes maximal between 'I and 5 days following the vascular occlusion. Resolution occurs over I to 2 weeks. Capillary endothelial

proliferation begins early, around day 5, in an attempt to resupply flow to ischemic tissue at the periphery of the infarction. This capillary ingrowth , along with the development of collaterals , is responsible for the concept of luxury perfusion. Neutrophilicinfitration occurs at 1 to 4 hrs with maximal infitration at the end of 3 days. Mononuclear phagocytic infiltrate occurs by fifth day. Lipid laden macrophages may themselves degenerate, leaving cystic spaces in areas of coagulation necrosis.[6] Based on their grossly visible features, brain infarcts associated with arterial occlusion are divided into white and red infarcts.Faced with an acute stroke, the physician must determine the cause, estimate the severity, consider the possibility of progression or recurrence, and seek ways of stabilizing or reversing it. Investigations should be designed to assist clinicians in sub categorizing patients at three specific levels.[3]

1. Separating strokes from non stroke causes such as cerebral tumor and subdural hematoma.
2. Distinguishing hemorrhage from infarction.
3. Identifying specific patho physiological sub types of cerebral infarction.

The ideal test should be inexpensive, noninvasive, accessible, accurate and informative.

The invention of computed topography scan by Sir.GodfreyN.Hounsetleld in 1971 has revolutionized the technique of investigating a stroke case. The advent of CT greatly facilitated the diagnosis and management of stroke and added significantly to our understanding of pathophysiological brain alterations

The imaging work up of patient with acute neurologic deficits should begin with Non contrast CT to exclude intracerebral hemorrhages.Early computed tomography signs of stroke signify major arterial occlusion, with hyperdense MCA sign being the most predictive of a MCA occlusion.

Computed tomography will differentiate infarct from hemorrhage up to at least five days after stroke. Recent hemorrhages are of high density and usually rounded and space occupying a vascular territory with some swelling.

In a patient with a stroke a normal scan excludes a hemorrhage and, in absence of an alternative, infarction is assumed.

I.V contrast is not normally required in patients considered for recombinant tissue plasminogen activator (Rt-PA), CT scanning is mandatory to exclude ICH or sizeable infarction before the thrombotytic drug is given.

Unenhanced CT of the brain in still the primary imaging modality used in the exclusion of ICH and the revelation of early signs of brain infarction. In the very early stage of brain infarction, However, these signs can be depicted only in a section of the patients. Thus, the use of unenhanced CT alone comprises some uncertainty of assessment. The current therapeutic opportunities in patients with acute stroke require reliable information about the location and six of brain ischemia. To accomplish these demands, in the late 1990's, perfusion CT was presented as an imaging modality to be used in patients with acute stroke.[5] Perfusion CT provides the information about brain perfusion, which permits differentiation of irreversibly damaged brain tissue from reversibly impaired tissue at risk. It allows the calculation of variety of functional maps of cerebral perfusion parameters such as regional CBF, CBV and time to peak enhancement. The impairment of vascular perfusion obviously is the primary event in stroke with defection of tow CBF to be of particular clinical interest in the demonstration of acute brain ischemia. The reduction of CBF can be considered the primary event in easy of embolic occlusion of cerebral vessels. CT angiography is another imaging modality that is being used increasingly in the evaluation of patients with acute cerebral ischemia to reveal the origin of Infarction and site of cerebral artery occlusion.CT angiography shows detailed assessment of the intra and extra cranial vasculature with thin section multiplanar views, especially when multidetector CT is used.

METHODOLOGY

All the patients admitted in with a clinical diagnosis of stroke in the acute medical care unit or emergency medicine department were included in this study, and formed our study material. All the patients underwent a CT study of the brain on admission. Contrast is administered only in few cases. Other relevant laboratory and special investigations were done as deemed necessary.

Patients with other neurologic symptoms, not related to vascular causes, such as hypoglycemia, diabetic ketoacidosis, intracerebral tumors and head injuries were excluded from our study. Patients with reversible neurological symptoms within 24 hours are excluded.

Patients admitted with an acute neurologic symptoms were assessed by a history taking and physical examination done by the residents of department of neurology, neurosurgery, medicine and casualty.

Magnetic Resonance Imaging, MRAngiography, Digital Subtraction angiography and echocardiography were done depending upon the patients requirement to arrive at a diagnosis. Repeat CT scan was done in few patients depending on the clinical progress, mainly in clinically deteriorating patients only in patients without financial constraints. Classification of stroke subtypes was done according to classification adopted by National Institute of Neurological Disorders and Stroke(NINDS) stroke data bank.

RESULTS

The overall male to female ratio of stroke cases is 2.2 :1 with 37,10,2,0 male cases as against 16,3,1,1 female cases in infarction ,hemorrhage, SAH and CVT respectively. As seen from the above table, 40% of the cases who presented with stroke were hypertensive. Around 69.23% of cases diagnosed as ICH were hypertensive and in the infarction group only 34.6% were hypertensive. Diabetes mellitus was noted in 21.42% of cases of stroke. Heart diseases were noted in 21 % of stroke cases. In majority of the cases, hypodensity of brain parenchyma and sulcal effacement was present accounting 92.30% and 57.69% of 52 infarct cases respectively. Hyperdense MCA artery sign was present only in 1 case. Hypodensity of lentiform nucleus and mass effect (edema) were present in only 8 patients .In minority of patients multiple CT signs of ischemia were present. An attempt was made to correlate prognosis of the patient with size of hemorrhage, midline shift, ventricular extension and contra lateral ventricular dilatation. This study shows that size of hemorrhage has a significant role in patient prognosis. Small hemorrhage less than 4.5 cms in size has good prognosis. Moderate and massive hemorrhages with other signs of midline shift, ventricular extension and contralateral dilatation of ventricle showed poor prognosis. Twenty three percent mortality was noted in ICH accounting for 3 cases of 13.

Table 1: Sex incidence of clinically diagnosed stroke

SEX	INFARCTION	HEMORRHAGE	SAH	CVT	TOTAL	PERCENT
MALE	37	10	2	0	49	70%
FEMALE	16	3	1	1	21	30%

Table 2: Risk factors

RISK FACTOR	INFARCTION	ICH	SAH	CVT	TOTAL	PERCENT
HYPERTENSION	18	9	1		28	40
DIABETESMELLITUS	14	1			15	21.42
HEART DISEASES	10	4			14	21

Table 3: CT signs of ischemia/infarct

CT SIGNS	NO OF CASES	PERCENT %
HYPODENSITY OF BRAIN PARENCHYMA	48/52	92
HYPERDENSE MCA	1/52	1.9
HYPODENSITY OF LENTIFORM NUCLEUS	8/52	15.3
SULCAL EFFACEMENT	30/52	57.69
MASS EFFECT	8/52	15.3

Table 4: CT correlation with Prognosis

HEMORRHAGE SIZE	NO OF CASES	MIDLINE SHIFT	VENTRICULAR EXTENSION	CONTRALATERAL VENTRICULAR DILATATION	OUT COME
SMALL <4.5cms	7	0	0	0	7 improved
MODERATE 4.5-6.5cms	4	4	1	1	3 improved 1 died
MASSIVE>6.5cms	2	2	2	1	2 died
TOTAL	**13**	**6**	**3**	**2**	**10 improved 3 died**

DISCUSSION

Classification of stroke in our study by cause is as - follows, 74.28 % infarcts, 18.5% 4.2 % SAH and 1.4 % CVT. Out of 52 cases of infarction large vessel artery or atherothrombotic vessel or undetermined cause accounted for 52.85%, lacunar infarct accounted 14.2% and cardiac emboli 7.14%. Classification of stroke based on data from NINDS stroke data bank ,there were 70% infarcts, hemorrhage 27%(ICH 13% +SAH13%) and others 3%. In infarction of 70%, infarcts of undetermined cause accounted for 28%,large artery occlusion 6% and tandem arterial 4% . This is followed by lacunar infarcts accounting for 19% and cardiac source accounting for 14 %.[7] In our study HIV+ patients accounting for stroke were 2.8%, which is lower than study done by Kumar swamy *et al* who accounted for 15% of cases. Hemorrhagic transformation of bland infarct was noted in 7.6%of total infarct cases. Never in the study of 121 cases of infarction by Turhan *et al*, only 29 cases Awed hemorrhagic transformation accounting for 32.3%. Our study showed low incidence of hemorrhagic transformation in infarct cases because CT scan was done before the treatment. Where as in the above study follow up CT done after initiating treatment with anti edema, anticoagulants showed increased incidence of hemorrhagic transformation of bland infarct and which is also strong

risk factor for hemorrhagic transformation of infarct.[8] In our study only one CVT case was noted and patient was on oral contraceptive pills. In Alain amen M B, Bousser M G series of 110 cases, oral contraceptive was the only etiologic factor in 9 patients accounting 8 %. In our study 40% of the cases who presented with stroke were hypertensive. Around 69.23% of cases diagnosed as ICH were hypertensive and in infarction only 34.6% were hypertensive. Diabetes mellitus was noted in 21.42% of cases of stroke. Heart ceases were noted in 21% of stroke cases. In the Natan M Bornstein et a1 in Tel Aviv stroke registry series hypertension was noted in 52.2% of the patients, diabetes mellitus in 25.2% and heart diseases in 29.7% . In Seiji kazui *et al* series of 204 ICH patients hypertension was noted in 84%of the patients. Hypertension was noted to have lower values when compared to present study but diabetes and cardiac diseases are well correlated. [9,10] In our study signs of ischemia which were detected by CT and diagnosed as arction were analyzed and correlated with Aronovich B D et a1 study, our study showed increased values because CT scans were done after almost 24 ours after the onset of symptoms, unlike the above study which was done within hours of onset of symptoms. In the present study territorial involvement of the arteries were analyzed which showed MCA involvement in 48.07% of patients, ACA 7.6%, PCA and VB in 9.6 % each in the single territorial involvement. Multi territorial involvement accounted for 25 % of all ischemic stroke cases of which ICA involvement was maximum. Oscar H Del Brutto MD et a1 reported 500 cases of stroke in which 313 were ischemic and the carotid territory was involved in 70.6%,vertebrobasilar territory in 17.9%, multiple territories in 6.7 % and watershed area in %.The Besta neurologic institute reported 500 cases of which MCA accounted 62%, RCA 14%, ACA 5%, posterior fossa 5% and multi territorial and water shed areas accounting for 14 %. In our study carotid territory was involved in majority of the cases and our incidence was well correlated with the above study, however multiterritorial involvement was high with MCA involvement being the highest.[11,12] In the present study of ICH 3 patients died out of 13 patients, and these patients had moderate to massive hemorrhage, midline shift and ventricular extension. Dhanaraj and Velmurugendran studied 20 patients with putaminal hemorrhage, out of which 5 died. These 5 patients who died showed hemorrhage size >6.5cms, ventricular perforation and midline shift on CT. Only 3 patients had contra lateral ventricular dilatation. In another study by Kaseet a1 prognosis of patients with lobar hemorrhage was noted based on hemorrhage size, midline shift and ventricular extension. Out of 22 patients with lobar hemorrhage, 7 patients who died showed moderate to massive hemorrhage, midline shift and ventricular extension. Our study correlated well with the above studies in determining the prognosis of the patients.[13]

CONCLUSION

The advent of CT scanning of brain has helped greatly in analyzing and evaluating the stroke in its cause, extent, location and complements in treatment as well as predicts the prognosis of patients.

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