Original Research Article

Role of computed tomography imaging in evaluation of stroke

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Abstract

Background: A stroke is the acute neurological injury occurring as a result of one of this pathological process and manifests either as cerebral infarction or hemorrhage. Identification of risk factors for stroke as well as an awareness of the relative importance of each and of their interaction should facilitate stroke prevention. The past, are now identified as definite strokes through the routine use of CT **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 the CT confirmed 52 infarct cases, the maximum incidence was noted in from5l-65 years with 24 patients(46.15%), followed by 9 patients(17.30%) in 66- 75years and 4 patients(7.6%) in each 41-45,46-50,76-80 years age group **Conclusion:** The major consideration for obtaining imaging examination in a patient with an acute stroke is to evaluate for an intracranial hemorrhage that CT can detect with great sensitivity and specificity

Keywords: CT, Stroke, Hypertension

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INTRODUCTION

Stroke is defined as the abrupt or ictal onset of focal or global neurologic symptoms caused by ischemia or hemorrhage within or around the brain resulting from diseases of cerebral blood vessels. Stroke is the most common life threatening disease and third leading cause of death in the United States, after heart disease and cancer, accounting for 1 of every 15 deaths[1]. In our country, stroke is the third commonest cause of mortality and morbidity after ischemic heart disease and malignant diseases[2].

A stroke or cerebrovascular accident is caused by one of the following pathological processes involving the blood vessel of the brain. Pathological process is given an inclusive meaning-namely, occlusion of the lumen by thrombus or embolus, rupture of the vessel, any lesion or altered permeability of the vessel wall , and increased viscosity or other change in the quality of the blood. The pathological process may be considered not only in its grosser aspects-thrombosis, embolism, dissection or rupture of the vessel-but also in terms of more basic and primary disorder i.e. atherosclerosis, hypertensive, arteriosclerosis change, arteritis, aneurysmal dilatation and developmental malformation[3]. A stroke is the acute neurological injury occurring as a result of one of this pathological process and manifests either as cerebral infarction or hemorrhage. Identification of risk factors for stroke as well as an awareness of the relative importance of each and of their interaction should facilitate stroke prevention. The past, are now identified as definite strokes through the routine use of CT. The wide spread availability of a diagnostic test for stroke, particularly important here[4].

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In Allegheny county, Pennsylvania the advent of CT was accompanied by total increase in survival of stroke patients. The invention of CT scan in 1971 has revolutionized the technique of investigating a stroke case. The advent of CT greatly facilitated the diagnosis and the management of stroke and added significantly to our understanding of pathophysiological brain alterations. In the overall investigation of cerebrovascular disease computerized transverse axial scanning will, without doubt has come to be an invaluable means of distinguishing between hemorrhage and infarctions[5].

MI CT, it became possible for the first time to noninvasively and reliably diagnose and distinguish between stroke caused by cerebral infarction and hemorrhage. In addition, other brain lesions that could present clinically as stroke like syndromes such as primary or metastatic brain tumors, brain abscess and subdural hematomas could usually be differentiated by CT examinations. CT has had an impact on several aspects of the diagnosis of intracranial haernorrhage. This noninvasive test not only allows a precise localization of the hemorrhage and its effects midline shift, surrounding edema, ventricular extension , but also provides rapid diagnosis of small or clinically atypical hemorrhages that in the past either were misdiagnosed as infarcts or required extensive invasive diagnostic efforts.[6]

Despite the introduction of MRI in 1984, and its many recent advances, CT continues to be the initial imaging modality for acute stroke patients. The major consideration for obtaining imaging examination in a patient with an acute stroke is to evaluate for an intracranial hemorrhage that CT can detect with great sensitivity and specificity. The employment of MR for the initial evaluation of stroke patients is limited[7].

MRI demands greater patient cooperation than CT because of its longer imaging time. This is not always possible with acute stroke who are frequently confused and uncooperative[8].

In addition MRI is not as universally available as CT and CT is cost effective. In certain situations in which patients clinical conditions cannot be fully explained by CT, MRI is of great value Hence CT scanning is a preferred during acute stroke as primary investigation modality of choice.

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 clinical records and Computed Tomography (CT) scans of 70 patients diagnosed as stroke clinically were analyzed. Fifty two patients had ischemic infarction, 13 patients had ICH, 3 patientshad Sub Arachnoid Hemorrhage(SAH), 1 patient had Cerebral Venous Thrombosis(CVT) and 'I normal scan with no abnormality. Thus CT detected 69 out of 70 clinically diagnosed cases of stroke. The male :female ratio was about 2.2:1. The ages ranged from 23 to 89 years with mean age of 56 years. In the CT confirmed 52 infarct cases , the maximum incidence was noted in from5l-65 years with 24 patients(46.15%), followed by 9 patients(17.30%) in 66- 75years and 4 patients(7.6%) in each 41-45,46-50,76-80 years age group. The least incidence was noted in 86-90 years age group with 1 patient. Among 70 cases of stroke, ischemic infarction accounted for highest number of patients accounting for 74.28%,with atherothrombotic or large vessel or undetermined cause accounting for 37 patients which is highest, followed by Iacunar infarcts in 10 patients and least being embolic stroke with 5 cases. Cardiac emboli accounted for all the 5 embolic infarction cases. All these 5 patients had thrombus in the cardiac chambers which was demonstrated by echocardiography.

Table 1: Age incidence of clinically diagnosed stroke

	Male	Female	Total
20-25	0	1	1
26-30	2	1	3
31-35	2	1	3
36-40	1	0	1
41-45	3	1	4
46-50	5	0	5
51-55	6	3	9
56-60	10	2	12
61-65	6	3	9
66-70	5	2	7
71-75	3	6	9
76-80	4	1	5
81-85	1	0	1
86-90	1	0	1
Total	**49**	**21**	**70**

Table 2: Age and Sex incidence of CT confirmed stroke cases

	INFARCTION			ICH			SAH			CVT		
AGE	**M**	**F**	**Total**	**M**	**F**	**Total**	**M**	**F**	**Total**	**M**	**F**	**Total**
20-25											1	I
26-30	1	1	2	1		1						
31-35												
36-40							1		1			
41-45												
46-50	4		4	1		1						
51-55	4	2	6	1		1	1	1	2			
56-60	7	2	9									
61-65	6	3	9									
66-70	3		3	1	2	3						
71-75	1	5	6									
76-80	3	1	4	1		1						
81-85	1		1									
86-90	1											
TOTAL	**36**	**16**										

Table 3: Classification of stroke by CT according cause

TYPE OF STROKE	NO OF CASES	PERCENT
ISCHEMIC INFARCTION	52	74.28
Large vessel artery,atherothrombotic,undetermined cause	37	52.85
Embolic (cardiac)	5	7.14
Lacunar	10	14.2
INTRA CEREBRAL HEMORRHAGE	13	18.57
SUBARACHANIOD HEMORRHAGE	3	4.2
aneurysms	2	
Others		
CEREBRAL VENOUS THROMBOSIS	1	1.4

DISCUSSION

The advent of computed tomographic scanning of brain has modified the clinical out look and management of stroke case. The imaging work up of patients with acute neurologic deficits should begin with non-contrast CT to exclude intracerebral hemorrhage. CT has helped to differentiate and identify infarct, intracerebralhemorrhages(ICH), Sub Arachniod Hemorrhage(SAH) and cerebral venous thrombosis(CVT). In the present study, we analyzed and correlated the clinical and CT findings in patients with acute stroke. Previous studies by Petersander cook *et al*[9] (1985) reported 72% overall accuracy of clinical diagnosis in all cases of acute stroke. Mohr *et al* (1978) reported 84% accuracy of clinically diagnosed ischemic infarcts and 43% for hemorrhage stroke. Aggrawal*et al*[10]

(1990) reported 69.5% accuracy for ischemic strokes and 75% for hemorrhagic strokes. In most of the studies clinical misdiagnosis was present which altered the clinical out come of the patient. Hence final verdict lies on CT scan only for accurate diagnosis of stroke. In our study CT was able to identify and differentiate 70 cases of clinically diagnosed stroke as ischemic infarcts in 52 cases,13 cases of ICH,3 cases of SAH,1 case of CVT and 1 normal scan. So the detection rate by CT in stroke accounted for 98.58%. In the study done by Mulkapoor and Aprajith kapoor[11] in 705 patients with clinical diagnosis of stroke, 700 patients were positive for stroke with CT detection rate of 99% In the first study by Paxton and Ambrose[12],could recognize ICH in 100 % of patients. ln our present study CT detected ICH in 100 % of cases. The normal CT study in 1 clinically diagnosed stroke patient was due to early CT can done within 4 hours of ictus. Our study maximum number of stroke cases were noted from 51-75 years range from 23years to 89years with mean age of 56 years. The male to female ratio was 2.2:1. M Bornstein et a1 in Tel Aviv stroke registry had 3600 consecutive patients mean age of 73.2years and 58.2% were males. Maximum no of cases were noted in 55-84 years age group. The hospital based stroke registry correlates well the above findings from present study. In our study lacunar strokes accounted for 14.28%, basal ganglia was involved in 29.4% of the cases followed by thalamus and periventricular white matter. Sixty percent of the lacunar stroke patients were hypertensive which correlated with the lowing studies. In one of the larger series published by Pullicino *et al* featured 7 consecutive cases with a CT scan, hypertension was more prevalent in this series. Tuszynskiet a1 autopsy based study of 2859 patients, 169 patients had launar infarcts and hypertension was present in 64% of the patients. In the stroke data bank project46 27 %of the patients had lacunar infarcts and 75% of them had hypertension. In another study by Kaul S *et al* in 893 ischemic stroke patients, 16% of them had lacunar infarction and hypertension was seen in 62% , diabetes 38% and smoking in 28%. In our study putamen bleed accounted for 46.15%, followed by thalamic bleed 23.07% and lobar and cerebellar bleed of 15.38% each. Seventy percent of the patients were hypertensive and 5 cases out of 6 putamen bleed were hypertensive. In the south Alabama medical center, out of 100 cases of ICH, putamen 34%, lobar 24%,thalamic 20%, cerebellar 7 %, pons 6% and miscellaneous 9%. In the Dhamija, study of 80 cases of ICH putamen bleed accounted for 32%,lobar 28%, thalamic 21%, pontine 14 % and cerebellar 5%. Hypertension was noted in 87.5%of cases on admission. In another study by Seiji kazui et a1 in 204 cases of ICH , putamen bleed 70(34%), thalamic 67 (33%), mixed 5 (2%), lobar 34(17%), pontine 11(5%), cerebellar 10(5%) and other sites 7(3%). History of hypertension was documented in 84%of the ICH cases. Our study correlates well with the above studies. However putamen bleed was higher and no bleed in the pons probably due to small group.

CONCLUSION

The maximum numbers of patients were in the age group of 51 – 75 years and intracerebral hemorrhage was more common. CT detection rate to identify the cause of stroke was 98.58%

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