

CT Scan Versus Clinical Diagnosis in Stroke-A Comparative Retrospective Study on 257 Cases in one Year

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Abstract

Original Research Article

Cerebrovascular disease (CVD) is one of the three leading causes of death in the world along with cancer and heart disease. CVD or stroke is a major cause of morbidity and mortality. For any treatment to be contemplated it is important to know whether we are dealing with a bleed or an infarct. Differentiation between cerebral infarction and intracerebral hemorrhage is necessary nowadays for proper management of acute stroke syndrome based on the correct diagnosis of the pathological type. This study compared clinical and CT scans diagnosis of stroke and determined the clinical reliability of the clinical diagnosis in cases of stroke. This study was conducted retrospectively on 257 patients. CT scan was requested to rule out nature of acute cases of stroke for one year duration at Hospital Duchess of Kent (HDOK) from July 2006 to June 2007. Clinical diagnosis was made in conformity with criteria for clinical diagnosis of intracranial hemorrhage, cerebral infarction due to embolism or thromboses. The CT scan findings were compared with clinical diagnosis of stroke. The patients included 148 males and 109 females with an age range of 11 to 90 years. Clinically, 91(35.40%) subjects were suspected to have cerebral infarction, 64(24.60%) intracerebral bleed and 102(40%) indeterminate. CT scan brain showed 174 (67.96%) cases of abnormal findings and 83 (32.29%) cases of normal findings other than different degree of degenerative changes. Out of 174 cases of abnormal findings, CT showed 119 (46.31%) cases of cerebral infarction, 52 (20.23%) cases of cerebral hemorrhage and 3 (1.17%) cases of space occupying lesion subjects. In order to make a clinical diagnosis of stroke, a detailed history, thorough clinical examination and to follow the definite criteria chart for stroke to be diagnosed is mandatory as well as to avoid unnecessary CT request of brain which are more concerned with radiation hazard and cost. As far as treatment planning is concerned clinical diagnosis of stroke is not safe enough as a guide for anticoagulant or thrombolytic therapy. We found that clinical diagnosis in majority of the cases is not as reliable as CT scan.

Keywords: Cerebrovascular Accident, CT scan, Ischemic Stroke, Hemorrhagic Stroke.

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INTRODUCTION

The term stroke means an acute neurological deficit resulting from cerebrovascular disease (CVD) and lasting more than 24 hours (or causing earlier death). Stroke is not a diagnosis but a clinical syndrome with numerous causes, principally cerebral infarction (85%). Cerebrovascular disease (CVD) is one of the three leading causes of death in the world along with cancer and heart disease. Distinction between cerebral infarction and intracerebral hemorrhage is important because now a days proper management of the acute stroke syndrome is based on the correct diagnosis of the pathological type. It is difficult to be sure clinically about the type of stroke (Ischemic or hemorrhagic) in majority of Diab Endocr J 2010; 38(2): 58-62 cases as there is no specific differentiating features [2]. The only

confirmatory test is computed tomography (CT) of brain. However, some features like sudden onset of coma or changing state of consciousness with severe headache, vomiting and meningeal irritation suggest intracranial bleed. Similarly in cerebral infarction patient usually presents with sudden onset of stroke with lateralizing neurological deficit (hemiparesis, aphasia, homonymous hemianopia) with or without clinically detectable risk factors (hypertension, atrial fibrillation, rheumatic heart disease, recent myocardial infarction) [3]. Computed tomography is an accurate, safe & noninvasive procedure for differentiating between cerebral hemorrhage and infarction. It also shows the correct site of lesion. This study not only helps in the management of stroke patients but also to determine the incidence of hemorrhage and infarction in various cases of stroke 4.5.6. This study also compared

clinical and CT scan diagnosis of stroke and determined the reliability of the clinical diagnosis in cases of stroke.

old stroke as well as MVA cases well excluded from the study.

MATERIALS & METHOD

257 patients were taken into the study, CT scans were done due to acute stroke from July 2006 to June 2007 at Hospital Duchess of Kent (HDOK), Sandakan, Sabah, Malaysia a district 300 bed Hospital. CT scan machine is Siemens Somatom Emotion single slice with spiral facility. CT scan was done with axial basal & cerebral sequences on the clinical basis of diagnosis of CVD mostly admitted into the hospital with certain cases among IV contrast medium introduction. Patient history and clinical diagnosis were recorded from CT x-ray standard requesting form. No definite clinical criteria was formulated to make a provisional diagnosis of cerebral infarction or cerebral hemorrhage to label as hemorrhagic or thromboembolic stroke. However from the requesting x-ray form clinical diagnosis was recorded as infarction or haemorrhage or TRO CVD. The time from onset of stroke to CT scan examination varied and was dependent on the accessibility of CT scanner, which varied from within 72 hours to maximum one week. It was mostly done within 72 hours, few cases within 24 hours. Patients with no, CT scan done within 07 days, and patients with

RESULT

The study included 257 cases of clinically diagnosed CVD of which 83 (32.29%) were normal and 174 (67.70%) were abnormal (infarction or haemorrhage) by CT scan findings. Their age ranged from 11 to 90 years. Mean age was in normal group 52.45 ± 12.65 years (Mean \pm SD) and in abnormal cases 57.74 ± 10.47 (Mean \pm SD) respectively. Clinical diagnosis of mostly CVD (both in normal and abnormal CT findings) reported in the age group 40 to 70 years. Presentations of CVD cases were calculated on both normal and abnormal groups by CT scan findings by 'Z' test to evaluate the significance of difference between the highest and lowest groups. It showed no significance difference ($P > 0.05$) in the initial presentation of CVD in CT normal cases between the highest (51- HU Bhuiyan 60 years) and lowest (11-20 years) age groups. But the table showed significant difference ($P < 0.001$) in the abnormal cases by CT scan between the highest (51-60 years) and lowest (11-20 years) number of patients in these two groups. The results are shown in table -1.

Table-1: Age distribution of subjects with normal & abnormal CT scan findings in CVD by group; number & percentage (n=257)

Age in years	Normal CT brain (n=83)			Abnormal CT Brain (n=174)		
	No. of subjects	%	Mean age [M \pm SD]	No. of subjects	%	Mean age [M \pm SD]
11-20	2	2.40		1	0.56	
21-30	10	12.04		3	1.72	
31-40	2	2.40		3	1.72	
41-50	14	16.86	52.45 ± 12.65	27	15.51	57.74 ± 10.47
51-60	28	33.73		72	41.37	
61-70	20	24.09		50	28.73	
71-80	4	4.81		14	8.04	
81-90	3	3.61		4	2.29	

'Z' test, $P > 0.05$ 'Z' test. $P < 0.001$

Among the normal CT scan brain findings the clinical diagnosis was labeled as low Glasgow comma scale (GCS), drowsy, altered level of consciousness, convulsions, impaired renal or liver functions and serum electrolyte imbalance.

In this study, among the 83 subjects of normal CT findings, 50 were male and 33 were female. In the

abnormal group of 174 subjects, 98 were male and 76 were female. Relative proportion of male in abnormal group seemed to be greater when compared with normal group. However when compared with the proportion of total male, female cases both in groups of normal and abnormal CT scan finding, it showed statistically high significance [$Z = 5.71$, $P < 0.001$] (Table-2).

Table-2: Sex distribution by group, number and percentage (n=257) in both CT scan findings of Brain on the basis of normal & abnormal groups

Sex	Normal CT Brain		Abnormal CT Brain	
	No of patients	%	No of patients	%
Male (n=148)	50	33.78	98	66.21
Female (n=109)	33	30.27	76	69.72
Total (n=257)	83	32.29	174	67.96

'Z' test, $P < 0.001$

Out of 257 patients clinically suspected of cerebral infarctions 91 (35.40%) cases where CT scan detected 119 (46.31%) cases and haemorrhage 64 (24.60%) subjects but CT found only 52 (20.23%) subjects (Table 3-5). Among the indeterminate group 102 cases mostly presented with low GCS, drowsy, altered level of consciousness, convulsions, severe

headache, limb weakness, impaired renal and liver function as well as very old age, TRO underlying stroke where clinical diagnosis were not certain. However major cases, 83 in number CT scan were found nothing significant abnormality other than few of them showed different degree of degenerative changes. Only 20 cases were found to have infarctions, hemorrhage & SOL.

Table-3: Clinical diagnosis of type of CVD (n=257)

Clinical diagnosis	No of cases	%
Infarction	91	35.40
Haemorrhage	64	24.60
Indeterminate	102	40.00

Table-4: CT scan findings in patients with CVD (n=257)

CT scan diagnosis	No of cases	%
Infarction	119	46.31
Haemorrhage (Including SAH, SDH)	52	20.23
SOL	03	1.17
Normal	83	32.29

Table-5: CT scan diagnosis in clinically classified cases (n=119+52=171).

	Clinical diagnosis	CT scan	Agreement of results
Haemorrhage	64	52	81.25
Infarctions	110	119	108.18

Table-6, shows that occurrence of cerebral infarction and hemorrhage are common in both male

and female, but no cases of SAH, SDH & SOL (were recorded in female group).

Table-6: Type of pathological lesions diagnosed by CT scan in acute stroke cases.

Sex	No of abnormal patient	Infarction	Haemorrhage	SAH	SDH	SOL
Male	98	64	26	3	2	3
Female	76	55	21	0	0	0

Diabetes was predominant in both male and female group compared to hypertension (Table-7).

Table-7: Infarctions findings CT scan & number of Hypertension (HTN), Diabetes Mellitus (DM), Ischaemic heart disease (IHD)

Sex	No of Infarction pt.	No of HTN& DM	No of HTN pt.	No of DM pt.	No of IHD pt.	Not recorded
Male	64	23	30	36	11	09
Female	55	16	21	28	07	04

Predominance of hypertension in hemorrhagic stroke was seen in both male and female groups (Table-8).

Table-8: Hemorrhagic findings CT scan & number of Hypertension (HTN), Diabetes Mellitus (DM), Ischaemic heart disease (IHD)

Sex	No of Haemorrhagic	No of HTN& DM	No of HTN pt.	No of DM pt.	No of IHD pt.	Not recorded
Male	31	11	19	12	02	03
Female	21	08	15	10	01	03

Table-9 reveals that, with CT scan, we found 119 cases (64 male and 54 female) of cerebral infarction and 52 cases (31 male and 21 female) of intracranial hemorrhage. Among 119 cases of cerebral

infarction 42.85% (51 patients) were hypertensive while this percentage was 65.28% (34 patients) in 52 cases of intracranial hemorrhages. Only 5 male patients found intracranial hemorrhage 3 cases SAH and 2 cases SDH.

Table-9: Findings on CT scan & percentage of hypertension in the patient with stroke

CT scan findings	Male	Female	% of patients with Hypertension
Cerebral infarction (n=119)	30	21	42.85%
Intracerebral Haemorrhage (n=52)	19	15	65.38%

DISCUSSION

Most important intracranial pathology causing neurologic deficit is cerebrovascular disease (CVD). Clinically it is classified as transient ischaemic attack (TIA) and stroke. These are common problems of middle and later year of life admitted in the general hospital. It is necessary to make correct identification of the exact pathological process causing stroke. This can enable us to benefit from new developments in the management of acute stroke. The primary objective of this study was to evaluate the utility of cranial CT scan performed in patients with CVD as well as comparison of its findings with clinical diagnosis according to type of CVD, either infarction or hemorrhage. Two hundred and fifty seven cases of CVD were taken in this study retrospectively who underwent CT scan of brain of acute onset at Hospital Duches of Kent (HDOK), Sandakan, Sabah, Malaysia. CT scan found pathological lesion in brain of 174 cases, and 83 cases were detected with no abnormality. The age ranged from 11-90 year with mean (\pm SD) of 52.54 ± 12.53 years and 57.74 ± 10.47 years for normal and abnormal CT findings respectively. The peak age incidence of CVD in both groups was observed in 6th and 7th decades which is similar with the findings of Sotaniemi *et al.*, (1990)8. In the present study the male preponderance was noted in both normal and abnormal CT findings of brain presented as CVD; ratio of male and female were 1.52:1 and 1.29: 1 respectively. Rahman (1997) [9]. also found male to female ratio of 1.9:1. In another study by Davies *et al.*, (1975) [10] the male- female ratio was 1.6:1. It is stated by Kumer & Clark that neurologic deficits due to stroke and other causes are less common below the age of 40 years, which is also reflected in the present study where 95% affected patients were over 40 years of age. Few cases were found below 20 years mainly due to seizure, convulsion or low GCS. In this present series, the predominant clinical features in abnormal CT brain findings presented was hemiplegia (57.45%) and in normal CT findings cases low GCS (35.82%). None of the normal group presented with hemiplegia. Out of 257 patients clinically suspected of cerebral infarctions 91 (35.40%) cases where CT scan detected 119 (46.31%) cases and hemorrhage 64 (24.60%) subjects but CT found only 52 (20.23%) subjects which are far away from Guy's and Siriraj study. Among the indeterminate group 102 cases mostly presented with low GCS, drowsy, altered level of consciousness, convulsions, severe headache, limb weakness, impaired renal and liver function as well as very old age, TRO underlying stroke where clinical diagnosis were not certain. However majority of cases,

83 in number, CT scan found nothing significant abnormality other than some of them showed different degree and degenerative changes. Only 20 cases were found infarctions, haemorrhage and SOL. In this study the percentage of intracranial hemorrhage and infarction varied considerably from the studies done in the developed countries of the western world but varied little from the studies done in developing and underdeveloped countries like Thailand, India, Pakistan, Bangladesh [17]. Cerebral hemorrhage is found in 20% of patients with stroke in the developed countries. But in developing countries like Malaysia the lesion is quite common, partly because of poorly controlled hypertension or defaulted treatment. In our study at HU Bhuiyan Hospital Duchess of Kent (HDOK), cerebral hemorrhage accounted for 30.40 % (52 cases out of 171 CT confirmed stroke) and cerebral infarction 69.59% (119 cases out of 171 CT confirmed stroke). This similar or near the studies done in Thailand showing 40-50% cases of cerebral hemorrhage and 50-60% cases of cerebral infarction [13]. In other studies like in India, Pakistan showing the almost similar result that is 42 to 42.5% for haemorrhage and 57.5 to 58% respectively that are also close to our findings but hemorrhage appears lesser degree [14]. Among the risk factors hypertension was the most important risk factor for stroke, not only in hemorrhage, but also in cases of cerebral infarction. Hypertension was 65.38% of the intracranial hemorrhage, 98% with intracerebral hemorrhage which is very similar study done in India 64% of intracranial hemorrhage but much lower than study done in Pakistan which is about 90% [15]. In this study intracerebral hemorrhage were common at the basal ganglion, at the thalamic area, near the internal capsule which are almost similar to different studies 16. Cerebral infarction involved while cerebral mainly the middle cerebral artery territory (MCA) predominantly parietal lobe hemorrhage involved the basal ganglion and thalamus.

CONCLUSION

In conclusion, in order to make a clinical diagnosis examination is mandatory. If we could do proper of stroke, a detailed history and through clinical judgment by following criteria for stroke 83 cases could be avoided urgent CT scan brain or could reduce the number of cases which are related to radiation as well as cost. However as far treatment planning is concerned clinical diagnosis of stroke is not safe enough as a guide for anticoagulant or thrombotic therapy. The incidence of intracranial hemorrhage is very high more than 40% in developing countries in

contrast to the 5 to 20% in developed countries. Hypertension is an important risk factor for intracranial hemorrhage and cerebral infarction and its poor control may be an important cause for the high incidence of intracranial hemorrhage in our part of the world. In our study significant number were found defaulted treatment by the patients themselves. So proper health education is necessary to control high blood pressure as well as diabetes mellitus. Further study could be done comparing clinical diagnosis with MRI findings which is more sensitive in detecting very early as well as smaller lesions in stroke.

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