CORRELATION OF CLINICAL AND COMPUTED TOMOGRAPHIC DIAGNOSIS IN PATIENTS OF CEREBROVASCULAR DISEASE

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Abstract:

Objective: *To find out the correlation of clinical and computed tomographic diagnosis in patients of cerebrovascular disease (CVD).*

Materials and Methods: *Clinical and computed tomographic diagnoses were compared in 133 patients who were diagnosed clinically as CVD and underwent computed tomography (CT) scan of brain for confirmation of their clinical condition. The study was done in Dhaka Medical College Hospital, Dhaka from July, 2003 to June, 2004.*

Results: *Of the 99 clinically diagnosed infarct cases, 82 cases were proved to be correct on CT scan. 25 out of the 34 provisionally diagnosed cases of haemorrhagic CVD were confirmed to have the same by CT scan. 4 cases were found normal and 10 cases as intracranial tumours in CT scan which were clinically diagnosed as CVD. 6 cases diagnosed clinically as haemorrhagic CVD were finally proved to be ischaemic CVD by CT scan and 6 cases diagnosed clinically as ischaemic infarction were confirmed as intracranial haemorrhage. No significant difference was found in between clinical diagnosis and CT scan diagnosis ($p > 0.001$).*

Conclusion: *Clinical and CT scan diagnosis in patients of cerebrovascular disease correlate well. Therefore, a careful neurologic assessment combined with CT scan of brain is useful in diagnosing specific cerebrovascular lesion for specific therapeutic implications with high certainty. Moreover, CT scan can exclude other intracranial lesions those mimic CVD clinically.*

Key words: *Cerebrovascular disease (CVD), clinical diagnosis, computed tomography (CT).*

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Introduction:

Cerebrovascular Disease (CVD) is defined as a focal neurological deficit due to vascular lesion of rapid onset and by definition, lasts longer than 24 hours if the patient survives [1]. The two clinical categories of CVD are ischaemic and haemorrhagic. Haemorrhagic CVD refers to primary parenchymal haemorrhage and subarachnoid haemorrhage, not haemorrhagic transformation of an ischaemic CVD. Ischaemic CVD results from occlusion of or reduced blood flow in an intracranial vessel and is the commonest form of CVD [2]. CVD is the third most common cause of death in the developed world after cancer and ischaemic heart disease and responsible for a large

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proportion of physical and mental disability [3]. It is also a common clinical problem in Bangladesh with incidence of 2.6 to 3.9 per 1000 [4] having high mortality and morbidity. Incidence of CVD rises steeply with age [3]. Males are more affected than females but the mortality is higher in women than men [5].

Before the introduction of computed tomography (CT) scan, diagnosis of CVD was based on clinical findings, cerebral angiography & lumbar puncture with cerebrospinal fluid (CSF) examination. The introduction of CT to clinical practice has had a great impact on our knowledge of CVD & it has become the most commonly used primary radiological investigation for CVD[6]. Primary intracerebral haemorrhage & ischaemic CVD are difficult to differentiate clinically reliably. The use of CT to exclude primary intra cerebral haemorrhage is already widespread, especially if the use of anticoagulant therapy is being considered[7]. It is found that in CT findings with a small hypo attenuating area, treatment with anticoagulant increase the chance of good out-come. In case of a normal CT scan or large hypo attenuating area, anti-coagulant therapy had no beneficial effect but increase the risk of fatal brain haemorrhage[8]. Again, anticoagulant is not without risk. Overall, intracranial haemorrhage occurs in 1-4% of patients who receive an anticoagulant for transient ischaemic attack (TIA) or acute ischaemic CVD. Accordingly, uncontrolled hypertension, intracranial haemorrhage, and uncontrolled bleeding at another site are contraindications to anticoagulation. In patients at risk for hemorrhagic transformation, e.g. patients who have had large hemispheric strokes or strokes also may

be at risk for hemorrhagic transformation[9]. So the rational management of a patient presenting with an acute stroke should be based on knowledge of its pathological types and locating the sites of lesion. To solve this problem, CT is the standard for the imaging of acute nontraumatic intracranial haemorrhage. So, both careful neurologic assessment and a policy of early computed tomography are of crucial importance in the diagnosis of CVD and for therapeutic consideration [6].

It is also important to confirm the presence of an ischaemic stroke and exclude mimics of ischaemic stroke or intracranial haemorrhage. Although CT remains the investigation of choice to exclude acute intracerebral haemorrhage, diffusion weighted magnetic resonance imaging (MRI) has proved to be a more sensitive method of detecting early ischaemic infarction [7]. MRI techniques however is often negative in the acute stage of subarachnoid haemorrhage or nonspecific in acute intracerebral haemorrhage and has several disadvantages, namely paucity of its availability and high cost in developing countries like Bangladesh, long scan time and its inability to be used in restless patient and patients with metallic objects like cerebral aneurysm clips, metallic prosthesis, cardiac pacemakers, implanted electrodes such as neurostimulators etc. Moreover, almost similar sensitivities were demonstrated for MR (85.5%) and CT angiography (88.5) for circle of Willis [10]. Recently with the advent of high resolution CT, imaging is very rapid and can be done with minimal patient co-operation, and with minimum radiation exposure. CT scan is usually axial but coronal image can be done in some cases and has the potential for image reconstruction. With the advent of multislice CT, the scan time has further been shortened. Thus CT is still used throughout the UK as a method of triaging patients with CVD. There has recently been keen interest in 3D spiral CT angiography of the intracranial (Circle of Willis) and extracranial vessels (carotids) and these scans are more reliable than their MR equivalents. Because of the linearity of iodine concentration and CT attenuation, perfusion CT techniques to assess cerebral perfusion may be more robust than some MR data. Besides, CT still remains much simpler for the confused or post operative patient [11]. Other imaging studies, such as Xenon CT, Single Photon Emission CT (SPECT), and Positron Emission Tomography (PET), are occasionally but not generally used [12].

Considering all these limitations, emphasis was given in this study to identify various presentation of CVD, to verify the accuracy of clinical diagnosis in correlation with CT scan findings, to improve the quality of diagnosis and management of CVD patients and thereby, to reduce death and long term complications.

Materials and Methods:

This prospective hospital based study was carried out in the Department of Radiology and Imaging in collaboration with the Department of Neurology in Dhaka Medical College Hospital (DMCH), Dhaka from July, 2003 to June, 2004. The study sample comprised of 133 patients who were admitted into DMCH during the above mentioned period with the provisional diagnosis of CVD and underwent CT scan of brain within 10 days of onset of their illness for confirmation of their clinical diagnosis.

The clinical diagnosis of the patient was made by a qualified neurologist of the Department of Neurology, DMCH who recorded the clinical data including patients' history, clinical features, risk factors and related laboratory investigations. A radiologist of the Department of Radiology and Imaging, DMCH determined the CT diagnosis mentioning the site, involved arterial territory, size and the number of the lesions. All the CT scan examinations included axial projections. The slice thickness was 4-5 mm in the posterior fossa and 8-10 mm supratentorially. Contrast enhancement was not used in patients with contraindications or in those with findings definable with certainty without contrast (e.g. ICH).

All clinical and CT data were collected and analyzed by using SPSS version 10.0. Chi-square test was done to see if any significant difference existed between the clinical and computed tomographic diagnosis with $p<0.001$ taken as the level of significance.

Results:

In the present study, 92 (69.18%) were males and 41 (30.82%) were females which showed a definite preponderance of males with a male: female ratio of approximately 2.24:1 Almost equal number of patients belonged to the age group of 51-60 years (36.84%) and 61-70 years (35.34%) followed by patients of above 70 years of age (15.04%). The mean age of the patients was 63.3±11.1 years (range was 32-75 years). Hypertension was found to be the most common risk factor and it was present in 98 (73.7%) patients. The habit of smoking was found in 74 (56.6 %) patients. Diabetes Mellitus and heart disease was found in 53 (39.8%) and 26 (19.5%) patients respectively.

The most common clinical presentation of CVD was hemiparesis/hemiplegia (90.9%). High blood pressure (73.7%), impaired consciousness (63.2%), headache (47.4%), cranial nerve palsy (40.6%), dysphasia (48.1%), and vertigo (30.8%) were the other major clinical features of the patients included in this study.

Among the 133 patients, 99 (74.4%) were provisionally diagnosed to be suffering from ischaemic stroke i.e. infarction and the rest 34 (25.6%) as haemorrhagic stroke comprised of intracerebral haemorrhage and subarachnoid haemorrhage (Table-I).

Computed tomographic diagnosis showed 88 as infarction, 31 as haemorrhagic CVD, 4 as normal and 10 found to have brain tumours. Among the 31 cases of haemorrhagic CVD, intracerebral haemorrhage was detected in 25 and subarachnoid haemorrhage was found in 6 cases (Table-II).

Table-I

Clinical diagnosis of the study subjects (n=133)

Clinical Diagnosis	Number	Percentage
Infarction	99	74.4%
Haemorrhage	34	25.6
a) Intracerebral	27	79.4%
b) Subarachnoid	07	20.6%
Total	133	100%

Table-II

CT diagnosis of study the subjects (n=133)

Clinical Diagnosis	Number	Percentage
Infarction	88	66.2%
Haemorrhage	31	23.3%
a) Intracerebral	25	18.8%
b) Subarachnoid	06	4.5%
Tumours	10	7.5%
Normal	04	3%
Total	133	100%

Comparison between clinical and CT-Scan diagnosis is shown in Table-III. Out of 99 patients who were provisionally diagnosed as

Table-III

Comparison between clinical and CT-Scan diagnosis

Clinical Diagnosis (Numbers)	CT-Scan Diagnosis (in numbers)			
	Infarction	Haemorrhage	Tumours	Normal
Infarction (99)	82	06	08	03
Haemorrhage (34)	06	25	02	01
Total (133)	88	31	10	04

ischaemic stroke, 82 patients confirmed as the same by CT scan but 6 of them found to have haemorrhage lesions, 8 had lesions suggestive of brain tumours and CT-Scan of 3 patients showed normal findings. Among 34 clinically diagnosed cases of haemorrhagic stroke, 25 were confirmed to have the same by CT-Scan. Among the rest, 6 had infarction, 2 had tumours and CT-scan of l patient found to be normal.

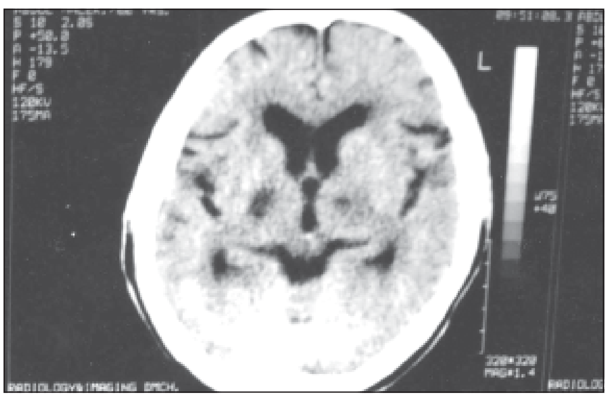

Fig. 1: *CT-Scan of brain showing small infarcts involving posterior limb of right internal capsule and left thalamus.*

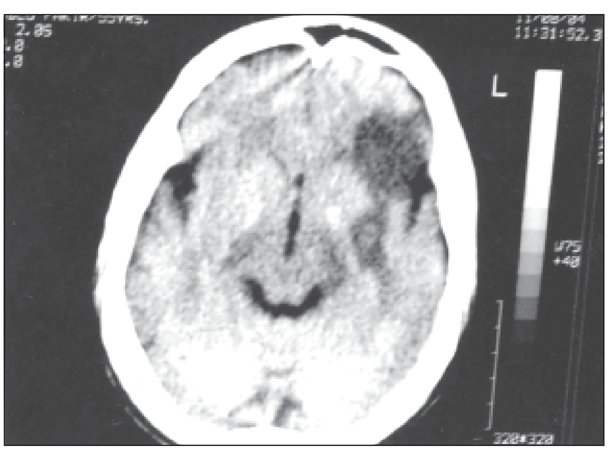

Fig. 2: *CT-Scan of brain showing large infarcts involving left frontal region at left ACA territory.*

Out of 88 patients having infarcts, 71 cases showed single infarct, 13 cases showed 2 infarcts each and 4 cases showed more than 2 infarcts. A total of 110 infarcts have been observed in those 88 patients. 40 out of 110 (36.4%) infarcts were < 2cm, 55 (50.0%) infarcts were 2-5 cm and 15 (13.6%). infarcts were > 5 cm in their longest dimension. Overwhelming

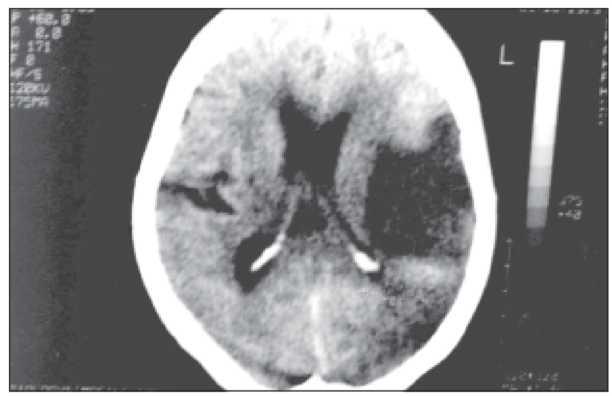

Fig. 3: *CT-Scan of brain showing large extensive infarct involving left parietal region extending from cortex to subcortical white matter at left MCA territory.*

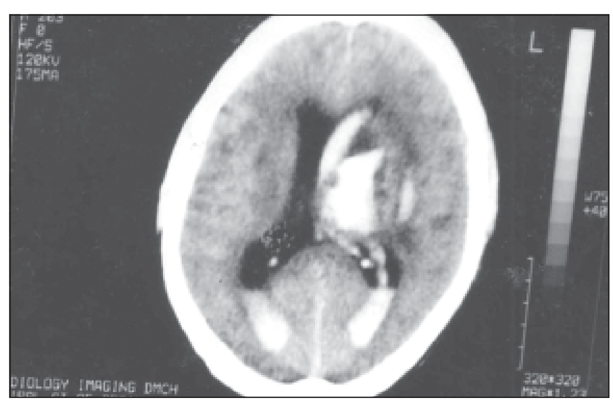

Fig. 4: *CT-Scan of brain showing left parietal paraventricular heamatoma at left MCA territory with ventricular extension.*

majority (70%) of ischaemic stroke occurred in the territory of Middle Cerebral Artery (MCA) followed by Anterior Cerebral Artery (16.4%) and Posterior Cerebral Artery (10%). Among 31 found to have haemorrhage in CT-Scan diagnosis, 30 cases showed haemorrhage in single site and one case showed haemorrhage in two sites. That is a total 32 haemorrhagic sites have been observed in 31 haemorrhagic patients. It is evident that majority (75%) of the ICH occurred due to rupture of MCA branch followed by Anterior and Posterior Cerebral Artery .More than half (67.7%) of the stroke patients with ICH detected by CT-Scan had mass effect whereas two-third (75%) of ischaemic stroke patients were without significant mass effect.

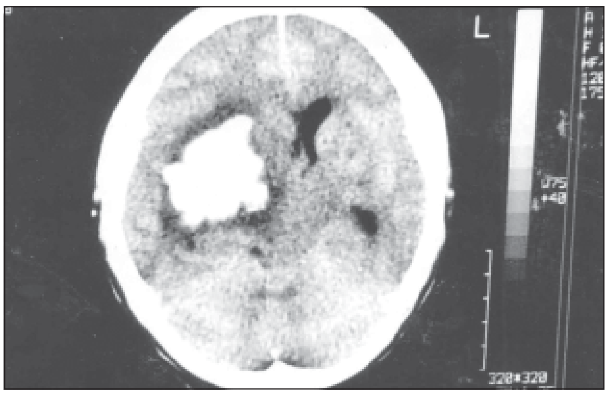

Fig. 5: *CT-Scan of brain showing large heamatoma involving right capsuloganglionic area with massive perifocal oedema at right MCA territory with significant mass effect.*

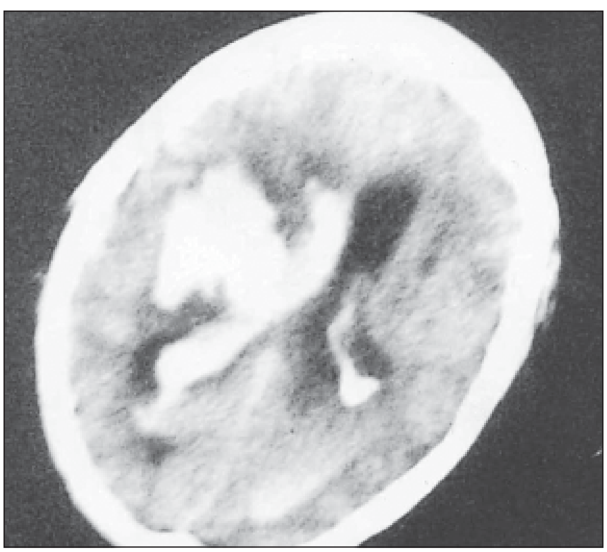

Fig. 6: *CT-Scan of brain showing right sided large intracerebral haematoma with ventricular extension at right MCA territory.*

No significant difference was found in between clinical diagnosis and CT diagnosis in CVD patients (p> 0.001).

Discussion:

Computed tomography has revolutionized the cross sectional imaging. It provides detailed anatomical out line without adjacent structures interfering with the visualization of each other. It is the primary imaging modality in the evaluation of CVD patient especially in haemorrhagic CVD. With the development of helical CT, the scan time has been reduced to minimum. Soft tissue structures are readily discernable with the addition of contrast agent. Multislice CT is one of the modern invention in computed tomography where scanning of 16 or more slices per second is possible. Advantage of multi- slice CT is short data acquisition time and real time imaging is possible due to having more than one row of detector - usually 2 to 4 rows. Though CVD may be diagnosed clinically but not all cases with confirmation, it is the pathology in the brain of patients of CVD which is difficult to differentiate as well as to assess clinically reliably. And here is the CT, which can confirm the pathology and can help in planning and management strategy of patients of CVD especially if the use of antiplatelet therapy is being considered[2].

CT scan detect whether there is infarct, brain haemorrhage or subarachnoid haemorrhage. It can also detect the mass effect especially in case of haematoma in the brain which causes serious neurological deficits. So, by confirming the pathology in CVD patients, CT scan can help in planning whether medical treatment (anti-thrombotics or antiplatelet drugs) or surgical intervention (drainage of haematoma to alleviate mass effect on the brain, clipping of ruptured cerebrovascular aneurysm) can be instituted or not.

CVD is uncommon below the age of 40 years [1]. CVD is becoming more frequent with increasing age [3]. These observations are also reflected in the present study where no case was found below the age of 30 years. CVD was commoner between the ages 41 and 70 of which commonest age group was 51-60 years, 49 (36.84%), second commonest 61-70 years (35.34%), third commonest 41-50 years (10.53%). Again about 72% affected patients were over 50 years of age. These findings are closer to other studies[13].

In the present study, the male preponderance was noted, which is consistent with another study [3]. The update on stroke, 2004, from Neurology Research Center (NRC) of Dhaka Medical College Hospital, had shown strikingly higher male preponderance (4:1). The higher preponderance of males in this study may be due to cultural attitude of our society that the females are less frequently brought to the hospital than the males.

Analysis of clinical features revealed that most common presentation was hemiplegia and hemiperesis (90.9%), which was found among 89 (89.9%) of clinically diagnosed ischaemic cases and 32 (94.1%) haemorrhagic cases. Easton et al [14] has observed that unconsciousness is a predominant feature of intracranial haemorrhage. From the present study it is evident that 84 patients presented with impaired consciousness which was strikingly high (82.35%) among patients with haemorrhagic CVD and relatively low (56.56%) in ischaemic CVD. Out of 133 patients of this study some patients had multiple clinical features. It was observed that vertigo, neck rigidity and headache were significantly correlated with haemorrhagic CVD. Clark [1] also showed the significance of headache and neck rigidity associated with haemorrhagic CVD. From the present study, it is also evident that cranial nerve palsy is markedly associated with ischaemic CVD than haemorrhagic CVD (46.46% and 23.52% respectively). Among the 133 clinically diagnosed CVD patients, 99(74%) patients were provisionally diagnosed to be suffering from ischaemic CVD that is infarction. Haemorrhagic CVD comprised of 34(25.6%) patients of which 79.4% intracerebral, 20.6% subarachnoid haemorrhage. This study is more or less similar with the study of Brown [15], where cerebral infarction was 85%, primary intracerebral haemorrhage was 10% and subarachnoid haemorrhage was 5%. In the present study, hypertension was found to be the most common risk factor and it was found in 98(73.7%) patients. These findings are consistent with update on stroke, 2004, Neurology research center, Dhaka Medical College Hospital, but differ with that of Bashar et al. [13] who found 36% of CVD patients were hypertensive. In this study 39.8% (53 cases) of the patients were diabetic. CVD patients associated with heart disease were found 19.5% (26 cases). It is known fact that cardio-embolism causes 15% of all CVD [14].

Cerebral CT has become the most commonly used primary radiologic investigation for CVD. Computed Tomographic scan diagnosis Of CVD slightly differed from that clinically diagnosed. In present study it was found that, of the 99 patients who were provisionally or clinically diagnosed to have infarction, 82 cases were proved as such on CT scanning. Incase of haemorrhagic CVD, 34 clinically diagnosed cases of haemorrhage 25 were confirmed to have the same by CT-scan. Primary intracerebral haemorrhage with ischaemic CVD is difficult to differentiate clinically reliably [7] which has been reflected in this study. Six cases which were diagnosed clinically as ischaemic infarctions were finally diagnosed by CT as intracranial haemorrhage and six cases which were diagnosed clinically as haemorrhagic CVD were finally diagnosed as infarction. Significance of this observation is that use of anti coagulant or antiplatelet agents on clinical ground alone may be unsafe and disastrous for actual haemorrhagic cases may present as infarction due to overlapping of clinical features. Out of 88 CT scan diagnosed CVD patient with infarction, the commonest site (23.6%) of the lesion was parietal regions followed by basal ganglion region (21.8%). The next common site of infarction (16.4%) was the paraventricular regions. Again the incidence of site involvement in case of intracranial haemorrhage (ICH) is different from that of infarction. Basal ganglia region (37.5%) was the commonest site of haemorrhage in the present study. The next common site of ICH (21.9%) was paraventricular region. These findings are almost consistent with that of Bashar et al [13]. Basal ganglionic haemorrhage may rupture into adjacent ventricles [14]. More than half (67.7%) of the CVD patients with ICH detected by CT scan had mass effect whereas, one-third (25%) of ischaemic CVD patients had significant mass effect. Mass effect is more common finding in case haemorrhagic CVD. Arterial territorial involvement is an important observation in this study. Majority of the lesion in both ischaemic and haemorrhagic CVD patient involve middle cerebral arterial (MCA) territory where haemorrhagic involvement (75%) is slightly higher than ischaemic involvement (70.0%). MCA involvement is followed by anterior cerebral artery and posterior cerebral artery involvement in case of both ischaemic and haemorrhagic CVD. Bashar et al. [13] found that MCA was responsible for 7% of the arterial territorial involvement, 12% were anterior Cerebral Arterial territory (ACA) and 9% were Posterior Cerebral Arterial territory (PCA). Middle cerebral artery is most frequently involved and almost always caused by ischaemia [16].

Conclusion:

It can be concluded that clinical and CT scan diagnosis in cerebrovascular disease correlates very well. Moreover, CT scan can also exclude intracranial lesions those mimic CVD clinically. Therefore, a careful neurologic assessment combined with CT scan of brain is useful in diagnosing specific cerebrovascular lesion for specific therapeutic implications with high certainty.

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