ORIGINAL RESEARCH ARTICLE

Role of Computed Tomography in Evaluation of Cerebrovascular Accidents

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ABSTRACT

Introduction: Cerebrovascular accidents or Stroke ranks first in frequency and importance among all the neurological disease of adult life. Majority of neurological disorders in a hospital are belongs to this category. Stroke is the commonest leading cause of death in the world, the extended morbidity and long hospitalization required by these patients makes the disease one of the most devasting in medicine. Stroke is a defined as a focal neurological abnormality due to disturbance in blood flow to the brain of any cause, generally of sudden onset that does not resolve completely in 24 hours. Aim: The aim of the present study is to collect the haemorrhage or infracts, to determine the dimensions and reasonably assessing the territory to blood vessels involved and to detect the incidence of negative cases of clinically suspected stroke.

Material and methods: 50 cases admitted to Sri Adichunchanagiri Hospital and Research Centre B.G.Nagara with the clinical diagnosis of acute stroke was taken up for the study. The present study was done between November 2005 to October 2007.

Results: Out of 50 patients clinically suspected of CVA submitted for CT scan study of the brain. 32 patients i.e., 64% had infracts. 12 patients i.e., 24% had haemorrhage, 1 patient i.e., 2% had C.V.T., 3 patients i.e., 6% had S.A.H. 1 patient i.e., 2% had tumors, 1 patient i.e., 2% had normal scans. Infracts formed the major group of the CVA cases i.e., 64%. Most commonly affected was the R.M.C.A. territory in 9 patients i.e., 28.12%. Haemorrhage formed the second major group o the CVA cases i.e., 24%. Involving most commonly the L.MCA territory 3 patients i.e., 26.66%.

Conclusion: C.T. Scanning is a standard most technique for the diagnosis of acute stroke and management of stroke depends upon perfect diagnosis and should be ideally done in all cases.

Key words: Tomography, X-ray Computed Cerebrovascular Accident Cerebral Infarction, Intracranial Haemorrhage, Hypertensive Intracranial Haemorrhage, Traumatic Venous Thrombosis, Intracranial Embolism and Thrombosis.

INTRODUCTION

CVA or stroke is defined as an acute loss of focal and at times global cerebral function, the symptoms lasting more than 24 hours or leading to death with no apparent cause other than that of vascular origin (WHO).[1]

CVA is one of the leading causes of death after cardio-vascular disease and neoplasm in the developed countries and one of the major causes of death in India. The correct prevalence rate of this disease in the India population is not yet evaluated, although it is responsible for about 1% of admissions to all hospital. The prevalence rate and 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.[2]

With the introduction of CT scan 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. With CT scan it is now possible for the first time to non-invasively and correctly 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 tumor or subdural haematoma that can usually be clearly differentiated by CT examination. However, it is a relatively new and scarcely available facility in a yet developing country like India. Its use is further restricted by patient's economic status.

There are many reasons for performing Brain CT scan of patients with CVA.[3]

To establish the diagnosis and types of stroke.

To exclude intracranial haemorrhage.

To diagnose spontaneous subarachnoid haemorrhage.

Medical field should be grateful to the high spatial and density resolution capability of a CT, it is one of the most reliable methods available for identifying and localizing an infarction within the brain. Ischemic infarction, hemorrhagic infarction

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and intracerebral haematoma are usually differentiated. CT scan also helps in identification of the acute and chronic sequence that may develop after a sequence of infarction. These include, in acute phase, brain swelling and conversion of a bland into haemorrhagic infarct and in chronic phase, cystic parenchymal change, cortical atrophy and focal ventricular dilatation.[2]

Despite many improvements in MRI technology, CT scan is still the first method of choice for more of the patients being evaluated for cerebrovascular accidents. CT scan is a good diagnostic tool even in early phase of acute ischemic stroke. In combination with new helical CT technique all-important decisions regarding early therapeutics can be found. In CT evaluation of stroke, additional and frequent valuable information may be gained when CT scans are performed both before and after contrast administration. Contrast administration aids in identifying other types of brain lesions that may present clinically as stroke and permits detection of up to 13% of infarcts, which are evasive on non-contrast scans. Although the underlying nature of the vascular pathology causing an infarction is not directly revealed on CT, frequently distinguishing patho-physiological alternations will be evident on contrast enhanced CT with in combination with alteration seen on non-contrast CT will suggest the correct diagnosis between two major causes of infarction, embolism and primary vaso-occlusive diseases. In this differentiation follow-up, non-contrast CT are frequently valuable during the last 2-3 weeks are distinctive difference in the temporal evolution of these two conditions may be revealed. The difference between the two has important therapeutic implications.

Therapeutic approach to stroke has gone many changes in the last few years. CT has become an internal part of the assessment and has given a more objective basis to management and use of the IV contrast material. After non-contrast CT scan and the availability of follow-up studies in many instance significantly helps in the determination of the correct vascular etiology of the stroke, as does correlation of CT scan changes with patient's age, sex, history and neurological deficit.

The aim of the present study was to collect the haemorrhage or infracts, to determine the dimensions and reasonably assessing the territory to blood vessels involved and to detect the incidence of negative cases of clinically suspected stroke.

MATERIAL AND METHODS

50 cases admitted to Sri Adichunchanagiri Hospital and Research Centre Balagangadharanatha Nagara with the diagnosis of acute stroke were taken up for the study. The present study was done between November 2005 to October 2007.

Patient Selection

Data for my intended study was collected by sampling referred cases with history of stroke with even C.T serial numbers for a period of 24 months starting from November 2005 to October 2007. This was a case study of 50 cases

The patients were submitted to a through clinical examination including radiological examination. Computed Tomography was carried out using SYTEC 1800 I. (G.E. medicals system) Machine using both plain and contrast study. We didn't try to compare computed tomography with other imaging modalities like M.R.I, Angiography or Doppler.

Follow up was done for a period of two months. Follow up was done by subsequent repeat scans of the patient and rest of the computed tomography scans was correlated with surgical finding where ever necessary or by favorable clinical outcome Size of the lesion, peri- lesional edema, attenuation values was compared with prior to and after treatment.

Inclusion Criteria

Patients with clinical diagnosis of acute stroke above 12 years, admitted in the Sri Adichunchanagiri Hospital and Research Centre. B.G.Nagara; were eligible for the study.

Exclusion Criteria

Patients with CNS defects due to proper cause other than vascular, such as hypoglycemia, diabetic keto acidosis and traumatic cause were not included in this study.

RESULTS

50 Cases admitted in Sri Adichunchanagiri Hospital and Research Centre; B.G.Nagara, with clinical diagnosis of stroke were taken for the study. Out of 50 patients clinically suspected of CVA submitted for CT scan study of brain in that 32 Patients had infarction, 12 Patients had hemorrhage, 3 patients had SAH, 1 Patient had normal scan,1 Patient

CT Scan findings	Number of cases	Calculation for 50 cases
Infarcts	32	64%
Haemorrhage	12	24%
CVT	1	2%
SAH	3	6%
Tumors	1	2%
Normal	1	2%
Total number of cases subjected for computerized tomography Scan of brains: 50 cases:		

Table-1: Distribution of cases

Age	Cases
20-29 Years	01
30-39 Years	02
40-49 Years	03
50-59 Years	03
60-69 Years	12
70-79 Years	10
80-89 Years	01

Table-2: Infarcts: Number of cases 32

Age	Cases
20-29 Years	01
30-39 Years	01
40-49 Years	01
60-69 Years	04
70-79 Years	03
80-89 Years	02

Table-3: Haemorrhage: Number of cases 12

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Region of brain	No. of Cases	Percentage
Putamen / External capsule	06 cases	50.00%
Thalamus	02 cases	16.60%
Cerebellum	02 cases	16.60%
Haemorrhagic infarcts	1 cases	8.3%
Pons	0 cases	0%
Miscellaneous	1 cases	8.3%

Table-4: Incidence of ICH in different parts of Brain in 12 cases of Intracerebral Haemorrhage

had tumorous pathology, 1 Patient had cerebral venous thrombosis (table 1).

In the present study the age of the patient varied from second decade to eighth decade. The minimum age of the patient was 21 years old and oldest was 88 years (table 2). Among the 50 cases included in the study, 33 patients were males, i.e., 66.66% and 17 patients were female (33.33%), Infarction in males: 67%, Infarction in females: 33%, Male: Female ratio: 1.05: 0.5. Haemorrhage in Males: 66.66%, Haemorrhage in Females: 33.3%, Male: Female ratio: 2.6: 1.3. Comparatively in our study cerebral infarct and haemorrhage incidence in men was more (table 2).

It was observed that both infarction and haemorrhage were most common in the age group between 60-69 years (table 3).

In the risk factors, past history of HTN was given more importance. 15 patients i.e., 30% had history of pre-existing HTN, however many patients admitted that they were not tested for hypertension before the onset of stroke, 8 patients i.e., 55.55% with hypertension showed cerebral haemorrhage, 4 patients i.e., 33.33% with hypertension showed infarct.

In the present study 24% of the patients had a history of Diabetes mellitus. Most of the patients were not tested earlier for evidence of diabetes before the onset of stroke, Out of 50 patients 12 patients had diabetes, 66.6% of the diabetic patients had cerebral infarction i.e., in 8 patients, 33.3% of the diabetic patients had cerebral haemorrhage i.e., 4 patients.

In the present study history revealed the existence of heart disease in 20% of the patients i.e., in 10 cases. Out of 10 cases, 6 cases had cardiac disease, which was previously detected, 5 cases had ECG changes after stroke attack and 1 case had silent cardiac chest pain.

Involvement of vascular territory

Cerebral infarction

Out of 50 cases of CT evaluation of CVA, 32 cases of infarcts were diagnosed that accounts for 64%, 09 patients had infarct in right MCA territory accounting for 28.12%, 07 patients had infarct in left MCA region accounting for 21.87%, 03 patients had infarct in right PCA territory accounting for 9.37%, 02 patients had infarct in left PCA territory accounting for 6.25%, 01 patient had infarct in left ACA territory accounting for 3.12%, 01 patient had infarct in right ACA territory accounting for 3.12%, 02 patients had infarct in right MCA and PCA territory accounting for 6.25%, 02 patients had infarct in left MCA and PCA territory accounting for 6.25%, 02 patients had infarct in both MCA territory accounting for 6.25%, 01 patient had infarct in vertebro basilar artery territory except PCA branch accounting for 3.12%, 02 patients had lacunar infarcts accounting for 6.25%.

Intracerebral haemorrhage

In our study of 50 cases of clinically suspected CVA, 12 cases were turned out to be intracerebral haemorrhage, which accounts for 24%. Out of 12 cases of intra cerebral haemorrhage, 03 patients had intracerebral haemorrhage in left MCA territory accounting 24%, 02 patients had intracerebral haemorrhage in right MCA territory accounting for 16.67%, 01 patient had intracerebral haemorrhage in right PCA territory accounting for 8.33%, 01 patient had ICH in left PCA territory accounting for 8.33%, 01 patient had ICH in left ACA territory accounting for 8.33%, 01 patient had ICH in right MCA and PCA territories accounting for 8.33%, 01 patient had intracerebral haemorrhage in left MCA and PCA territories accounting for 8.33%, 01 patient had intracerebral haemorrhage in both MCA territories accounting for 8.33%, 01 patient had haemorrhagic infarction accounting for 8.33%, In our study left MCA territory was the most commonly affected site.

In our study Putamen / external capsule involves 06 cases (50.00%), Thalamic involvement shows 02 cases (16.60%), Cerebellar involvement shows 02 cases (16.6%), Haemorrhagic infarction shows1 cases (8.3%), Intraventricular extension was noted in 05 cases accounting for 40% which had bad prognosis, 03 Cases of intracerebral haemorrhage on follow up scan study showed reduction in the bleed with signs of improvement following treatment (table 3).

Subarachnoid haemorrhage as a percentage of all strokes

In my study of 50 cases of CVA, 03 cases had subarchnoid haemorrhage i.e., accounting for 6%. These studies of primary subarachnoid haemorrhage include SAH due to aneurysmal rupture, rupture of A-V malformations and SAH of unknown cause.

Cerebral venous thrombosis

In our study we had 1 cases of CVT out of 50 cases and the percentage calculation was 2.0%.

Clinically suspected cerebro-vascular accident but normal on CT scan report of brain

Out of 50 cases of suspected stroke cases subjected to CT scan study, 01 case turned out to be normal accounting for 2.0%. This was considered as negative case. There are many medical problems to detect infarction but certainly the haemorrhage is ruled out in all cases.

Tumors

In the present study stroke resembling – tumors deterred in 01 case out of 50 cases of suspected cerebro-vascular accident cases, which accounts for 2.0% of the present study. Signs and symptomatology of tumor were resembling the signs and symptoms of stroke, hence Neurophysicians suspected these cases as stroke, which turned out to be of tumorous pathology on computed tomography scanning.

DISCUSSION

This present study was initiated to evaluate the role of CT

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scan in patients presenting with acute CAV in differentiating between haemorrhage, infarct and other causes of stroke.

Before the introduction of CT scan and in places where CT scan is not yet available, physicians were mainly dependent on the history, physical findings and the Allen's method of scoring to differentiate between haemorrhage and infarct using this scoring system. Allen studies 174 cases of acute stroke and was able to make an accurate diagnosis in 90% of cases.[4]

But the scoring system had certain problems as it is dependent on the history given by the relatives of patients and most of the time they are not able to give a clear idea of signs and symptoms which correlated with the scoring system. 100% accuracy in differentiating haemorrhage from ischemic stroke based on clinical findings was not possible.

Oxfordshire Community Stroke project that assesses 325 consecutive patients of acute stroke pointing the role of advantage of CT scan. Previously, CT scan was considered as not of significant in the evaluation of acute ischemic stroke patient; but, recently detection of early CT findings has proved to be of prognostic value in the evaluation of these patients. 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 scan is a mainstay in emergency diagnostic work up of acute stroke patients and conveys important information within a few hours after the ictus. Hans Peter Harring et al., identified 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.[5]

In the present study 50 patients of stroke were assessed and in that 32 patients had infarct i.e., 64%, 12 patients had haemorrhage i.e., 24%,1 patient had CVT i.e., 2% and 3 patients had SubArachnoid haemorrhage i.e., 6%. 1 patient had tumor, 2% and 1 patients had normal scan i.e., 2%.

According to a research done from Nubiola and Kubota stated an incidence of 60% infarcts and 30% haemorrhage, 8% subarachnoid haemorrhage in a case study of 50 patients. Ghosh SK and Row Chowhary in 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. In this study that had a different experience in the severity, the incidence of haemorrhage is seen to be higher than that of infarction.[6,7]

According to a research done by Rosenwasser RH and Ogun SA, 7.2% patients had sub arachnoid haemorrhage. Carlisle, England 7.0% patients had sub arachnoid haemorrhage. Auckland, New Zealand 6.8% patients had sub arachnoid haemorrhage. Perth, Australia 4.5% patients had subarachnoid haemorrhage.[8,9]

In our study of 50 cases of CVA, 3 cases had subarchnoid haemorrhage i.e., accounting for 6%. These studies of primary subarchnoid haemorrhage include SAH due to aneurysmal rupture, rupture of A-V malformations and SAH of unknown cause. Out of 50 cases of clinically suspected CVA subjected to CT study, 1 case turned out to be normal accounting for 2%. These cases are taken as negative cases. There are technical problems to detect infarction but certainly the haemorrhage is ruled out in all cases.

Moha Briton reported 3 patients with mass from 197 patients who had presented with acute stroke. In the Oxfordshire community stroke project five non-stroke lesions were detected by CT scan among 325 patients who were clinically diagnosed as having a definite stroke. In the present study of 50 patients, 1cases of glioma, 1 case of CVT and 3 cases of subarachnoid haemorrhage was detected and the patients presented with an acute stroke like picture. [10]

CONCLUSION

Computerised tomography scanning is the standard technique for diagnosis of acute stroke as the rational management of stroke depends on perfect diagnosis and should be ideally being done in all cases. Many risk factors such as hypertension, diabetes, cardiac disease and previous episodes of stroke play major role in the evolution of cerebrovascular accidents, it is suggested that.

1. That patients should be investigated carefully.
2. Sudden onset of neurological deficit or unexplained headache should further be investigated for the possibility of cerebro-vascular accident.
3. If treatment is given early some of the cases of CVA could be saved from life threatening problems.

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