Original Article

Clinicoradiological study of stroke

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ABSTRACT

Background: Stroke is the 3rd commonest cause of death in the world. It is a group of diseases that are of abrupt onset and causing neurologic damage due to vascular cause.

Aims &Objectives: The study conducted to establish the value of the Brain Imaging (Computerized Tomography scan) and its advantages over traditional methods of clinical diagnosis of stroke. Hence its correlation with radiological findings helps in deciding the treatment guidelines.

Material &Methods: 100 cases of Cerebrovascular accidents (excluding traumatic) were studied at Sir Takhatsinghji hospital, Bhavnagar from May 2006- April 2007. All cases were primarily diagnosed by clinical examination and further Evaluated by CT scan.

Result : Out of 100 cases clinically diagnosed as a case of Cerebrovascular accident (CVA), diagnosis was confirmed by CT Scan in 84 cases (84%)[infarct and hemorrhage] and in 16 cases (16%) had diagnosis other than Cerebrovascular accident. Potentially treatable conditions like hematoma, intracranial mass, meningitis or intracranial infections can be missed if we do not do Brain Imaging.

Conclusion: CT scan (Brain Imaging Modalities) is better than clinical method (including scoring system) in diagnosis of Cerebrovascular accident and other stroke mimicking conditions. So it must be done in all cases whenever feasible for deciding the treatment guideline and for better outcome.

Key words: Stroke (Cerebrovascular Accident), Clinical diagnosis, CT scan (Radiological investigation).

INTRODUCTION

WHO (World Health Organization) has defined stroke as "rapidly developing clinical signs of focal or global disturbance of cerebral function, lasting for more than twenty four hours or leading to death, with no apparent cause other than vascular origin." The disturbance of cerebral function due to vascular cause could be caused by three morphological abnormalities i.e. (1) stenosis (2) occlusion or (3) rupture of arteries [1, 2]. Cerebral infarction accounts for approximately 80-85% of the stroke in compare to 9-15% due to intracerebral bleed [2]. It is the 3rd commonest cause of death in the world after heart diseases and cancer. It was considered as disease of elderly people but now a day's incidence has increased in young (20-27%) [3].In U.S.A., stroke has 11% mortality while in India it comprises of 04% of medical admissions in major hospitals and 20% of disease of central nervous system [4]. In India, its incidence is 0.2 to 2.5 per 1000 population per year and prevalence is 05/1000, depending on the population age. Mortality rises rapidly with age and in winter season compared to that in summer. Stroke occurs frequently in hour or two after waking up in the morning. Stroke also had geographical, racial and social influence viz. (1) Its mortality is lower in higher social classes (2) Blacks more affected than white population in U.S.A. & U.K. (3) Posterior circulation intracerebral hemorrhage less common in Western countries than in Japan [5,6]. Due to availability of various modalities of treatment, accuracy in diagnosis of this syndrome has been desirable. Anticoagulant therapy, surgical evacuation of intracerebral hematomas, subdural hematomas and the relief of carotid occlusion in neck, all demands precision in the diagnosis which is unattainable by clinical means alone. In earlier times, the physician did not have wide range of neurodiagnostic procedure; they had to be satisfied with whatever limited information was available through the existent techniques. The traditional procedures were of limited information (skull radiograms and electroencephalogram), hazardous (cerebral angiograms and lumbar puncture) and uncomfortable (pneumoencephalogram), the newer

imaging techniques now unfolding have the capability of providing unprecedented, almost limitless information about the brain structure, function and regional chemistry.
Noninvasive techniques, short time required for complete examination and pose no risk to patient renders CT scan the most valuable emergency diagnostic procedure in stroke [7]. In acute stroke, CT scan readily distinguishes hemorrhage from infarct guiding anticoagulant therapy and site, size of lesion provides prognostic value. Other stroke mimicking conditions can also be identified [6]. The development of CT scan and Brain imaging modalities has leaded a milestone that provides a "Living Autopsy" of the brain [7]. This prospective study was conducted with the aim to establish the clinical efficacy of computed tomography and its advantages over traditional methods of clinical diagnosis in 100 patients of stroke. Hence its (CT scan) role in subsequent treatment and prognosis of the patient can be determined.

MATERIAL AND METHODS

In the present prospective study, 100 cases of Cerebrovascular accident (excluding traumatic) were primarily diagnosed by clinical examination and further evaluated by available Brain imaging modality viz. Computerized Tomography Scan (CT SCAN), admitted to Medical Ward at Sir Takhatsinghji Hospital Bhavnagar during May 2006-April 2007.
Detailed history was taken and thorough examination (general &systemic) of patient and Stroke score grading was done. Hence clinical diagnosis was made. Than further evaluation of patient was done by routine blood investigations (including Lipid profile, serum electrolytes), fundus examination & CT scan were done to correlate and confirm the clinical diagnosis. Cerebrospinal fluid (CSF) examination was done in indicated cases.

RESULTS

All 100 patients of Cerebrovascular accident were admitted in ward and observed till they were discharged. Average stay in hospital was of 5-7 days. After the discharge prolonged follow up study was not carried out. After hospitalization detailed history was taken and thorough Central Nervous System examination was done. Clinico-radiological correlation was done by doing Brain imaging (CT scan) in all patients. Provisional diagnosis of ischemic stroke was thought in 67 cases, it was confirmed radiologically in 54 cases (80.59%) and out of remaining 13 cases (19.40%), 02 had cortical atrophy, 09 cases had normal brain imaging reports and 02 had space occupying lesion (S.O.L) (1.Meningioma & 2.Tuberculoma).

Hemorrhage was suspected in 33 cases but was confirmed radiologically in 30 cases (90.90 %) only. Out of remaining 03 cases, 02 cases of space occupying lesions (secondaries in brain and multiple Tuberculoma) and 01 had changes of meningitis. A total of 17 patients (17%) expired during hospitalization. Of this 12 patients expired due to raised intracranial tension and its effect while remaining 05 patients developed aspiration pneumonia and its complications as cause of death.

DISCUSSION

Stroke Cerebrovascular accident) is a worldwide problem and nowadays it's common in young and elderly population. Stroke has been defined as a focal neurological deficit due to a vascular lesion (TABLE 1).

Table 1: Pathophysiologic classification of Cerebrovascular diseases [18, 19]

Stroke subtypes	%	CT findings	Etiology
Ischemic	85		
Thrombotic	25	Hypodensity	Lipohyalinosis of small vessels
Lacunar	20-25	usually <1.5cm	Atherosclerosis of intracranial arteries
Stroke			
Large vessels	1-5	Varies	
Embolic	75	Wedge shaped cortical or sub cortical	Aortic, carotid or intracranial atherosclerosis
Cardio embolic	20		
Artery-artery	15		Extensive work up reveals no cause
Cryptogenic	30	Hypodensity	
Other	10	Varies	
Hemorrhagic	15	Hyperdensity within the brain substance	Hypertension, arterio venous malformation, ruptured aneurysm, amyloid angiopathy

Various risk factors are associated with an increased risk of vascular disease viz. age, male sex, race, smoking, obesity and sedentary lifestyle, positive family history, other co morbid conditions like hypertension, diabetes mellitus, dyslipidemia, hypercoaguable stat and drugs(e.g. steroid, oral contraceptive pills) [1,5,6].

In present study 100 case of stroke were studied during the hospitalization. All cases were primarily diagnosed by clinical examination, Siriraj stroke scoring (TABLE 2) and blood investigations were done.

Table 2: Siriraj stroke score

Level of consciousness	Alert	0
	Drowsy/Stuporous	1
	Semi-conscious/comatose	2
History of vomiting after onset	Absent	0
	Present	1
History of headache within 2Hrs.	Absent	0
	Present	1
Atheroma markers (Angina, Claudication, Diabetes)	None	0
	One or more	1

SSS= 2.5 (consciousness) + 2 (vomiting) + 2 (headache) + 0.1 (diastolic blood pressure) – 3 (atheroma)-12.
If SSS is >1 diagnosis of cerebral hemorrhage,<-1 diagnosis of cerebral infarction -1 to 1 uncertain diagnosis.

Than all patients were subjected to the brain imaging (CT scan) to differentiate an infraction from a hemorrhage. Still in many developing countries (except for major cities) or undeveloped countries, a vast number of patients do not have access to brain imaging. Therefore the clinical criteria for distinguishing between ischemic and hemorrhagic stroke has been emphasizes. Different scoring systems are used to differentiate intracranial vascular event. Famous and commonly used are Siriraj Stroke Score and Guys Hospital Scoring System as an alternative to brain imaging (CT scan) in a limited resource institute especially in rural India [8.9].Some studies conducted in India reported that Siriraj Stroke Score is better than Guys Hospital Score in Indian population. The bedside clinical diagnosis of the pathology of stroke (hemorrhage or infarction) is difficult to make by clinical features alone due to unreliability of these symptoms. So stroke scoring systems are used to make provisional diagnosis where Brain imaging facilities are not available. Guy's Hospital score is based on eight variables and requires cumbersome calculations, giving sensitivity of 89% for cerebral infarct and 55% for cerebral hemorrhage. Siriraj Stroke score uses thirteen variables and has sensitivity of 89.3% for cerebral hemorrhage and 93.2% for cerebral infarct. Siriraj Stroke score was computed for each case and classified as suffering from hemorrhage if score is >1, and cerebral infarction if score <-1. The stroke type was uncertain if the value was between -1 and 1 hence such patients compulsorily need brain imaging modality for further evaluation and deciding the treatment guideline [10]. The formulation is: [(2.5* level of consciousness) + (2* vomit) + (2* Headache) + (0.1* DBP)]-[(3* atheroma markers) -12] (Table II). In this study, SSS>1 was seen in 33cases, SSS<-1 seen in 67cases. And stroke score of -1 to 1 was seen in zero number of cases. Than all patients were subjected to Computerized Tomography scan to correlate the clinical diagnosis with radiological finding (TABLE 3, 4).

Table 3: C.T. Findings of the study participants

Lesion	No. of patients	%
Infarction	54	54%
Hemorrhage	30	30%
Normal scan	09	09%
Cortical atrophy	02	02%
Space occupying lesion	04	04%
Changes of meningitis	01	01%
Total	100	100.00%

Table 4: Clinico-radiological correlations

Clinical diagnosis	No. of cases & Percentage (%)	Confirmed on CT	Not Confirmed on CT
Infarction	67(67%)	54(80.59%)	13(19.40%)
Hemorrhage	33(33%)	30(90.90%)	03(09.09%)

In present study mean age of patients was 49.92 years (50 years) with maximum age incidence was between 40-80 years of age. This result is comparable with Indian study by H. Singh et al (2001) having peak age incidence range of 41- 80 years of age with mean age of 58 years [2]. But 22 patients (22%) were below 40 years of age. Hence maximum age incidence is in elderly people due to atherosclerosis and other risk factors but higher incidence has been reported in young Indians. Indian study by Dalal et al (1968) [11] reports 23.6% incidence of young stroke which is almost equal to present study result of 20-22% incidence. Certain predisposing factors like diabetes mellitus, hypertension, rheumatic heart disease, syphilis, autoimmune disorders, drugs (e.g.: oral contraceptive pills, steroids),dyslipidemia, hypercoaguable stat have been identified [4,12]. Male are more frequently affected than female, the present study result shows M: F =2:1 which is comparable with H. Singh et al study results of M: F = 3:1 [1, 2]. Past history of stroke or transient ischemic attacks (TIA) was found in 08 & 12 cases respectively. Incidence of TIA as forerunner of permanent stroke is between 13-50% and of recurrence of stroke is 07-23% which is comparable with present study results of 12% and 08% respectively [13,14]. Incidence of tumor presenting as stroke is 10-15% [15] which is slightly higher than present study result of 04%. Similarly other risk factors were assessed and their incidences were obesity (11%), smoking (35%), hypertension (66%), and diabetes mellitus (26%). In first clinical paper devoted to Computed tomography published in 1973 by Ambrose [16], the investigator concluded that, “In

overall investigation of Cerebrovascular diseases computerized transverse axial scanning will, without doubt turned out to be an invaluable means of distinguishing between cerebral hemorrhage and infarction". Before CT was available Transient Ischemic Attacks (TIA) were not considered to be associated with permanent focal lesions of the brain parenchyma. However, CT demonstrated that various pathologic findings can manifest as TIA viz. (1) small infarcts (2) small leak (10%) from lesions such as vascular malformations (3) tumors or (4) atrophy. A small infarct far from crucial area may even be completely asymptomatic [17]. So in transient ischemic attacks& vertebral basilar insufficiency [VBI], CT findings may be normal. In this study cerebral infarct (54%)case predominates over cerebral hemorrhage (30%) cases, this results are comparable with study results given by H. Singh et al viz. 61.67% of cerebral infarct and 38.33% of cerebral hemorrhage cases [2]. Final outcome of the study was as shown in TABLE 5.

Table 5: Final outcome of the patients of CVA

Types	Improved	Expired	Status co	Total
Hemorrhage	16	10	4	30
Infarction	45	5	4	54
Normal scan	9	--	--	9
Cortical atrophy	2	--	--	2
SOL	--	1	3	4
Meningitis	--	1	--	1
Total no. of pts.	72	17	11	100
%	72	17	11	100

Reason for negative scan: (1) Scan done within first 06 hours of onset of the event. (2) Negative scan in acute stage (12-24 hours of onset) even after contrast study. (3) Fogging effect (4) cerebral ischemia without infarction (5) Posterior fossa infarct or stroke is very small. Advantages of CT scan: (1) Non-invasive and less time consuming (2) Safe and painless (3) Cheap (4) No superimposition of unwanted structures (5) High degree of attenuation achieved by sensitive detectors to detect ischemic tissue.

In Cerebrovascular accident advantages of CT scan: (1) Diagnostic value to confirm the stroke (2) Definitive differential diagnosis especially in other stroke mimicking conditions (3) Site, size and nature of lesion has prognostic value (4) Anticoagulant therapy can be guided (5) Normal scan correlates with final diagnosis of transient ischemic attack(TIA) or permanent lesions in TIA can be identified. To exclude the unexpected lesions (e.g. stenotic or occluded artery) in transient ischemic attacks, detailed and advanced investigations are needed. Disadvantages or Limitations of CT scan in Cerebrovascular accident: (1) Normal scans within first 24-48 hours that latter become abnormal (07%) (2) Mass effect of infarction misdiagnosed as brain tumor (05%) (3) Posterior fossa (Brain stem) lesions are not well visualized (4) Small vascular structures and details of large vessels can't be seen properly. Risk/hazards related to CT scan: (1) it delivers 1 to 10 rads of radiation to the brain. Caution must be observed against multiple scanning especially in children. (2) Risk of administration of intravenous contrast agents (dye). E.g. In urological study, reaction occurs in 0.5% of cases when dye is used and risk of fatality is 1 in 16000. High risk group includes patients with advanced age, diabetes, cardiac or Cerebrovascular disease and administration of large doses. Thus computed tomography is not without risks, but its risks are small.

Thus to summarize, this study has shown that although clinical methods can be useful to Physicians of rural India in differentiating the probable cause of stroke viz. cerebral infarct or hemorrhage but radiological investigations (Brain imaging modalities viz. CT scan etc.) are superior over the age old methods. It not only confirms the diagnosis but also gives clear vision for deciding the treatment protocol and also other causes (stroke mimicking conditions) are ruled out.

CONCLUSION

To conclude herewith, 100 cases of Cerebrovascular accident (excluding traumatic), primarily diagnosed by clinical examination and routine investigations, later sent for CT scan examination to correlate between clinical and radiological diagnosis. The study clearly showed that the stroke is a disease of elderly but higher incidence is also seen in young Indians. Out of 100 cases, clinical diagnosis correlated in 84 cases (84%) and in rest 16 cases (16%) it did not correlate radiologically but other stroke mimicking and treatable conditions were identified. Thus CT scan (Brain imaging modality) is better than clinical method in diagnosing the cerebral infarct vs. cerebral hemorrhage and other stroke mimicking conditions. Hence it must be done in all cases whenever feasible for early treatment and better outcome.

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