Original Research Article

A study to evaluate role of computed tomography in clinically suspected cerebrovascular accident in tertiary care hospital

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Abstract

Background: Cerebrovascular accident is a leading cause of death and disability throughout the world. It is a common cause of death after heart disease and cancer in India. Accurate and early diagnosis can improve the morbidity and mortality rates, as newer and more effective therapies are currently being instituted. Since computed tomography imaging is widely available, cost effective and less time consuming, it plays the role of first-line imaging modality. This study is aimed to demonstrate the role of computed tomography in clinically suspected cerebrovascular accident. **Materials and Methods:** Study setting: - Department of radiology, Sri Siddhartha medical college, Tumkur, Karnataka department of radiology Study design: - Prospective cross sectional study Sample size: - 50Source of data:- Data for our study was collected by sampling referred cases with clinical history of stroke **Results:** Majority of the subjects 64% had infarcts in CT Finding followed by hemorrhage in 24% subjects, SAH in 8% of the subjects and 4% of the subjects had normal. Among 60 subjects of clinically suspected CVA subjected to CT study, 02 case turned out to be normal accounting for 4%. This case was taken as negative case. There are technical problems to detect infarction but certainly the hemorrhage is ruled out in all cases. **Conclusion:** The result of the study showed that there is a preponderance of ischaemic CVA over haemorrhagic CVA. There is also a male preponderance in the incidence of both haemorrhagic and ischemic CVA.
Key Words: - Cerebrovascular accident, Cerebral infarction, Intracranial Haemorrhage,

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Email: radioraj@gmail.com
Received Date: 22/08/2019 Revised Date: 18/09/2019 Accepted Date: 07/10/2019
DOI: https://doi.org/10.26611/10131215

Access this article online

Quick Response Code:

Website: www.medpulse.in

Accessed Date: 12 October 2019

INTRODUCTION

Cerebrovascular accident or stroke is defined as an acute loss of focal and at times global (applied to patients in deep coma and those with subarachnoid haemorrhage) 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] Cerebrovascular accidents are one of the leading causes of death after heart disease and cancer in the developed countries and one of the leading causes of death in India. The exact prevalence rate of this disease in the Indian population is not known, although it accounts for about one percent of admissions to general hospital. The incidence rate and the 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 hemorrhage. 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] The advent of CT in early 1970s greatly

How to cite this article: Rajashekhar Muchchandi, Nandini Takalaki. A study to evaluate role of computed tomography in clinically suspected cerebrovascular accident in tertiary care hospital. *MedPulse – International Journal of Radiology.* October 2019; 12(1): 23-28. http://www.medpulse.in/Radio%20Diagnosis/

facilitated the diagnosis and management of stroke and added significantly to our understanding of Patho physiological brain alterations in case of humans. With CT it is now possible for the first time to non-invasively and reliably 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 rural population of developing country like India. Its use is further restricted by patient‟s economic status. There are several reasons for performing Brain CT of patients with cerebrovascular accidents.[3]To establish the diagnosis. To identify types of stroke amenable by surgery. To exclude intracranial haemorrhage. To diagnose spontaneous subarachnoid haemorrhage. To detect bone changes. Thanks to the high spatial and density resolution capability of a CT, it is one of the most accurate methods available for identifying and localizing an infarction within the brain. Ischemic infarction, haemorrhagic infarction and intracerebral haematoma are usually differentiated. CT also permits 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 MR technology, CT is still the method of choice for more of the patients being evaluated for cerebrovascular accidents because of its fast acquisition. CT is a good diagnostic instrument even in early phase of acute ischemic stroke. In combination with new helical CT technique (CT angiography) all- important decisions regarding early therapeutics can be answered. Clinical approach to stroke has undergone many changes in the past few years. CT scan has become an essential and integral part of the assessment and has given a more objective basis to management and use of the IV contrast material. After non- contrast CT and the availability of follow-up studies in many instance significantly aids in the determination of the correct vascular etiology of the stroke, as does correlation of CT changes with patient‟s age, sex, history and neurological deficit. This study is aimed to demonstrate the role of computed tomography in clinically suspected cerebrovascular accident. The purpose of the present study is to document the presence or absence of haemorrhage or infarcts, to determine the location and reasonably assessing the territory to blood vessels involved and to detect the incidence of negative cases of clinically suspected stroke

MATERIALS AND METHODS

Study setting: - Department of radiology, Sri Siddhartha medical college, Tumkur, Karnataka department of radiology

Study design: - Prospective cross sectional study

Sample size: - 50

Source of data:-

Data for our study was collected by sampling referred cases with clinical history of stroke. Patients were subjected to computed tomography scan of the head using GE Light Speed Plus 4 slice helical computed tomography scan. The imaging protocol consists of acquisition of contiguous axial sections with a maximum thickness of 5mm without intravenous contrast material administration. Images will be evaluated with brain window settings. Clinical details and the computed tomography findings of the case was recorded as per the proforma. Definition of study subject The study subject would be considered as a case of cerebrovascular accident if he/she has an acute stroke which is defined as a focal or global deficiency of brain function lasting for more than 24 hours which had occurred within 2 weeks of the patient‟s presentation and which was considered on admission to have a vascular cause. Detailed clinical history was noted in patients admitted in our hospital as per the Proforma.

Inclusion Criteria

All patients with clinical diagnosis of acute stroke, Sri Siddhartha medical college, Tumkur, Karnataka were eligible for the study.

Exclusion Criteria

Patients with neurological deficiency due to obvious cause other than vascular, such as hypoglycemia, diabetic keto acidosis and traumatic cause were excluded in this study.

Plan of study

Details were noted down on proforma either immediately before or after the procedure was carried out depending upon the status of the patient.

Equipment used:

GE Light Speed Plus 4 slice helical computed tomography scan machine was used for the study, it is a modified third generation scanner with scan times of 2, 3, 5seconds.

Slice Thickness – 2mm, 5mm and 10mm Available gantry tilt ± 25 degree .Matrix size of 512 X 512

CT Technique Patient Position:

Patient should be supine with the head on the head rest, arms by the sides and the chin should be as far down as comfortably possible.

Plane of Section at 100 – 250 to Reids line or parallel to orbito-meatal Line

Reid’s base Line: Passes from infraorbital margin to the

upper border of external auditory meatus. This ensures that a minimum number of scans will pass through the lens.

OM Line (Orbito-metal line): Passes from lateral canthus to the middle of the external auditory meatus.

Scan parameter:- Lateral head scanogram: scans are taken parallel to the floor of the anterior fossa the lowest section through the external auditory meatus and continuing to the top of the head. The gantry is angled towards the feet (negative Angulations). To decrease the artifacts from beam hardening from the petrous bone across the posterior fossa, higher mA scans may be helpful. Factors of 120 kV and 80 mA were constant for all cases.

Slice thickness:-5mm sections of the brain were obtained. Wherever necessary, 3mm sections were taken.

Coronal section: - Modern gantries are wide enough to permit coronal or near coronal section to be obtained directly. Patient is supine or prone with hyper extended neck; section is perpendicular to orbito-meatal line. Sagittal or near sagittal section can also be obtained in most cases; however these projections are obtained by computer reconstruction of the stacked axial slices (reformat).

Window setting: - Smallest slices through the posterior fossa Window width – 150

Window level – 36 above the tentorium Window width – 75 Window level – 36

Statistical analysis:

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions

RESULTS

We can included 50 subjects clinically suspected of CVA submitted for CT scan study of the brain. Out of 50 subjects 32(64%) were males and 18(36%) were females. In our study minimum age was 25yrs and maximum was 82yrs.

Table 1: Distribution of subjects according to CT finding

CT Findings	No. of subjects	Percentage
Infarcts	32	64%
Hemorrhage	12	24%
SAH	4	8%
Normal	2	4%

Majority of the subjects 64% had infarcts in CT Finding followed by hemorrhage in 24% subjects, SAH in 8% of the subjects and 4% of the subjects had normal. Among 60 subjects of clinically suspected CVA subjected to CT study, 02 case turned out to be normal accounting for 4%. This case was taken as negative case. There are technical problems to detect infarction but certainly the hemorrhage is ruled out in all cases.

Table 2: Distribution of subjects according to age group and CT finding

Age group	Infracts	Hemorrhage	SAH
25-39 Years	5(15.62%)	2(16.67%)	1(25%)
40-54 Years	9(28.12%)	3(25%)	1(25%)
55-69 Years	14(43.75%)	5(41.66%)	2(50%)
70-84 Years	4(12.5%)	2(16.67%)	0
Total	32(100%)	12(100%)	4(100%)

Majority of infracts 43.75% were in the age group 55-69yrs, followed by 28.12% in 40-54yrs age group,15.62% in 25-39yrs age group and 12.5% were in 70-84yrs age group. Majority of Hemorrhage 41.66% were in the age group 55-69yrs, followed by 25% in 40-54yrs age group, 16.67% in 25-39yrs age group and 16.67% were in 70-84yrs age group. Majority of SAH 50% were in the age group 55-69yrs, followed by 25% in 40-54yrs age group and 25% in 25-39yrs age group.

Table 3: Distribution of subjects according to sex and CT finding

Sex	Infracts	Hemorrhage	SAH
Male	21(65.62%)	7(58.33%)	2(50%)
Female	11(34.38%)	5(41.67%)	2(50%)
Total	32(100%)	12(100%)	4(100%)

Among 32 subjects who had infracts in CT finding 65.62% were male and 34.38% were female. Among 12 subjects who had Hemorrhage in CT finding 58.33% were male and 41.67% were female. Among 4 subjects who had SAH in CT finding 50% were male and 50% were female. Among the risk factors, past history of hypertension was given importance. 20 patients i.e., 40% had history of pre-existing hypertension, however many patients admitted that they

were not tested for hypertension before the onset of stroke.12 patients i.e.,60 % with hypertension showed cerebral haemorrhage. 8patients i.e., 40% with hypertension showed infarct. In our study 28% of the patients had a history of Diabetes mellitus. Many patients were not tested previously for evidence of diabetes before the onset of stroke. 64.28% of the diabetic patients had cerebral infarction i.e., in 9 patients. 35.72% of the diabetic patients had cerebral haemorrhage i.e., 5patients. In this study among the subjects who had infracts right MCA is most commonly affected site. In this study among the subjects who had hemorrhage left MCA territory was the most commonly affected site.

Table 4: Incidence of Intracerebral Hemorrhage in different parts of brain

	No. of cases	Percentage
Putamen / external capsule	5	41.66 %
Thalamus	2	16.66 %
Cerebellum	2	16.66 %
Pons	1	8.33 %
Miscellaneous	2	16.66 %

In our study Putamen/External capsule involves 5 cases (41.66%) , Thalamic involvement seen in 2 cases (16.66%), Cerebellar involvement seen in 2 cases (16.66%%) ,Pontine hemorrhage seen in 1 case (8.33 %).

DISCUSSION

This study was directed to evaluate the role of CT scan in patients presenting with acute cerebrovascular accident in differentiating between haemorrhage, infarct and other causes of stroke.Before the advent of CT scan and in places where CT scan was available, physicians were mainly dependent on the history, physical findings and the Allen‟s method of scoring system to differentiate between haemorrhage and infarct using this scoring system. Allen studied 174 cases of acute stroke and was able to make an accurate diagnosis in 90% of cases.[4] However, the scoring system had certain limitations as it is dependent on the history given by the relatives of patients and sometimes they are not able to give a clear description of signs and symptoms due to poor literacy level which correlated with the scoring system. 100% accuracy in distinguishing haemorrhage from ischemic stroke based on clinical findings was not possible. Previous studies have reported the usefulness of CT scan in patients suffering from stroke by ability to differentiate between haemorrhage and infarct and other causes of stroke and thus aiding in the clinical management. Oxfordshire Community Stroke project that assessed 325 consecutive patients of acute stroke highlighting the role of usefulness of CT scan.[3] Previously, CT was considered insensitive in the evaluation of acute ischemic stroke patient; however, more 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 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*., found 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 Majority of the subjects 64% had infarcts in CT Finding followed by hemorrhage in 24% subjects, SAH in 8% of the subjects and 4% of the subjects had normal. In studies done from India Mehta JK and Jacob reported 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 hemorrhage is seen to be higher than that of infarction. Moha, Briton (40) reported 3 patients with mass lesions (one subdural haematoma, one hydrocephalus and one metastasis) from 197 patients who had presented with acute stroke. In the Oxfordshire community stroke project five non- stroke lesions were detected by CT (2 gliomas, one metastasis, and 2 subdural hematomas) among 325 patients who were clinically diagnosed as having a definite stroke. In the present study 2 case of SAH and 2 case had normal scan in the patients presenting with acute stroke like symptoms.

CONCLUSION

CT scanning is the “Gold standard” technique for diagnosis of acute stroke as the rational management of stroke depends on “Accurate diagnosis” and should be ideally done in all cases. The results and factors obtained from our study correlates well with studies done in different parts of the world. The result of the study showed that there is a preponderance of ischaemic CVA over haemorrhagic CVA. There is also a male preponderance in the incidence of both haemorrhagic and

ischemic CVA. Since risk factors such as hypertension, diabetes and previous episodes of stroke play major role in the evolution of cerebrovascular accidents, it is suggested that. Such patients should be investigated carefully. Sudden onset of neurological deficit or unexplained headache should further be investigated for the possibility of CVA. If treatment is given early some of the cases of CVA could be saved from life threatening problems.

ACKNOWLEDGEMENTS

Authors would like to acknowledge all the subjects participated in the study. Everyone who contributed in the completion of the study including the technical staff

REFERENCE

1. Hatano S. Experience from a multicenter register, Bull. WHO, 1976;54 : 541- 553.
2. Osborn AG. Stroke, Chapter 11, In: Osborn AG, ed. Diagnostic Neuroradiology, St. Louis : Mosby, 1994 ;330-385.
3. Sandercock P, Molyneux A, Arlow C. Value of CT in patients with stroke: Oxfordshire Community Stroke Project, BMJ. 1985; 290: 193-197.
4. Ambrose J. Computerized transverse axial scanning (tomography): Part-2 Clinical Applications, B.J.R. 1973 ; 46 : 1023-1047.
5. Paxton R, Ambrose J. The EMI Scanner: A brief review of the first 650 patients, BJR, 1974; 47: 53-565.
6. Baker HL. The impact of the computedtomography on Neuroradiologic practice.Radiol.1975; 116: 637-640.
7. Evans RG. New Frontier for Radiology: Computed Tomography, AJR,1976; 126: 1116-1129.
8. Curry TS, Dowdey JE, Murry Jr. RC. Computed Tomography.Christensens physics of diagnostic radiology, 4th edition. Philiadelphia Lea and Febiger, 1990 : 289-323.
9. Lev MH, Farkas J. Gemmete JJ, Hossain ST, Hunter GJ, Koroshetz WJ*et al*. Acute Stroke: Improved non-enhanced CT detection-benefits of soft copy interpretation by using variable window width and central level settings, Radiology, 199 ; 213 (1) : 150-155.
10. Chaurasia BD. Blood supply of the spinal cord and brain. Chapter 31, In: BD Chaurasia, Editor, Human anatomy (3), 4th ed. New Delhi : CBS.Vol(3), 2004: 383-389.
11. Marks MP. CT in ischemic stroke: Neuro-imaging. Clinics of North America.1998 ; 8 (3) : 515-523.
12. Chatterjee CC. Cerebral circulation. Chapter VII, In :Chatterjee CC,Human Physiology, Vol. 1 P. No. 329.
13. Allen CMC, Lueck CJ. Neurological disease, Chapter 22, In : Haslett C.Chilver SE, Boon NA, Colledge NR, Hunter JAA, Editors, Davidson‟s Principles and practice of medicines, 19th ed. Philedelphia : Churchill Livingstone ; 2002 : 1159-1168.
14. Bonita R. Epidemiology of stroke, Lancet : 1992 : 339 : 342-344.
15. Sharper AG. Phillips AN, Pocock, SJ.Walker M. Macfarlene PW. Risk factors for stroke in men, BMJ, 1991 ; 302 : 1111-1112.
16. Nubiola AR, Masana L, Masdeu S. Prat JR. HDL cholestrol in CVD,Arch Neurol. 1981 ; 38 : 468.
17. Kubota K, Yama Guchi T, Abe Y, Fujiwara T, Hatazawa T, Matsu ZawaT. Effects of smoking on regional cerebral blood flow in neurological normal subjects, stroke 1983 ; 14 (5) : 720-722.
18. Fisher M, Garcia JH. Evolving stroke and the ischemic pneumbra.Neurology, 1996 ; 47 : 884-888.20. Mohr JP. The Harvard cooperative stroke registry, Neurology, 1978 ; 28(a) : 754-762.
19. Portenoy RK, Abissi CJ, Lipton RB, Berger AB, Mebler MF, Baglivo J*et al*., Headache in CVD, stroke. 1984 : 15 : 1009-1012.
20. Gorelick PB, Hier DB, Caplan LR, Langenberg P. Headache in acute CVD, Neurology, 1986 ; 36 : 1445-1450.
21. Johnson MH, Kubal NS. Stroke, Chapter 12, In : Less SH, Rao KCVG. Zimmerman RA, Editors. Cranial MRI and CT, 4th edition.USA :McGraw Hill, 1999 ; 557-594.
22. Harring HP, Dilitz E, Pallua A, Hessenberger G, Kampfl A, Pfausler B,Schmutzhard E. Attenuated cortico medullary contrast : An early cerebral CT sign indicating malignant middle cerebral artery infarction,Stroke. 1999 ; 30 : 1076-1082.
23. Weisberg LA. How to identify and manage brain haemorrhage, Post Graduate Medicine, 1990 : 88 (3) : 169-175.
24. Drury I, Whisnant JP, Garraway VM. Primary intracerebral haemorrhage : Impact of CT on incidence, Neurology. 1984 ; 34 : 653-657.
25. Waga S, Yamamoto Y. Hypertensive putaminal haemorrhage, stroke,1983 ; 14 (4) ; 480-485.
26. Weisberg LA. Computed Tomoraphy and pure motor hemiparesis,Neurology.1979 ; 29 : 490-495.
27. Weisberg LA. Thalamic haemorrhage : Clinical CT correlation,Neurology, 1986 ; 36 : 1382-1386.
28. Nakajima K. Clinico-pathological study of pontine haemorrhage, stroke,1983 ; 14 (4) : 485-492.
29. Ropper AH, Davis KR. Lobar cerebral haemorrhage : acute clinical syndromes in 26 cases, Ann of Neurol, 1980 ; 8 :141-147.
30. Kase CS, Williams JP, Wyatt DA, Mohr JP. Lobar intra-cerebralhaematoma : CT and clinical Analysis, Neurology. 1982 ; 32 : 1146-1150.
31. Allen CMC. Clinical diagnosis of the acute stroke syndrome.QuarterlyJournal of Medicine.1983 ; New Series II (208) : 515-523.
32. Kinkel WR Jacobs L. Computed axial tomography in cerebrovasculardisease. Neurology.1976 ; 26 : 924-930.
33. Fiorelli M, Toni D, Bastianello S, Sett S. CT findings in the first fewhours of ischemic stroke : Implications for the clinician, Journ. Neurol.Sci. 2000 ; 173 (1) : 1-2.
34. Tomura N. Uemura K, Inugami A, Fujita H, Higano S, Shishido F.Early CT findings in cerebral infarction : Obscuration of lentiformnucleus, Radiology, 1988 ; 168 : 463-467.
35. Truwit CL, Barkovich AJ, Marton AJ, Hibri N, Normal D. Loss ofinsular ribbon : another early CT sign of acute

middle cerebral arteryinfraction, Radiology, 1990 ; 176 : 801-806.
36. Kummer RY, Lamade UM, Forsting M, Rosin L, Rieke K, Hacke W.Sartor K. Sensitivity and prognostic value of early computedtomogrpahy in occlusion of the middle cerebral artery trunk, AJNR.1994 ; 15 : 9-15.
37. Moulin R, Tin FC, Chavot D, Early CT Signs in acute middle cerebralartery infarction : Predictive value for subsequent infarct locations andoutcome, Neurology. 1996 ; 47 : 366-375.
38. Gacs G, Fox AJ, Barnett HJM. CT Visualization of intracranialthrombo- embolism, Stroke. 1983 ; 14 : 756-762.
39. Eastwood JD. Stroke, Chapter 7, In : HAAGA JR. Lanzieri CF. FilkesonRC, eds. CT and MR imaging of the whole body, 4th ed. USA : Mosby,2003 : 246- 284.
40. Mark MP, Holmgren EB, Fox AJ. Patel S, Kummer RV, Froehrich J.Evaluation of early computed tomographic findings in acute ischemicstroke, Stroke.1990 ; 30 : 389-392.
41. Brott T. Broderick J, Kothari R, Barsan W. Early haemorrhage growth inpatients with intra-cerebral haemorrhage, Stroke. 1997 ; 28 (1) : 1-5.
42. Jager R, Saunder D, Murray A. Cranial and intracranial pathology (2) :Cerebro vascular disease and non traumatic intracranial haemorrhage.Chapter 99 (a), In Grainger RG, Allison DJ, Ardam A, Dixon AK eds.Diagnostic radiology, 4th edition, London : Churchill Livingstone. 2001 ;2351-2376.
43. Barbar PA, Darby DG, Desmond PM, Yang Q. Identification of majorischemic change: Diffusion weighted imaging versus computedtomography, Stroke. 1999 ; 30 : 2059-2065.
44. Sutton D, Stevens J. Miszkiel K. Internal Lesions (2). Chapter 58.In :Sutton D, Editor, Radiological imaging, 7th edition, Newyork : ChurchillLivingstone, Vol. 2, 2003 : 1774-1778.
45. Horowitz SH, Zito JL, Donnarumma. Patel M. Computed tomographicangiographic findings within first five hours of cerebral infarction,Stroke. 1981 ; 22 : 1245-1253.
46. Grotta JC, Chik D, Lu M, Patel S. Agreement and variability in theinterpretation of early CT changes in stroke patients qualifying forintravenous rTPA therapy, Stroke. 1999 ; 30 : 1528-1533.
47. Harrison JG. Clinical distinction of cerebral haemorrhage and cerebralinfarction, Post Graduate Medical Journal.1980 : 629-632.
48. Pradhan S, Role of CT in stroke in Indian Context, JAPI. 1988 ; 36 (7) :428- 430.
49. Thaker AK, Radhakrishnan K, Malu JC, El-Magbri AA. Mousa ME.Clinical and Computed Tomographic analysis of intra-cerebralhaemorrhage.JAPI.1991; 39 (4) : 317-319.
50. Sharma JC, Fletcher S. Vassal LM, Ross I. Prognostic value of CT scanfeatures in acute ischemic stroke and relationship with clinical strokesyndrome, Int. Journ. Clin. Proc. 2000 ; 54 (8) : 514-518.
51. Koussy ME, Guzman R, Bassetti C. CT in acute hemorrhagic stroke,Cerebrovascular diseases. 200 ; 10 (6) : 480-482.
52. Rosenwasser RH, Annonda RA. Diagnostic imaging for stroke, ClinicalNeurosurgery.2000 ; 46 ; 237-260.
53. Ogun SA. Olawole O, Fatade B. Misdiagnosis of stroke : Acomputerized. Tompgraphy scan study, West. African Journ ofMedicine.2000 : 19 (1) : 19- 22.
54. Iso H, Rexrode K, Hennekens CH, Mason JE. Application of CToriented criteria for stroke sub-type classification in a prospective study :Annual Epidemiology, Harvard Medical School, Boston 2000 ; 10 (2) :81-87.
55. Razzaq AA, Khan BA, Baig S. CT imaging in young stroke patients,Journal of Pakistan Medical Assoc. 1999 ; 49 (3) : 66-68.
56. Scott JN, Buchan AM, Serick RJ. Correlation of neurologicaldysfunction with CT findings in early acute stroke, Can. J. Neurol. Sci.1999 ; 26 (3) : 182-189.
57. Gaskill. Shipley MF. Routine CT evaluation of acute stroke.Neuroimaging Clin. N. Am. 1999 ; 9(3): 411-412.
58. Forsting M, Dorfler A, Knauth M, Kummer RY. Neuro radiologicalstudies and findings in stroke, Ther-Umsch. 1996 ; 53(7):535-543.
59. Mukherjee N, Hazra BR. Evaluation of stroke patients with reference toCT scanning findings, Journal Indian Medicine Assoc. 1998 ; 96 (6) : 174-176.

Source of Support: None Declared
Conflict of Interest: None Declared