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ASSESSMENT OF CEREBROVASCULAR ACCIDENTS ON COMPUTED TOMOGRAPHY

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ABSTRACT

BACKGROUND: Cerebrovascular accident is acute onset of a neurological deficit due to vascular cause. CT is an imaging modality performed quickly and safely on critically ill patients, and is relatively inexpensive**.Methods**: This prospective study includes sixty patients with clinical diagnosis as CVA with or without persistent neurological deficit. Non contrast CT was done in each case,contrast study was done when indicated .The results of study were systematically collected, assimilated and analyzed to draw valid conclusions.**Results**:The range of patient age was found from 27 – 83 years. Mean age ± SD of patients in this study were 57.5±13.2 years. Male to female ratio was found to be 1.1:1. Hypertension was the commonest risk factor in this study and 23.3% cases had history of diabetes mellitus and11.6% cases had previous history of TIA/CVA. 43 cases (71.7%) were diagnosed clinically as ischemic stroke and 17 cases (28.3%) were diagnosed clinically as hemorrhagic stroke. **Conclusion:** CT brain remains an essential imaging study in stroke patients due to its sensitivity for the detection of blood and infarction. CT scan done to differentiate the two types of stroke and thus helps in improved management and therapeutic outcome in patients of stroke

KEY WORDS: Cerebrovascular accident (CVA), Hypertension,CT

INTRODUCTION

Cerebrovascular accident or stroke is defined as the abrupt onset of a neurological deficit that is attributable to a focal vascular cause[1]. It results either due to ischemia and infarction caused by impairment of blood supply and oxygenation of brain tissue (thrombo-embolism) or due to haemorrhage (subarachnoid and intra - parenchymal) [3] resulting from rupture of vessels in brain[2]. Cerebral infarction accounts for approximately 85% of all CVA.The conditions like hypertension, smoking, obesity, hyperlipidemia, diabetes mellitus and homocystinemia are the risk factors for stroke. Many types of cardiac diseases e.g. valvular and ischemic heart disease predispose to embolic stroke[3].

The clinical manifestations of CVA are variable because of the complex anatomy of the brain and its vasculature. Neurological deficit occur due to insult to neurons.When blood flow is quickly restored, brain tissue can recover fully and the patient's symptoms are only transient –

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this is called a Transient Ischemic Attack (TIA). CVA has occurred if the neurological signs and symptoms last for more than twenty four hours[1].

A comprehensive evaluation of stroke may be performed with a combination of CT or MR imaging techniques[6]. A detailed investigation of cerebral perfusion may also include PET, SPECT and Xenon CT. However the availability of these modalities is often limited and their use can be problematic in an emergency situation in which "time is brain" [7].

CT is an imaging study in that it is widely available, relatively inexpensive and performed quickly in uncooperative patients. The ability to exclude intraparenchymal haemorrhage helps in management of stroke patients. CT has demonstrated nearly 100% sensitivity for the detection of intraparenchymal haemorrhage, except for in very anaemic patients with isoattenuating hematomas[5]. Nonenhanced CT can help exclude haemorrhage and detect "early signs" of infarction but cannot reliably demonstrate irreversibly damaged brain tissue in the hyperacute stage of ischemic stroke[8].Perfusion CT provides information about brain perfusion which permits the differentiation of irreversibly damaged brain tissue from reversibly impaired "tissue at risk". CT Angiography can help detect stenosis or occlusion of extra- and intracranial arteries. Multisection CT allows the combined use of all three imaging modalities - nonenhanced CT, perfusion CT and CT angiography[7].

The major drawback of CT is the high radiation dose, while in MRI it is the more complicated and time consuming aspect of the examination[9].

MATERIAL AND METHODS

This prospective study included sixty patients with clinical diagnosis as CVA with or without persistent neurological deficit .The patientswere referred to the department of Radio-diagnosis from indoor and outdoor departments of Guru Nanak Dev Hospital,Amritsar.

Imaging techniques and features

The brain imaging of the patients was done on CT Philips ingenuity core 64 multislice unit. Non contrast CT was done in each case and studied for any lesion as its site, size and alteration of density from the normal, both visually and numerically. Administration of intravenous contrast medium was done in the peripheral vein under all aseptic conditions only where indicated. Contrast enhancement, if any, in such cases, was looked for both visually and numerically.

The sensitivity of Computed Tomography in the detection of early changes of infarction is related to the underlying principles of image acquisitions. CT images are obtained by projection of a high kilovoltage collimated beam through the brain. Beam attenuation is due to absorption proportional to the linear attenuation coefficient of the materials through which it passes. Differentiation of adjacent tissues such as gray matter and white matter depends on perceivable differences in electron density and thus detection of a pathologic condition also requires a perceivable change in electron density. Fluid redistribution characterizes cerebral ischemia and imparts the change in electron density detectable with CT.

In the hyperacute period, CT signs of infarction are sulcal effacement with loss of gray-white differentiation in superficial cortical infarction and hypodensity of the basal ganglia in cases of deep cerebral infarction. In the acute period (6-24 hours), the changes of ischemia become more apparent. The loss of gray-white interface, sulcal effacement, hypodensity of basal ganglia and that of the insular cortex become prominent with mass effect at this stage. During the subacute period (1-7 days), edema and mass effect with lateral and vertical shift of infarcted tissue

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increases with peak at 1 to 2 days and then decline[7]. Marked hypodensity (the density is similar to cerebrospinal fluid) without mass effect is seen in chronic infarctions on CT scans.

Analysis

The results of study were systematically collected, assimilated and analyzed to draw valid conclusions.

RESULTS

The range of patient age was found from 27 – 83 years. Peak incidence was observed in the age group of 61-70 years (32%). Mean age ± SD was 57.5±13.2 years. It is obvious from the above table that in present study 51 cases (85%) of the stroke occurred above the age of 40 years.

In the present study, out of the total 60 cases, 31 cases (51.7%) were male and 29 cases (48.3%) were female. Male to female ratio was found to be 1.1:1.

It is evident from the above table that there was slight preponderance of males in the older age group (>70 years). Out of the 7 cases above 70 years who presented with stroke, 5 cases (71.4%) were males. Sex wise, the mean age of female cases was 58.4 years and for males, it was 56.6 years.

TABLE I: DISTRIBUTION OF CLINICALLY DIAGNOSED CASES OF STROKE ACCORINDG TO ASSOCIATED RISK FACTORS(n=60)

Risk Factors	No. of Cases	Percentage
Hypertension	24	40.0%
Diabetes mellitus	14	23.3%
H/O previous TIA/CVA	07	11.6%
Smoking	03	5.0%
CVS Disease	03	5.0%
Clotting disorder	00	00

In the present study, out of total 60 cases, 24 cases (40.0%) had history of hypertension, 14 cases (23.3%) had history of diabetes mellitus, 7 cases (11.6%) had previous history of TIA/CVA, 3 cases (5%) were smoker and 3 cases (5%) had history of cardiovascular disease which included 2 cases of ischemic heart disease and 1 case of rheumatic heart disease. It is evident from the above table that hypertension was the commonest risk factor in this study.

TABLE II: DISTRIBUTION OF CLINICALLY DIAGNOSED CASES OF STROKE ACCORDING TO CLINICAL PRESENTATION(n=60)

Presentation	No. of cases	Percentage
Weakness/paralysis of body (Right sided + Left sided)	47 (27 + 20)	78.3% (45% + 33.3%)
Headache	18	30.0%
Loss of consciousness	05	8.3%
Meningeal signs	04	6.7%
Facial nerve palsy	03	5.0%
Cerebellar signs	02	3.3%

In the present study, the commonest complaint of the cases was weakness/paralysis of right or left side of body seen in 47 cases (78.3%). Right side was involved in 27 cases (45%) while left

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side involvement was seen in 20 cases (33.3%). 18 cases (30%) presented with headache. Loss of consciousness was seen in 5 cases (8.3%). Meningeal signs were present in 4 cases (6.7%). Facial nerve palsy was seen in 3 cases (5%) and cerebellar signs were present in 2 cases (3.3%).

TABLE III*:* DISTRIBUTION OF CASES ACCORINDG TO CLINICAL DIAGNOSIS (n=60)

Clinical diagnosis	No. of Cases	Percentage
Ischemic stroke	43	71.7%
Hemorrhagic stroke	17	28.3%
Total	60	100

In the present study, out of total 60 cases, 43 cases (71.7%) were diagnosed clinically as ischemic stroke and 17 cases (28.3%) were diagnosed clinically as hemorrhagic stroke which included 13 cases (21.6%) of intracerebral haemorrhage and 4 cases (6.7%) of intracerebral haemorrhage with sub-arachnoid haemorrhage.

TABLE IV: AGE WISE DISTRIBUTION OF CASES OF CT SCAN PROVEDTYPE OF STROKE

Age group	No. and %age of Ischemic stroke cases (n=43)	No. and %age of Haemorrhagic stroke cases (n=15)
21-30	02 (4.7%)	0
31-40	06 (13.9%)	1(6.6%)
41-50	09 (20.9%)	3(20%)
51-60	09 (20.9%)	2(13.3%)
61-70	10 (23.2%)	9 (60%)
71-80	05 (11.7%)	0
81-90	02 (4.7%)	0
Total	43	15

The above table shows the age wise distribution of cases of CT scan proved type of stroke. In the present study majority of the CT scan proved stroke cases were seen in 61-70 years of age which included 10 cases (23.2%) of ischemic stroke and 9 cases (60%) of haemorrhagic stroke.It is obvious from the above table that in the present study CT scan proved ischemic stroke was slightly more common in males seen in 22 out of 43 cases (51.2%) than in females seen in 21 out of 43 cases (48.8%) whereas CT scan proved hemorrhagic stroke was slightly more common in females seen in 8 out of 15 cases (53.3%) than in males seen in 7 out of 15 cases (46.7%). One male case was found to have intracranial space occupying lesion on CT scan and one male case CT scan showed normal study.

TABLE V: DISTRIBUTION OF CASES OF CT SCAN PROVED TYPE OF STROKE ACCORDING TO RISK FACTORS (n=60)

CT findings		No. of cases	Percentage
Hypertension	Ischemic stroke	13	21.6%
	Haemorrhagic stroke	11	18.3%
Diabetes mellitus	Ischemic stroke	12	20%

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	Haemorrhagic stroke	2	3.3%
Smoking	Ischemic stroke	2	3.3%
	Haemorrhagic stroke	1	1.6%
CVS diseases	Ischemic stroke	2	3.3%
	Haemorrhagic stroke	1	1.6%

It is evident from the above table that CT scan proved ischemic stroke was seen in 13 out of 24 hypertensive cases and haemorrhagic stroke was seen in 11 out of 24 hypertensive cases. It was also found in the present study that 11 out of 15 cases (73.4%) of CT scan proved haemorrhagic stroke were hypertensive and 13 out of 43 cases (30.2%) of CT scan proved ischemic stroke were hypertensive.

History of diabetes mellitus was seen in 12 cases (20%) of ischemic stroke and 2 cases (3.3%) of haemorrhagic stroke. 2 cases (3.3%) of ischemic stroke and 1 case (1.6%) of haemorrhagic stroke were smokers. History of CVS disease was seen in 2 cases (3.3%) of ischemic stroke and 1case (1.6%) of haemorrhagic stroke.

TABLE VI: DISTRIBUTION OF CASES ACCORINDG TO CT DIAGNOSIS(n = 60)

CT Findings		No. of cases	Percentage
Infarct	Non-Haemorrhagic	43	72%
	Haemorrhagic	0	
Haemorrhage	Intracerebral	13	25%
	ICH with SAH	12	
Others	Normal	1	3%
	Intracranial SOL	1	

Majority of the cases presented with finding ofischemic stroke seen in 43 cases (72%) on CT. 15 cases (25%) presented with finding of haemorrhagic stroke which comprised of 13 cases (21.6%) of intracerebral haemorrhage and 2 cases (3.3%) of intracerebral haemorrhage with subarachnoid haemorrhage. 2 cases (3%) had other findings which included 1 case (1.6%) of normal scan and 1 case (1.6%) of intracranial space occupying lesion presenting with signs and symptoms of stroke (stroke mimics).

TABLE VII: SITE WISE DISTRIBUTION OF CASES OF CT SCAN PROVED TYPE OF STROKE(n=60)

Site		No of cases	Percentage
Ischemic stoke	Cerebral hemispheres	35	52.2%
	Lacunar infarcts	6	10%
	Cerebellar hemispheres	1	1.7%
	Brainstem	1	1.7%
Intracerebral Hemorrhage	Basal ganglia	8	13.2%
	Cerebral hemispheres	3	5%
	Cerebellar hemispheres	1	1.7%
	Thalamus	1	1.7%
ICH and	Basal ganglia	1	1.7%

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SAH	Cerebral hemispheres	1	1.7%
Others	Normal	1	1.7%
	Intracranial SOL in right cerebral hemisphere	1	1.7%
Total		60	100%

In 43 cases of CT scan proved ischaemic stroke, cerebral hemispheres were involved in 35 cases (58.2%) and 6 cases (10.0%) had lacunar infarcts. In 1 case (1.7%) cerebellum was involved. Brainstem involvement was also seen in one case (1.7%). In 13 cases of CT scan proved intracerebral hemorrhage, the lesion was seen in basal ganglia in 8 cases (13.2%) and in cerebral hemispheres in 3 cases (5%). One case (1.7%) was seen each in cerebellar hemispheres and thalamus. In 2 cases of CT scan proved intracerebral haemorrhage with subarachnoid haemorrhage, one case (1.7%) was seen each in basal ganglia and cerebral hemispheres.

TABLE VIII: DISTRIBUTION OF CASES ACCORDING TO CT FINDINGS (n=60)

CT findings	Mass Effect		Midline shift		IV leak	
	No.	%age	No.	%age	No.	%age
Ischemic Stroke	26	43.3%	03	5.0%	-	-
ICH	12	20%	07	11.6%	05	8.3%
ICH with SAH	02	3.3%	01	1.6%	02	3.3%
Intracranial SOL	01	1.6%	01	1.6%	-	-
Normal	-	-	-	-	-	-
Total	41	68.3%	12	20%	07	11.6%

In the present study, mass effect in the form of effacement of sulcal spaces, compression of sylvian fissure and ventricles was seen in 41cases (68.3%) which included 26 cases (43.3%) due to ischemic stroke, 12 cases (20.0%) due to intracerebral hemorrhage, 2 cases (3.3%) due to intracerebral hemorrhage with sub-arachnoid hemorrhage and one case (1.6%) due to intracranial SOL.

Midline shift was seen in 12 cases (20.0%) which included 3 cases (5.0%) in ischemic stroke, 7 cases (11.6%) in intracerebral hemorrhage, 1 case (1.6%) in intracerebral hemorrhage with sub-arachnoid hemorrhage and one case (1.6%) in intracranial SOL.

Intraventricular leak was seen in 7 cases which included 5 cases (8.3%) in intracerebral hemorrhage and 2 cases (3.3%) in intracerebral hemorrhage with sub-arachnoid hemorrhage.

TABLE IX: CT SCAN FINDINGS IN CASES OF STROKE (n=60)

CT Diagnosis	No. of Cases	Percentage
Infarct	43	71.8%
Haemorrhage	15	25.0%
Intracranial SOL	01	1.6%
Normal	01	1.6%
TOTAL	60	100

Ischemic stroke was seen in 43 cases (71.8%) and haemorrhagic stroke was seen in 15 cases (25%) on CT. 1 case (1.6%) had intracranial space occupying lesion and 1 case (1.6%) had normal scan.

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TABLE X: CT SCAN DIAGNOSIS IN CLINICALLY CLASSIFIED CASES (n=60)

	Clinically diagnosed cases	CT scan diagnosed cases	Agreement of result (%)
Ischemic Stroke	43	38	88.3%
Haemorrhagic Stroke	17	12	70.6%

Out of 43 clinically suspected cases of ischemic stroke, only 38 cases proved to have infarction on CT scan reflecting a clinical accuracy of 88.3%. Out of the rest 5 cases, 3 cases were diagnosed as haemorrhagic stroke, 1 case as intracranial SOL and 1 case as normal findings by CT scan.

Out of 17 clinically suspected cases of hemorrhagic stroke, only 12 cases had hemorrhage on CT scan reflecting a clinical accuracy of 70.6% while the rest 5 had ischemic stroke on CT scan.

DISCUSSION

Imaging in stroke helps to exclude hemorrhage or other mimicking lesions because patients with ischemic stroke can benefit from thrombolytic therapy.

In the present study, age of the 60 cases of clinically diagnosed stroke ranged from 27 – 83 years. Mean age+SD was 57.5+13.2 years. The peak incidence of clinically diagnosed stroke cases was observed in the age group of 61-70 years (19 cases, 32%) . In a study conducted by Khan et al, 59 cases (59%) were above 60 years of age[14]. Nabavi et al have found the mean age of 63.8$\pm$13.8 years[13].Bharucha et al have discussed that most studies in India show an increase in prevalence of stroke with advancing age. This is in accordance to our findings[19]. Out of the total 60 cases, 31 cases (51.7%) were males and 29 cases (48.3%) were females. Male to female ratio was 1.1:1. There was slight preponderance of males in the older age group (>70 years). l Barber et al also reported the male to female ratio of 1.1:1 with 53 male cases (53%) and 47 female cases (47%)[12].

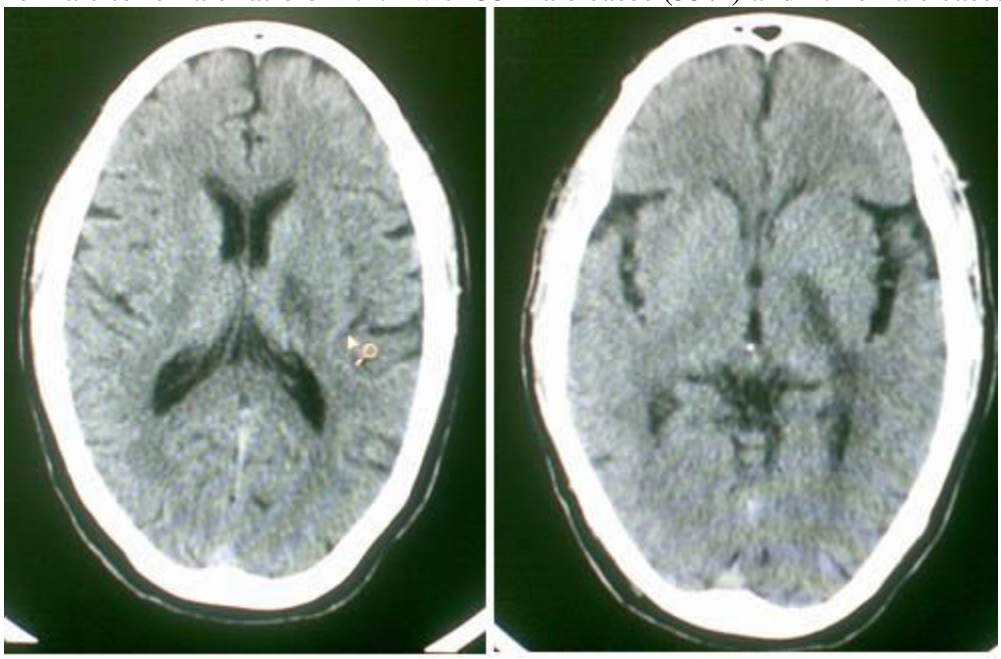

Fig1: Acute right MCA territory infarct in 35 M patient including basal ganglia with mass effect

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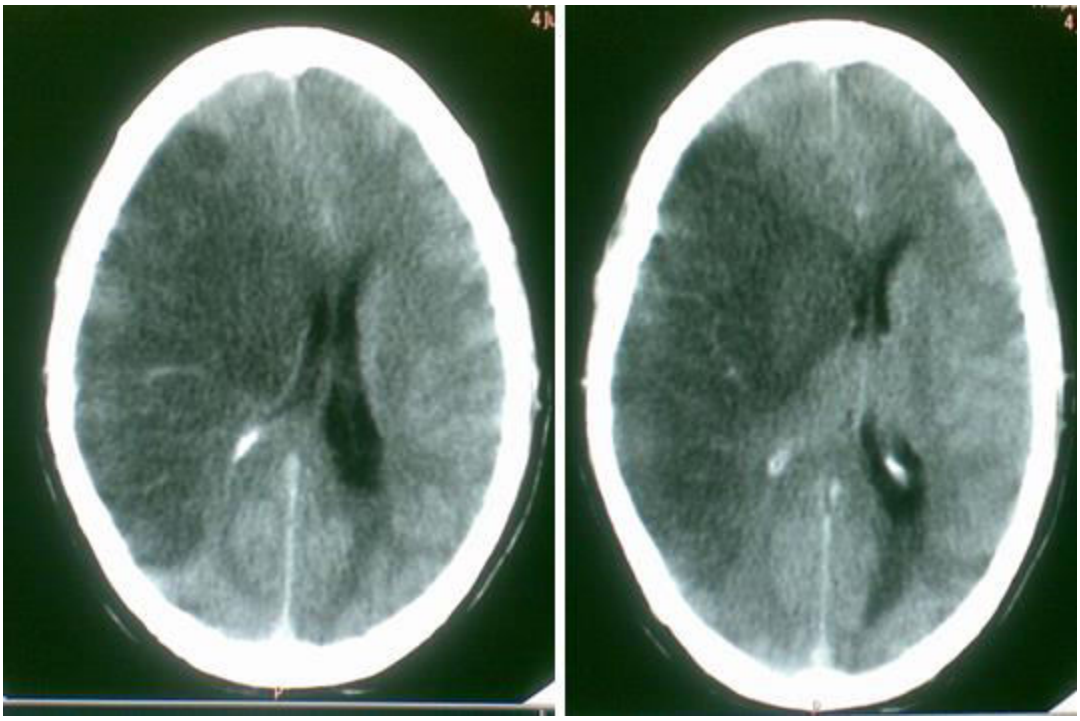

Fig 2: Acute right MCA territory infarct in 35 M patient including basal ganglia with mass effect

In the present study, out of total 60 cases of clinically diagnosed stroke, 24 cases (40.0%) had hypertension, 14 cases (23.3%) had diabetes mellitus, 7 cases (11.6%) had previous history of TIA/CVA, 3 cases (5%) were smoker and 3 cases (5%) had history of cardiovascular disease which included 2 cases of ischemic heart disease and 1 case of rheumatic heart disease. It is evident that hypertension was the commonest risk factor in this study. In a study conducted by Noor-ul-Hadi, out of 100 cases, 27 cases (27%) were known hypertensive while 17 cases (17%) suffered from diabetes[18]. Bharucha et al have discussed that hypertension, diabetes mellitus, smoking, previous history of transient ischemic attacks, cardiac disease (especially rheumatic heart disease and ischemic heart disease) have been considered to be significant risk factors for stroke in different studies[19].

In the present study, the commonest complaint of the cases of stroke was weakness/paralysis of right side of body seen in 27 cases (45%). Left side involvement was seen in 20 cases (33.3%). Thus weakness/paralysis of body was seen in total of 47 cases (78.3%). Out of 60 cases of stroke, 18 cases (30%) presented with headache. Loss of consciousness was seen in 5 cases (8.3%). Meningeal signs were present in 4 cases (6.7%). Facial nerve palsy was seen in 3 cases (5%) and cerebellar signs were present in 2 cases (3.3%). Khan et al have mentioned that sudden onset of coma or changing state of consciousness with severe headache, vomiting and meningeal irritation suggest intracranial bleed[14]. Similarly in cerebral infarction patient usually presents with lateralizing neurological deficit such as hemiparesis. Nicol et al have discussed the numbness or weakness in the face, arms, or legs (especially on one side of the body), dizziness and severe headache with no known cause as the warning signs of stroke established by the (American) National Institute of Neurological Disorders and Stroke[15].

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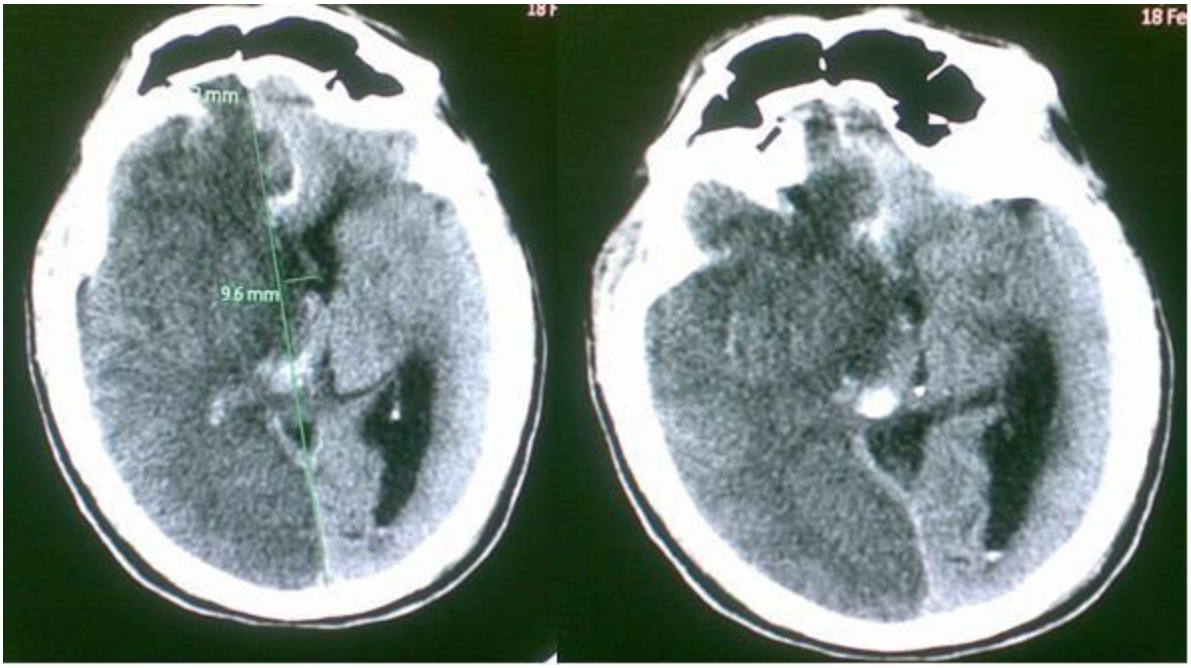

Fig 3: Acute right MCA and PCA territory infarct in 40 M patient with mass effect and midline shift of 9.6 mm

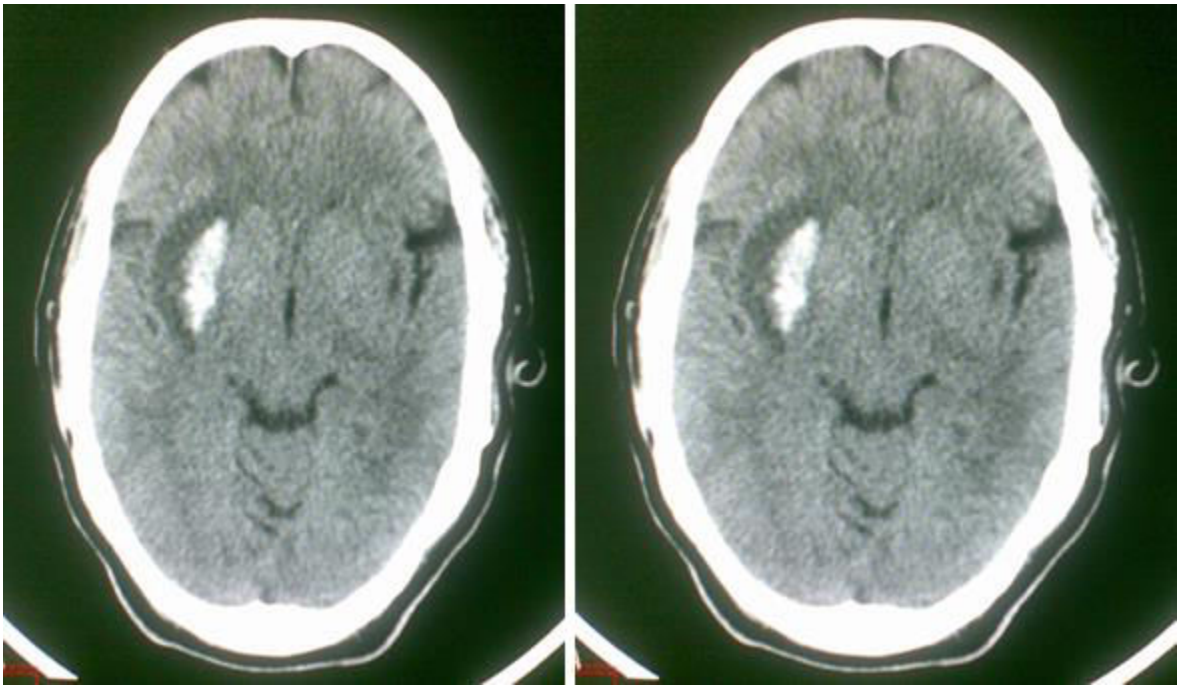

Fig 4: Acute intracerebral hemorrhage right side in 70 F patient with mass effect

In the present study, out of total 60 cases, 43 cases (71.7%) were diagnosed clinically as ischemic stroke, 17 cases (28.3%) were diagnosed clinically as hemorrhagic stroke which included 13 cases (21.6%) of intracerebral haemorrhage and 4 cases (6.7%) of both intracerebral haemorrhage with sub-arachnoid haemorrhage. In a study conducted by Khan AN et al, out of

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200 cases, 175 cases (87.5%) were diagnosed clinically as ischemic stroke and 25 cases (12.5%) were diagnosed clinically as hemorrhagic stroke[16]. Bharucha et al have discussed that most studies in India have recorded a larger number of ischemic stroke (57.3% to 89.7%) to hemorrhagic stroke (13.6% to 37.9%).[19]This is in accordance with our study.

In the present study majority of the CT scan proved stroke cases were seen in 61-70 years of age which included 10 cases (23.2%) of ischemic stroke and 9 cases (60%) of haemorrhagic stroke. This is similar to the age range seen in clinically diagnosed cases of stroke and is supported by studies done by Safeer et al, Khan et al and Bharucha et al. Ariesen et al have also reported age to be a risk factor for intracerebral hemorrhage.

CT scan proved ischemic stroke was slightly more common in males seen in 22 out of 43 cases (51.2%) than in females seen in 21 out of 43 cases (48.8%) whereas CT scan proved hemorrhagic stroke was slightly more common in females seen in 8 out of 15 cases (53.3%) than in males seen in 7 out of 15 cases (46.7%). One male case was found to have intracranial space occupying lesion on CT scan and one male case CT scan showed normal study. Khan AN et al and Noor-ul-Hadi et al reported that males suffered from stroke more than females.

In the present study, 11 out of 15 cases (73.4%) of CT scan proved haemorrhagic stroke were hypertensive and 13 out of 43 cases (30.2%) of CT scan proved ischemic stroke were hypertensive. In a study conducted by Khan AN et al, hypertension was seen in 28 out of 33 cases (84.8%) of haemorrhagic stroke and in 103 out of 167 cases (61.6%) of ischaemic stroke. Ariesen et al[5]and Teunissen et al [20]have reported the hypertension as a risk factor for hemorrhagic stroke. Increased fragility seems a plausible explanation. This is in accordance with the present study.

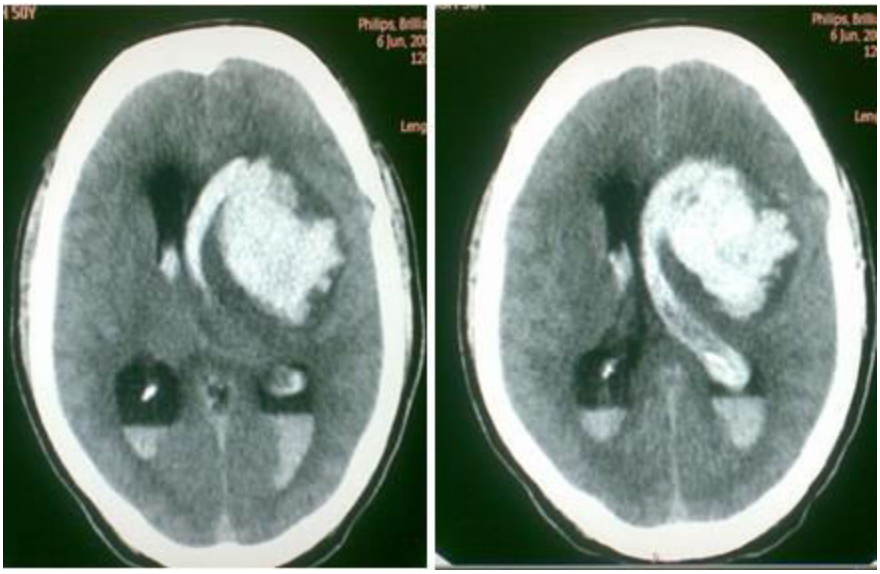

Fig 5: Acute intracerebral hemorrhage involving left basal ganglia in 50 M patient with intraventricular leak and midline shift

In the present study, history of diabetes mellitus was seen in 12 cases (20%) of ischemic stroke and 2 cases (3.3%) of haemorrhagic stroke. Two cases (3.3%) of ischemic stroke and one case (1.6%) of haemorrhagic stroke were smokers. History of CVS disease was seen in 2 cases (3.3%) of ischemic stroke and one case (1.6%) of haemorrhagic stroke. In a study conducted by Safeer et al hypertension was the commonest risk factor found in 55 cases (55%), ischemic heart

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disease was found in 34 cases (34%), diabetes mellitus was found in 26 cases (26%) and 30 cases (30%) were smokers[17]. Ariesen et al have reported that smoking and diabetes mellitus are risk factors for ischemic stroke but not obvious risk factors for ICH[5]. This is in accordance with the present study

In the present study, majority of the cases presented with finding of ischemic stroke on CT seen in 43 cases (72%). 15 cases (25%) presented with finding of haemorrhagic stroke which comprised of 13 cases (21.6%) of intracerebral haemorrhage and 2 cases (3.3%) of intracerebral haemorrhage with subarachnoid haemorrhage. 2 cases (3%) had other findings which included 1 case (1.6%) of normal scan and 1 case (1.6%) of intracranial space occupying lesion presenting with signs and symptoms of stroke (stroke mimics). Our study shows that ischemic stroke is more common than hemorrhagic stroke. In a study carried out by Khan AN et al, out of 200 cases, ischemic stroke was seen in 167 cases (83.5%) and haemorrhagic stroke was seen in 33 cases (16.5%) which comprised of 28 cases (14%) of intracerebral haemorrhage and 5 cases (2.5%) of subarachnoid haemorrhage.[16]

In the present study intracerebral hemorrhage was seen in 13 out of 15 cases (86.6%) of hemorrhagic stroke on CT scan. In study conducted by Khan AN et al, intracerebral hemorrhage was seen in 28 out of 33 cases (84.8%) of hemorrhagic stroke on CT scan. This is in accordance with present study. [16]

In the present study, out of 43 cases of CT scan proved ischaemic stroke, cerebral cortex were involved in 35 cases (58.2%) and 6 cases (10.0%) had lacunar infarcts. In 1 case (1.7%) cerebellum was involved. Brainstem involvement was also seen in one case (1.7%). Thus most of the infarcts were seen in cerebral cortex. Khan AN et al have found that the cerebral cortex was the most common area of the brain involved in ischaemic stroke seen in 54 cases (32.33%), lacunar infarct in 23 cases (13.7%), brainstem in 12 cases (7.1%) and cerebellum in 5 cases (2.9%). In a study conducted by Noor-ul-Hadi, infarcts were more commonly found in the cerebral cortex. This is in accordance with the present study.[18]

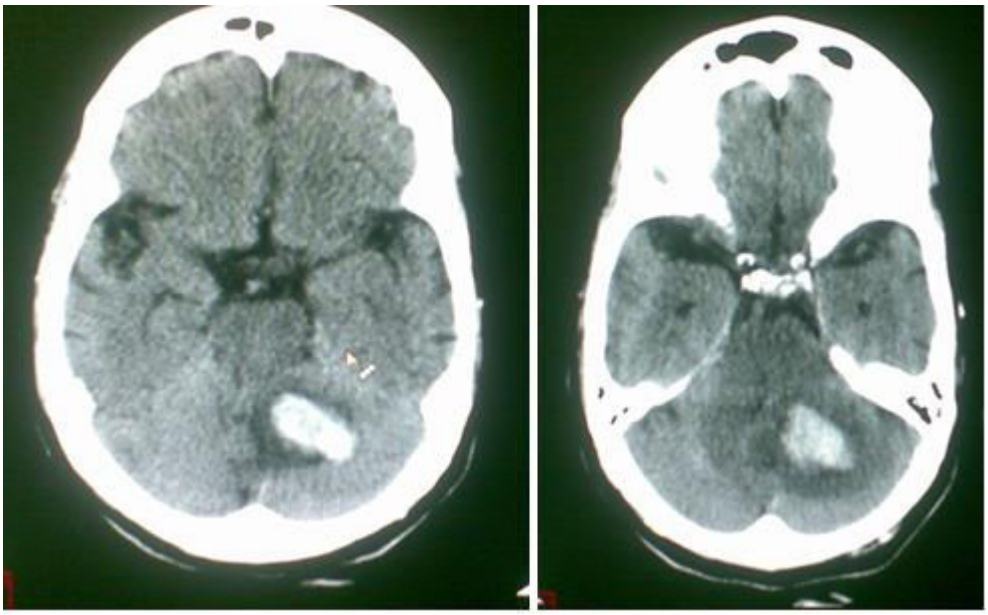

Fig6: Acute left cerebellar hemorrhage in 65 F patients with mass effect

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In 13 cases of CT scan proved intracerebral hemorrhage, the lesion was seen in basal ganglia in 8 cases (13.2%) and in cerebral hemispheres in 3 cases (5%). One case (1.7%) was seen each in cerebellar hemispheres and thalamus. In 2 cases of CT scan proved intracerebral haemorrhage with subarachnoid haemorrhage, one case (1.7%) was seen each in basal ganglia and cerebral hemispheres. Thus in our study the most common location for intracerebral hemorrhage was basal ganglia. In study conducted by Khan AN et al, in intracerebral haemorrhage the most common area of the brain involvement was the basal ganglia seen in 11 out of 28 cases (39.2%) followed by cerebral lobes in 7 out of 28 cases (25%) and brain stem in 6 out of 28 cases (22.32%).[16]

In the present study, mass effect in the form of effacement of sulcal spaces, compression of sylvian fissure and ventricles was seen in 41 cases (68.3%) which included 26 cases (43.3%) due to ischemic stroke, 12 cases (20.0%) due to intracerebral hemorrhage, 2 cases (3.3%) due to intracerebral hemorrhage with sub-arachnoid hemorrhage and one case (1.6%) due to intracranial SOL. Midline shift was seen in 12 cases (20.0%). Xavier et al have mentioned that increasing mass effect with lateral and vertical shift of infarcted tissue is seen in cases of infarction involving large vessel territories.[7]Similar findings are seen in the present study.

Intraventricular leak was seen in 7 out of 15 cases (46.6%) of hemorrhagic stroke which included 5 cases (8.3%) in intracerebral hemorrhage and 2 cases (3.3%) in intracerebral hemorrhage with sub-arachnoid hemorrhage. In a study conducted by Khan AN et al, intraventricular leak occurred in 5 out of 28 cases (17.85%) of hemorrhagic stroke. Thus they have also observed intraventricular leak in cases of hemorrhagic stroke.[16] This is in accordance with the present study.

In the present study, out of 43 clinically suspected cases of ischemic stroke, only 38 cases proved to have infarction on CT scan reflecting a clinical accuracy of 88.3%. Out of the rest 5 cases, 3 cases were diagnosed as haemorrhagic stroke, 1 case as intracranial SOL and 1 case as normal findings by CT scan. Out of 17 clinically suspected cases of hemorrhagic stroke, only 12 caseshad hemorrhage on CT scan reflecting a clinical accuracy of 70.6% while the rest 5 had ischemic stroke on CT scan.

CONCLUSION

So to conclude non-contrast CT brain remains an essential imaging study in suspected stroke patients due to its sensitivity for the detection of blood and infarction. It is widely available, simple to perform and can be performed quickly on confused, delirious patients. CT scan must be done which is the confirmatory test to differentiate between the hemorrhagic and non-hemorrhagic stroke and thus helps in improved management and therapeutic outcome in patients of stroke.

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