

Research Article

Detailed epidemiological analysis of cerebrovascular disease, the first study from Eastern India

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ABSTRACT

Background: Prevalence of cerebrovascular diseases (CVD) is rising in India along with its morbid impact. Till now there is no study from Eastern India to reflect the current scenario of cerebrovascular diseases in this part of world. This study destined to know and analyse several epidemiologic factors behind cerebrovascular diseases in Eastern India.

Methods: 108 patients who were admitted with symptoms of stroke were analysed based on several parameters. They were investigated, treated and their outcomes were followed.

Results: Correlation between clinical findings and radiological confirmation was much more in case of infarction (65%) compared to haemorrhagic cases (22%). Superior division of the middle cerebral artery was the commonest site get involved in infarction cases and internal capsule area is the most commonly involved area in lacunar infarction almost one third of haemorrhagic patients had intraventricular extension. Most common association with this was thalamic bleeding although most common site of haemorrhage was lentiform nucleus. Among the patients with hemorrhage with intraventricular extension 50% were thalamic bleed and 50% were non thalamic bleed (mainly lentiform nucleus). In hospital mortality rate was found to be highest in non-thalamic group (63%). Overall mortality in non-thalamic bleed was higher though not statistically significant.

Conclusions: Haemorrhagic CVD is much more prevalent in this part of world compared to western population. Clinico radiologic correlation is much more in ischaemic infarction hypertension and smoking are two strong associations in cerebrovascular diseases.

Keywords: CVD, Hypertension, MRI, CT scan

INTRODUCTION

Stroke is defined as abrupt onset of a neurologic deficit that is attributable to a focal vascular cause.¹ It is associated with widely different clinical presentation, etiopathogenesis, appropriate management strategy and outcomes. Once the clinical diagnosis is made, a brain imaging (computerized tomography or magnetic resonance imaging) is done to determine the cause of stroke such as ischemia or hemorrhage. A search for

etiology and pathological process involved is made by finding out the risk factors and co morbid associated conditions responsible for the clinical event. Imaging studies help us to locate the anatomical sites and likely vessels involved. Such detailed study not only helps to prevent recurrence but also guide in better management for that particular patient. There are several common causes of sudden onset neurological symptoms that may mimic stroke, including seizures, intracranial tumor, migraine or metabolic encephalopathy. An adequate

history, through clinical examination and imaging studies are necessary to exclude these disorders.

Imaging techniques, as already alluded to, continue to enhance the clinical study of stroke patients; they allow the demonstration of both the cerebral lesion and the affected blood vessel. CT scanning demonstrates and accurately localizes even small haemorrhages, haemorrhagic infarcts, subarachnoid blood, clots in and around aneurysms, regions of infarct necrosis and arteriovenous malformations. Magnetic resonance imaging (MRI) also demonstrates these lesions and, in addition, reveals flow voids in vessels, hemosiderin and iron pigment, and the alterations resulting from ischemic necrosis and gliosis. Of the two procedures, MRI is particularly advantageous in demonstrating small lacunar lesions deep in the hemispheres and abnormalities in the brainstem (a region obscured by adjacent bone in CT scans). One of the diagnostic advances in the last decade has been the introduction of the diffusion-weighted technique, which allows the early detection of an infarctive lesion within minutes of the stroke, i.e., considerably earlier than CT and MRI scan.²⁻⁶

The purpose of our study is to evaluate the patients admitted in our hospital both clinically and radiologically (either by CT scan brain with 3D reconstruction or MRI of brain), to localize the lesion or the area of involvement and to correlate the clinical presentation with the radiological-anatomical localization. We have also tried to see the pattern of stroke in this part of India and to find out the difference in presentation vis-a-vis the western population and to look into the probable etiological diagnosis.

The aim of the study was to conduct thorough clinical examination including fundoscopy; (2) to do imaging studies (CT scan of brain with 3D reconstruction, MRI of brain and MR angiography wherever necessary); (3) to conduct cerebrospinal fluid analysis wherever necessary for etiological diagnosis.

The objectives of the study was (1) to know the pattern of different types of stroke along with its area of involvement and vascular distribution; (2) to correlate radiological finding with the clinical findings (3) to find out those cases which mimic stroke clinically but are radiologically non conclusive and (4) to make a probable etiological diagnosis.

METHODS

This study has been conducted in department of medicine, RIMS, Ranchi for duration of one and half year.

Study population: 108 Patients have been selected randomly during the study period among the patients admitted from emergency department in department of Medicine.

Selection of cases: The cases have been selected on the basis of following eligibility criteria.

Inclusion criteria

- Patients more than 14 years old
- Both sexes included
- Patients presented with stroke like features

Exclusion criteria

- Patients who later diagnosed as metabolic encephalopathy
- Patients with known or diagnosed as intracranial tumor or metastasis
- Patients who are diagnosed as sub Dural or extra Dural hematoma
- Patients with h/o head injury

As soon as the patients are admitted in the emergency detailed clinical examination and history taking have been done along with ophthalmoscopic examinations and CSF study in some cases. Majority of the patients were advised CT scan of brain as it is the gold standard for screening and excluding space occupying lesion in brain, intra cranial hemorrhage, subdural or extra dural hematoma. Few patients were advised MRI where the patients were hemodynamically stable with minor neurological deficit and patient were conscious and cooperative. Some other investigations like MR angiogram were considered according to the situations.

RESULTS

108 patients have been selected for our study during the study period. Among this 71 were male and 37 were female. Out of 71 male patients 38 patients presented with ischemia (53.52%), where as 33 patients presented with hemorrhage (46.47%). Among the 37 female patients 21 patients presented with hemorrhage (63.64%) and 16 patients presented with infarction (48.48%). This study shows maximum number male stroke patients in the age group 51-60 years and maximum number of female stroke patients in the age group 61-70 years (Figure 1).

Correlation between clinical findings and radiological confirmation was much more in case of infarction (65%) compared to haemorrhagic cases. Out of 108 patients, 13 patients were advised MRI brain with TOF sequence. Other 95 patients went through plain CT scan brain with 3D reconstruction images. Though diffusion weighted MRIs most sensitive for detection of infarction our set up does not have this facility we relied on CT scan and conventional MRI brain. Out of 38 male infarct cases and 16 female infarct cases, radiologically conclusive cases were 35 and 13 respectively. The cause of the radiologically non- conclusive cases might be due to inability of CT scan to detect small lacunar infarct (Figure 2 and 3).

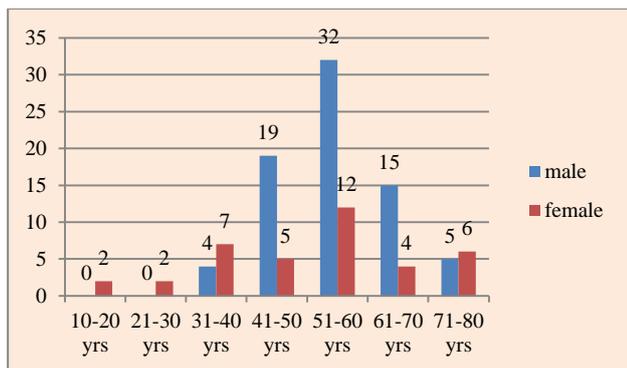


Figure 1: Distribution of study population (n=108).

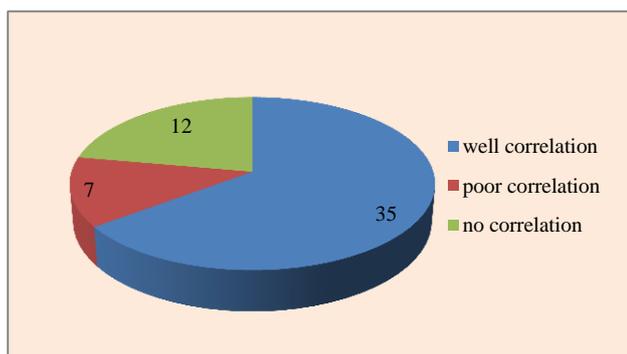


Figure 2: Clinico-radiological correlation in infarct cases in both male and female (n=54).

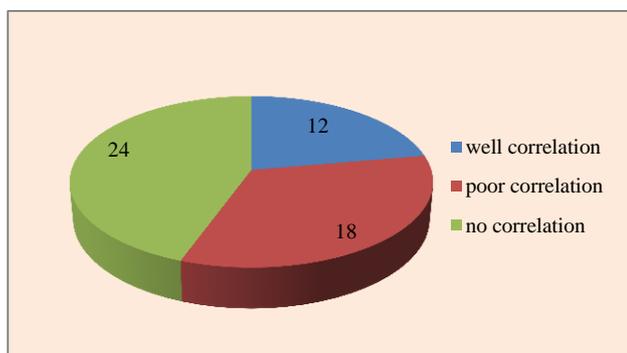


Figure 3: Clinico radiological correlation in haemorrhagic cases (n=54).

This study showed that almost one third of haemorrhagic patients had intra-ventricular extension. Most common association with this was thalamic bleeding although most common site of haemorrhage was lentiform nucleus. Among the patients with hemorrhage with intra-ventricular extension 50% were thalamic bleed and 50% were non thalamic bleed (mainly lentiform nucleus). In hospital mortality rate was found to be highest in non thalamic group (63%). Overall mortality in non thalamic bleed was higher though not statistically significant (Figure 4 and Table 1-3).

Table 1: Pattern of intracerebral hemorrhage in male and female patients(n=54).

Pattern of hemorrhage	Male	Female
Total cases	33	21
Hemorrhage with intraventricular extension	15	7
Thalamic bleed	11	3
Bleed in lentiform nucleus	18	14
Pontine hemorrhage	1	3
Aneurysm/AV malformation	3	1

Table 2: Hemorrhage with intraventricular extension and in study population in thalamic and non-thalamic bleed (n=22).

Pattern of hemorrhage with intraventricular extension and in hospital mortality	Male	Female
Total no cases of hemorrhage with intraventricular extension	15	7
Thalamic bleed with intraventricular extension	8	3
Non thalamic bleed with intraventricular extension	7	4
Mortality in thalamic bleed with intraventricular extension	3	0
Mortality in non thalamic bleed with intraventricular extension	6	1

Table 3: Few stroke syndromes found in our study.

Stroke syndrome	No. of cases
Brachial syndrome	1
Frontal opercular syndrome	1
Lateral medullary syndrome	1
Perinaud syndrome	1
Pure motor hemiparesis	2
Clumsy-hand dysarthria syndrome	1
Ataxic hemiparesis	1

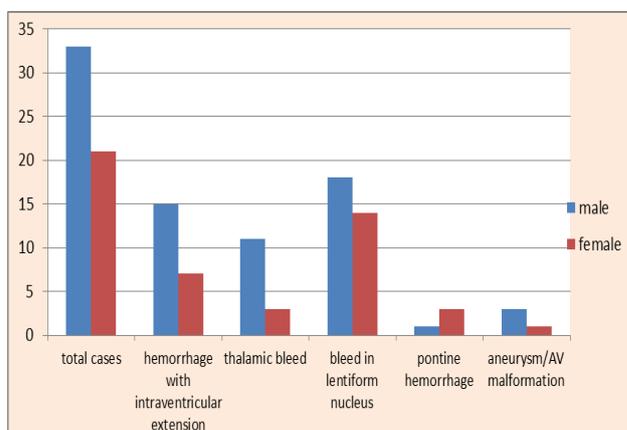


Figure 4: Pattern of hemorrhage in male and female patients (n=54).

This study showed superior division of the middle cerebral artery was the commonest site get involved in infarction cases and Internal capsule area is the most commonly involved area in lacunar infarction (Figure 5 and 6).

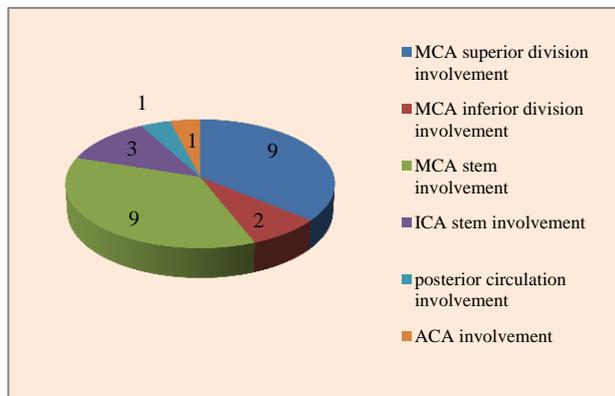


Figure 5: Territory involvement in large vessel infarct cases (n=25).

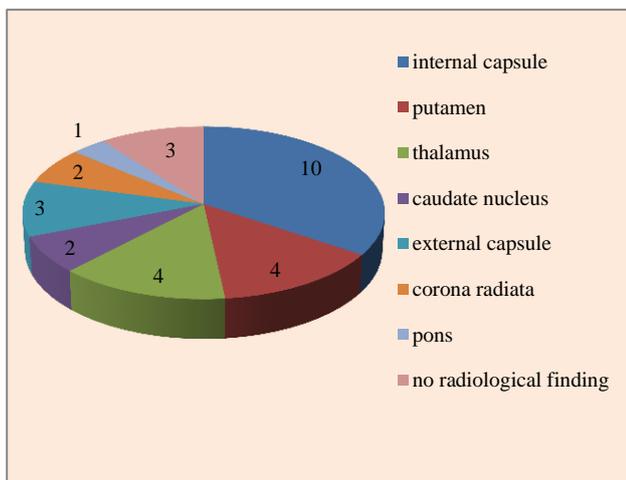


Figure 6: Predominant sites for lacunar stroke (n=29).

Predominant clinical presentation of stroke patients in this study has been shown in Figure 7. Most common presentation in our study is hemiparesis without unconsciousness (33%) followed by unconsciousness with

hemiplegia (27%). Other clinical manifestations are aphasia with or without hemiparesis (17%), hemisensory loss, Hemineglect, monoparesis, seizure and no neurological deficit (4 cases). Least common presentation is usually of different stroke syndrome.

Figure 8 is showing pattern of stroke and its relation with smoking and alcohol intake, highest correlation being with smoking and alcohol synergistic effect to causation of haemorrhagic stroke.

In our study 63 patients presented with hypertension. Out of these 27 (43%) gave the history of hypertension though all were on irregular antihypertensive treatment. Other 36 (57%) were undetected hypertensive patients. In our study mean systolic blood pressure at the time of presentation in hemorrhage patients was 175mm of Hg and infarct patients was 156mm of Hg. There is no significant difference in blood pressure between two study group (p=0.769).

Overall outcome was poor with male patients and in haemorrhagic stroke whereas patients with ischaemic strokes had better recovery (Table 4).

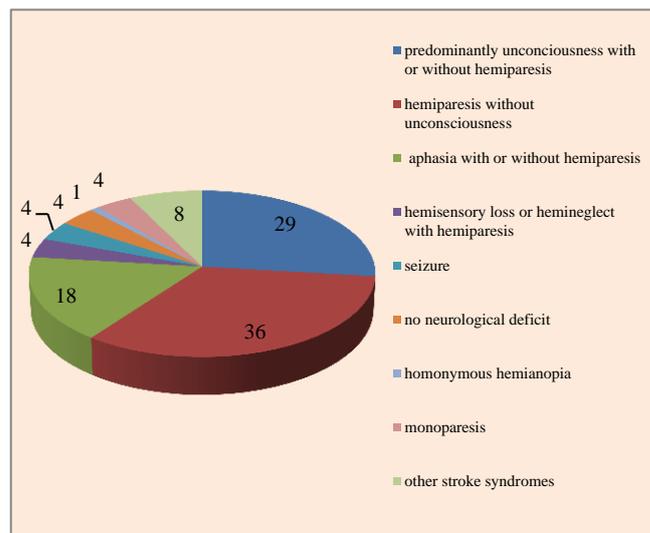


Figure 7: Predominant clinical presentation of stroke patients (n=108).

Table 4: Glasgow outcome in stroke patients (n=108).

Glasgow outcome scale	Male hemorrhage cases	Female hemorrhage cases	Male infarction cases	Female infarction cases
Total no. of cases	33	21	38	16
Full recovery	3	0	3	0
Moderate disability	2	4	5	2
Severe disability	16	10	25	9
Vegetative state	3	6	2	3
Death	9	1	3	2

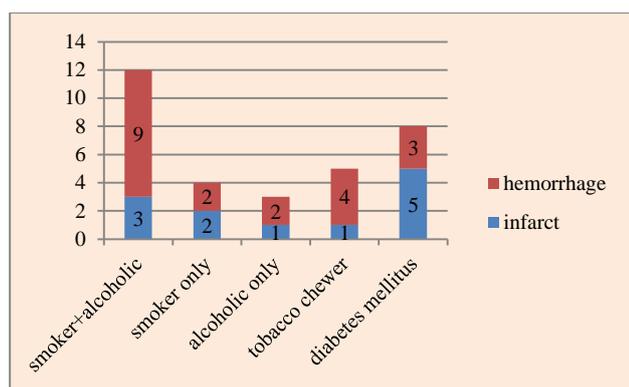


Figure 8: Pattern of stroke and its relation with smoking and alcohol intake.

DISCUSSION

Stroke or cerebrovascular accident continues to baffle physicians and neurologists world over since early years of evolution of scientific management of disease process. Nevertheless it continues to find important place in scientific medical literature. Fischer said that neurologists have learned the subject stroke by stroke implying that in those times autopsy studies and clinical material were the only two ways to understand the brain functions.

The onset and early natural course of stroke gives critical information about the stroke mechanism. For example, the deficit which is maximal at onset and not associated with headache is most compatible with an embolic phenomenon, while a stuttering onset with improvement followed by worsening in the deficit zone would be against cerebral hemorrhage, but most compatible with a thrombotic process. The gradual development of a progressive focal deficit, accompanied by gradually developing symptoms of increased intracranial pressure, may suggest cerebral hemorrhage.⁷

In our study incidence of hemorrhage and infarct is 50%. Several studies done worldwide also showed almost same kind of results like that from Nepal supports our data (hemorrhage 42% and infarct 58%).⁸ On the contrary, in western literature hemorrhage occurs in only 15% to 20% of cases. Uncontrolled hypertension, irregular drug intake and lack of basic health care may be risk factors for increased incidence of hemorrhage in this part of world.

The role of clinically differentiating between ischemic and hemorrhagic stroke is not relevant as radiologic diagnosis is gold standard and in India, more and more people from remote villages are able to reach to such places where CT scan facility is available. However few studies have shown diagnostic accuracy of Siriraj scoring system, Allen scoring system, Mayo clinic scoring system, WHO scoring system to distinguish between ischemic and haemorrhagic stroke. Several studies done at India showed 66.25% diagnostic accuracy and virtually

ruled out its usefulness.⁹ This is also supported by several other studies.¹⁰ Nevertheless in developing nations like African nations and some parts of India this scoring system may be of some help where CT scan facility is not available. As the management of ischemic and hemorrhagic stroke are entirely different, an error in diagnosis will lead to wrong treatment and catastrophic result whereas delay in diagnosis with 100% accuracy (like CT scan or MRI) will be by far less harm full for the patients.

Age is the strongest risk factor for ischemic stroke, primary intra cerebral hemorrhage and subarachnoid hemorrhage.¹¹ There is a small excess of males, which is most prominent in middle to old age, disappearing in the very elderly and probably absent in the young.¹² This western data is very much similar to our study result, though number of males are almost twice to the number of female patients admitted in our institution.

Elevated blood pressure is strongly associated with stroke risk, and probably with all the main pathological types but its relationship is far more in evidence in hemorrhagic type.^{13,14} Although most of the information comes from consideration of diastolic blood pressure, the relationship with systolic blood pressure is similar and possibly stronger and even isolated systolic hypertension is associated with increased incidence.¹⁵⁻¹⁸

Cigarette smoking has been accepted as a risk factor for stroke. There is a dose – response relationship, males and females are equally affected.¹⁹ Numerous epidemiological studies have now established a close relationship between smoking and stroke as a whole and particularly for subgroups of cerebral ischemia and subarachnoid hemorrhage. Whether smoking is a risk factor for primary intracerebral hemorrhage is there or not is not yet clearly established. The mechanism whereby smoking may exert these effects is by vessel wall changes (atherogenesis) and hematological effects and the relative impact of each of these mechanisms may vary depending on the age of the patient. Smoking may be a more potent risk factor in younger patients and in this group hematological effects may predominate. The duration of smoking may be more important than total daily dose and cessation of smoking may diminish but perhaps may not abolish the risk of stroke. Much more evidence needs to be accumulated concerning the relationship between smoking and various stroke subgroups and a greater understanding is required concerning the specific mechanisms in each case. Information such as this is an important tool in public awareness campaigns which are needed to minimize one of the most potent but correctable risk factors for stroke.²⁰ The study done by Bhat VM et al showed a strong dose response relationship between smoking and ischemic stroke in young women.²¹ Healthcare settings provide an important teachable moment for smoking cessation intervention. Seventy-five percent of the adult population visits a physician at least once a year, with the average

adult making five visits per year. In the physician's office, patients are often conscious of their health and most receptive to risk factor intervention, providing an important opportunity for change. A number of studies have documented that physician-delivered counselling interventions for smoking cessation can be effective.²²

Although large sample size is required for definitive conclusion and amount of alcohol and type of alcoholic beverage is not known there may be an association between alcohol intake and hemorrhagic stroke. Although light to moderate alcohol consumption is of proven value in protecting stroke, heavy alcohol consumption is associated with hemorrhagic or non hemorrhagic stroke.^{23,24} The study done by Reynolds C et al showed heavy alcohol consumption is associated with significant non-linear correlation with ischemic stroke and linear correlation with hemorrhagic stroke.²⁵

The commonest site of non-thalamic bleed is lentiform nucleus in this study. It seems that mortality rate of non-thalamic bleed with intraventricular extension is higher than mortality rate of thalamic bleed with intraventricular extension which is in accordance with many other studies done before.

This study showed that with the exception of infarction due to cerebral venous occlusion, seizures are quite infrequent in stroke patients as has been seen with other studies.²⁶

Our study shows well clinical correlation in 65% of infarct cases, poor correlation 13% of infarct cases and no correlation in 22% of infarct cases. This is comparable to the study done by Tei H et al on the contrary in haemorrhagic cases well correlation is possible in 22% of cases, poor correlation in 33% and no correlation seen in 44% of cases. The clinico-radiological correlation in hemorrhage cases are poor because majority of the patients presents with unconsciousness, therefore localization becomes difficult. The majority of the intracranial hemorrhage occurs due to ruptured penetrating artery aneurysm due to lipohyalinosis (charcot-bouchard aneurysm). The blood may track to multiple areas causing compressive effect, thus complex clinical manifestation.

As the arrangement of the fibres in the regions supplied by the penetrating arteries are complex and one region supplied by several penetrating arteries and one artery supply several regions and small lacunar infarct is very often undetectable by CT scan, therefore localization of lacunar infarct and its clinical correlation is a difficult one. Newer modalities of diagnosis will be more helpful in this aspect.

Majority of the patients were discharged with severe disability (according to Glasgow outcome scale). Male patients with haemorrhage were associated with more morbid outcome as evident from this study.

At the end of our discussion, it can be said that stroke is a worldwide health problem. It makes an important contribution to morbidity, mortality and disability in developed as well as developing countries. Incidence of stroke is likely to increase proportionally with the increase in life expectancy. The proportion of strokes in the young is significantly more in India than in developed countries; some of the more important causes for this are likely to be rheumatic heart disease, strokes in peripartum period and arteriopathies as a sequel to CNS infections of bacterial and tuberculous origin. Routine screening of every case of suspected stroke is of utmost importance as clinical diagnosis is often not reliable.²⁷ Incidence of different types of stroke and its outcome varies in different geographical regions of the world depending on variability in race, ethnicity, different unknown risk factors, different health care system as well as resources available for management and the financial burden for the health care of the patients in a particular country. Besides methodology and design adopted in stroke studies, using standard definition and study design are essential for a world-wide comparative study. The possibility of comparing incidence of accurately assigned pathological types and subtypes of cerebral infarction is an interesting new prospect, based on advances in imaging technology that are becoming increasingly widely available. Practice and experience with MR imaging in a stroke team significantly reduce the time and effort required to perform this technique and thus make 24-hour availability for MR imaging of stroke practical. Assessment of patients with hyperacute stroke is rapid and comprehensive. MRI might be the investigation of choice particularly in lacunar infarct.²⁸

CONCLUSION

The following are the conclusions of this study;

- Incidence of hemorrhage is much more in India (50% according to our study) in comparison to 15-20% in western population.
- The most prominent risk factor in our patients is uncontrolled and/or undetected hypertension with or without treatment.
- Smoking is a strong risk factor for intracerebral hemorrhage as well as other types of stroke. Alcohol has synergistic effects along with it.
- MRI is a better investigation modality particularly in early hours of ischemic stroke particularly in lacunar stroke.
- Clinico-radiological correlation is possible in 65% of infarct cases and 22% of hemorrhage cases.
- Anatomical correlation in intracerebral hemorrhage patient is very problematic as it is difficult to localize the lesion in unconscious or patient with altered sensorium which is a very common presentation of intracerebral hemorrhage.
- The major type of ischemic stroke in our study is the small vessel stroke or lacunar stroke (50% of

ischemic stroke in male and 62.5% of ischemic stroke in female).

- Commonest involvement in large vessel ischemic stroke is MCA territory (72%)
- Commonest site of lacunar infarct is internal capsule (34%) though multiple site involvement is more common (79%).
- The commonest presenting feature is hemiparesis with or without altered sensorium (60%).
- Commonest outcome of ischemic stroke according to Glasgow outcome scale at the time of discharge from hospital is severe disability (48%) irrespective of gender.
- Commonest outcome at the time of discharge in hemorrhagic stroke cases according to Glasgow outcome scale is severe disability (66% in case of male and 56% in case of female).
- Hemorrhage around lentiform nucleus including putamen and internal capsule with intraventricular extension has the worst outcome (63% in hospital mortality rate according to our study).
- In hospital mortality in all hemorrhage cases is 20% whereas in all infarct cases it is 10%.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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