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Role of Computed Tomography in Evaluation of Cerebrovascular Accidents

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ABSTRACT: PURPOSE(Background and objectives):
Cerebrovascular accident is a leading cause of death and disability throughout the world. This study is aimed to demonstrate the role of computed tomography in clinically suspected cerebrovascular accidents. Its purpose is to document the presence or absence of haemorrhage or infarcts, to determine the location and assess the territory of blood vessels involved and to detect the incidence of negative cases of clinically suspected stroke.

MATERIALS & METHODS:
A Hospital based prospective study was performed with the clinical diagnosis of Cerebrovascular accident (excluding trauma).
Total sample size is 100 cases.
Cases were primarily diagnosed by clinical examination and further evaluated by CT scan, and taken up for the study over period of 6 months from October-2019 to March-2020. Further evaluation ofpatient was done by routine blood investigations, fundusexamination to correlate andconfirm the clinical diagnosis.

RESULTS: 100 patients of CVA were admitted in ward and observed till they were discharged. Clinico-radiological correlation was done by doing CT scan in all patients. Provisional diagnosis of ischemic stroke was thought in 67 cases, of which 39 were males and 28 were females, it was confirmed radiologically in 54 cases (80.59%) and out of remaining 13 cases (19.40%), 2 cases had cortical atrophy, 9 cases had normal brain imaging reports.

CONCLUSION: 1. CT scanning is the “Gold standard” technique for diagnosis of acute stroke as the rational management of stroke depends on “Accurate diagnosis”
2. Risk factors such as hypertension, diabetes and previous episodes of stroke play a major role in the evolution of cerebrovascular accidents.

KEYWORDS: Computed tomography, cerebrovascular accidents, ischemic stroke, hemorrhagic stroke.

I. INTRODUCTION:

- Cerebrovascular accident or stroke is defined as an acute loss of focal and frequently 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.
- 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 incidence rate and the death rate from stroke increases exponentially with age. About 15 to 30% of patients die with each episode of cerebral infarction and 16 to 80% with cerebral haemorrhage.
- Those who survive are usually left with permanent disability.
- Many studies have been performed throughout the world to demonstrate the role of computed tomography in management of cerebrovascular accidents.
- The reasons for performing CT for patients with cerebrovascular accidents are to establish a reasonable diagnosis, to identify types of stroke amenable to surgery, to exclude intracranial haemorrhage, to diagnose spontaneous subarachnoid haemorrhage, to detect any bone changes.
- In addition, other brain lesions, at times, may clinically present as stroke like syndromes namely primary or metastatic brain tumors or subdural haematomas that can usually be clearly differentiated by CT examination.

Purpose:

- Accurate and early diagnosis of CVA can improve the morbidity and mortality rates, as newer and more effective therapies are currently being applied.
- Since computed tomography imaging is widely available, cost effective and less time consuming, it plays the role of a first-line imaging modality.

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- This study is aimed to demonstrate the role of computed tomography in clinically suspected cerebrovascular accidents.
- The purpose of the present study is to document the presence or absence of infarcts or haemorrhages, to determine the size, location and accurately assess the territory of blood vessels involved and age of infarct with respect to onset of clinical symptoms. Finally to detect the incidence of negative cases of clinically suspected stroke- other causes simulating stroke.

Materials & Methods:

- The source of data for the study is 100 patients from Great Eastern Medical School and Hospital, Ragolu, Srikakulam, AP.
- Duration of study: 2 years
- Data Analysis: Prospective study
- 100 cases of Cerebrovascular accidents (excluding traumatic) primarily diagnosed by clinical examination and further evaluated by available brain imaging modality- Computerized Tomography Scan (CT scan) from a time period of January 2018 to January 2020.
- Detailed history is taken and thorough examination (general &systemic) of patient and Stroke score grading is done, thus coming to a clinical diagnosis. Then further evaluation of patient is done by routine blood investigations (Lipid profile, serum electrolytes), fundus examination & CT scan were done to correlate and confirm the clinical diagnosis. Cerebrospinal fluid (CSF) examination is done in indicated cases.

Inclusion criteria:

• All patients of suspected clinical stroke admitted to the hospital, those patients with furthur evaluation such as CT brain, confirming diagnosis.

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.

WHY IS CT PREFFERED?

- Due 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 intracerebralhaematomaare usually differentiated.
- CT also enables identification of the acute and chronic sequence that may develop after a sequence of infarction. These include, in acute phase, brain edema and conversion of a bland into haemorrhagic infarct and inchronic phase, cystic parenchymal change, cortical atrophy and focal ventricular dilatation.

CT TECHNIQUE:

- Study will be undertaken on GE 16 slice MDCT with collimation of 40x0.625mm, slice thickness of 0.6mm and 16 slices per rotation.

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.
- 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-

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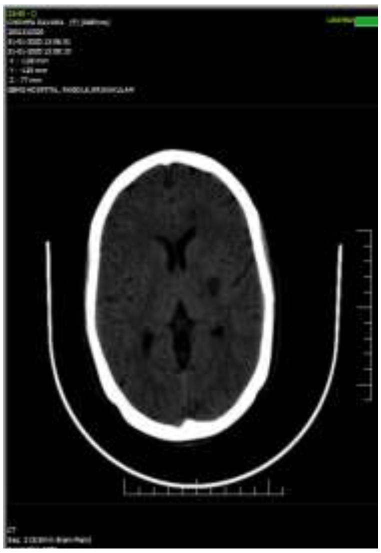
- Window width – 75, Window level – 36

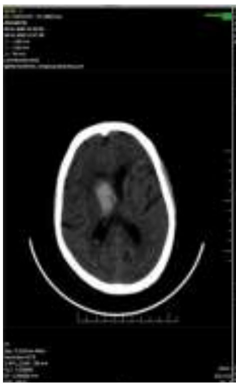
IMAGING FINDINGS:

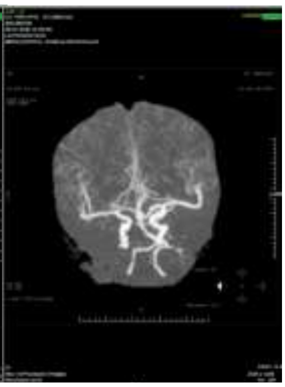


Well defined hypodense area involving left lentiform nucleus, posterior limb of internal capsule,body of left caudate nucleus and left corona radiata.-Acute infarct.

Well defined hyperdense area of Hemorrhaghic attenuation in the left lateral putamen and external capsule extending in to corona radiata with surrounding hypodensities noted suggesting edema.
Mass effect in form of effacement of ipsilateral cortical sulci,compression on ipsilateral lateral ventricle.

Illdefined hyperdense areas of Hemorrhaghic attenuation in the left frontal and temporal regions.
Biconvex area of hemorrhaghic attenuation in the left fronto temporal region-EDH
Mass effect in form of effacement of ipsilateral cortical sulci,compression of ipsilateral lateral ventricle and effacement of basal cisterns.
Well defined hyperdense area of Hemorrhaghic attenuation in the right inferior cerebellar hemisphere.
Midline shift right side with subfalcine herniation seen.





Evidence of well definedhyperdensearea(HU 64) in the right caudate,anterior limb of right internal capsule & right corona radiata with Intraventricurlarhyperdensities seen in the ipsilaterallateral,third& fourth ventricles.
Midline shift to left.Periventricularhypodensities noted.

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IlldefinedHypodense areas noted in the leftfronto temporal region ,insular cortex and corona radiata.

Extraaxialsulcalhyperdensities in bilateral frontotemporoparietal regions.-SAH.
Hemorraghic attenuation of Hyperdensities in suprasellarcistern,chiasmaticcistern,cistern of lamina terminalis and bilateral sylvian fissures-S/O SAH.
Intraventricurhyperdensities in occipital horns of both lateral ventricles.
Periventricular hypodensities noted bilaterally.

Area of hypodensity with HU 24 noted involving leftfrontoparietal region and insular cortex.
Ventricular sytem and sulcal spaces are prominent.
Perivetricularwhitematterhypodensities.

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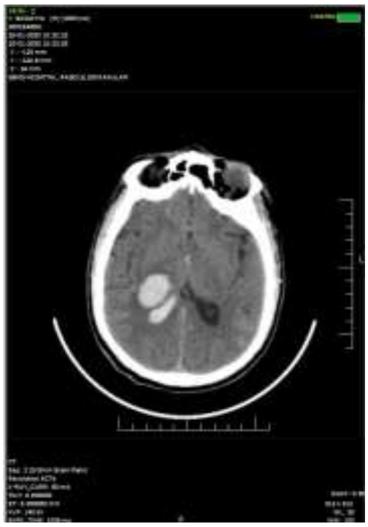

Well defined hyperdense area of Hemorrhaghic attenuation in the right postero lateral thalamus and extending in to corona radiata with surrounding hypodensities suggesting edema.
Intraventricular extension into bilateral lateral ventricles(R>L) ,third and fourth ventricles.

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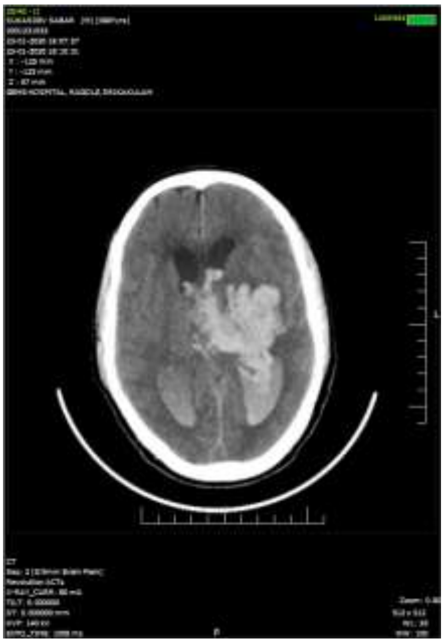

Well defined hyperdense area of Hemorrhaghic attenuation in the left lentiformnucleus,thalamus ,left internal and external capsule extending in to corona radiata with surrounding hypodensities suggesting edema. Mass effect in form of effacement of ipsilateral cortical sulci,compression on thrid ventricle and mid brain and obliteration of mibdbrain cisterns.
Intraventricular extension in the bilateral lateral,third and fourth ventricles.
Midline shift of 5 mm towards right side.

Well defined hyperdense area of Hemorrhaghic attenuation in the right lentiform nucleus and external capsule extending in to corona radiata with surrounding hypodensities suggesting edema causing effacement of ipsilateral cortical sulci and frontal horn of right lateral ventricle.Intraventricular extension in the ipsilateral lateral ventricle and occipital horn of left ventricle.
Midline shift towards left side.

II. RESULTS:

Out of 100 patients clinically suspected of CVA submitted for CT scan study of brain,

- 49 Patients had infarction
- 29 Patients had hemorrhage
- 7 Patients had SAH
- 6 Patients had cortical atrophy
- 9Patients had normal study.

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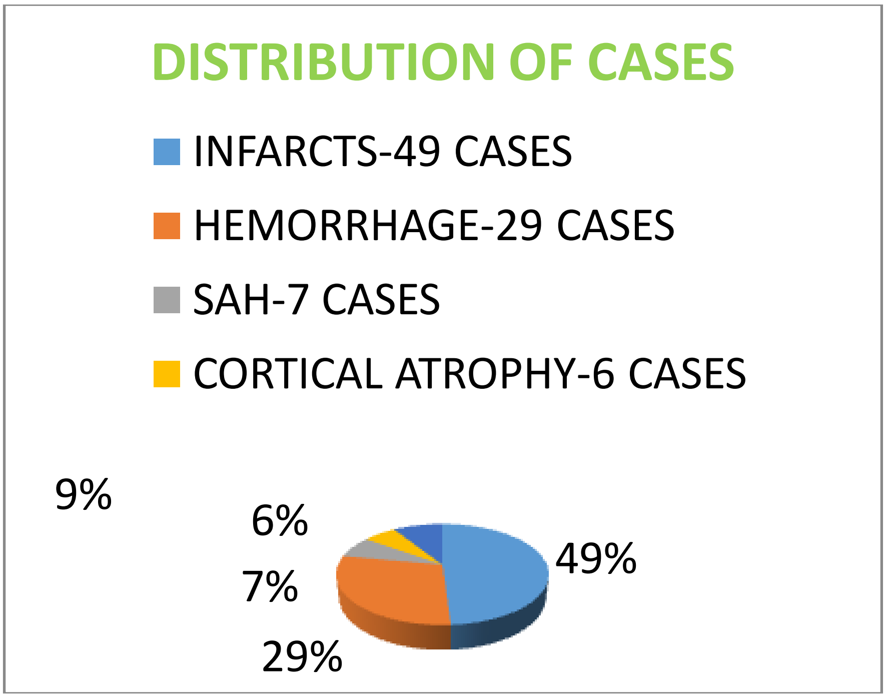
CT FINDINGS	NUMBER OF CASES	PERCENTAGE FOR 100 CASES
INFARCTION	49	49%
HEMORRHAGE	29	29%
SAH	7	7%
CORTICAL ATROPHY	6	6%
NORMAL STUDY	9	9%
	100	100%



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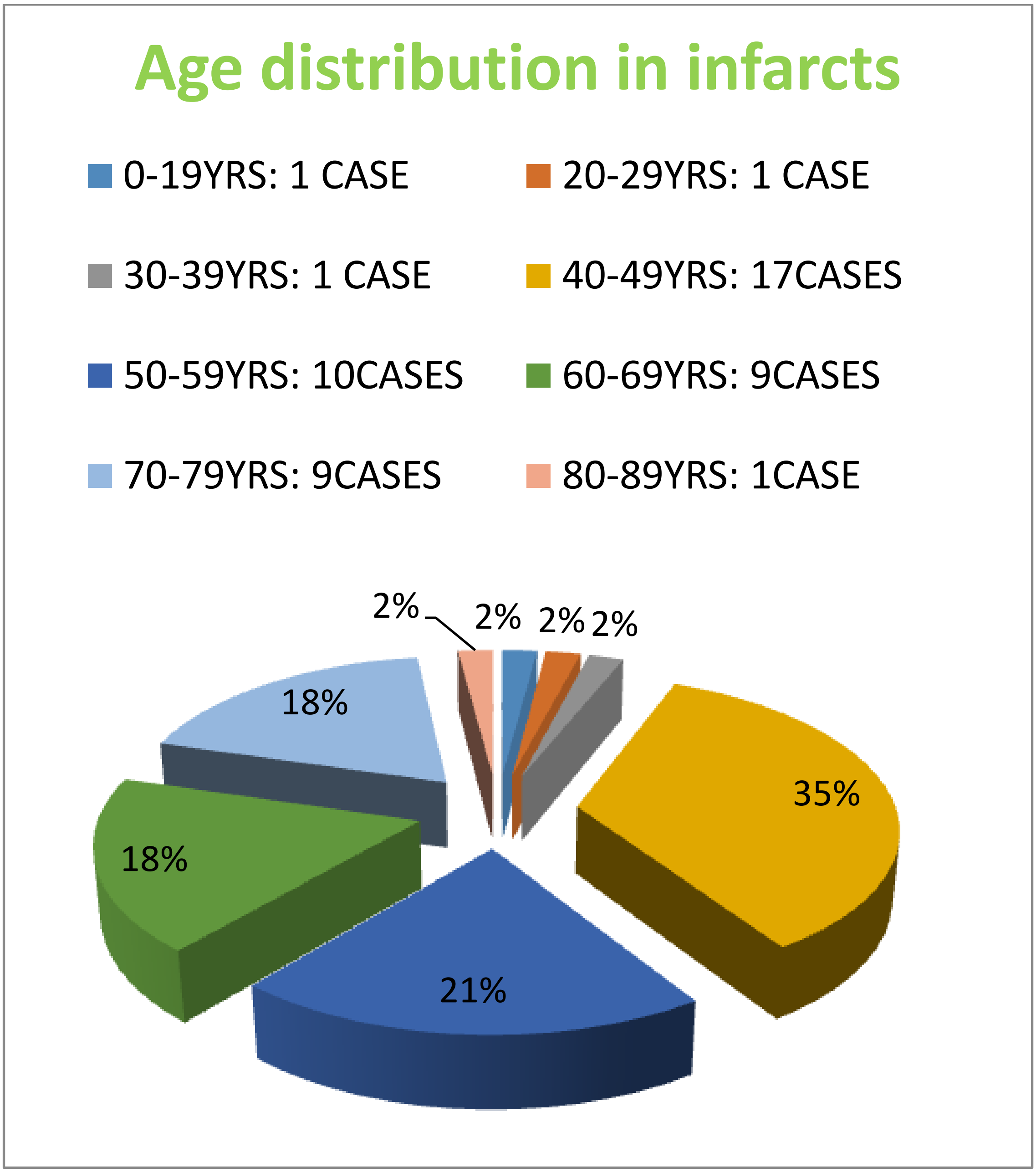

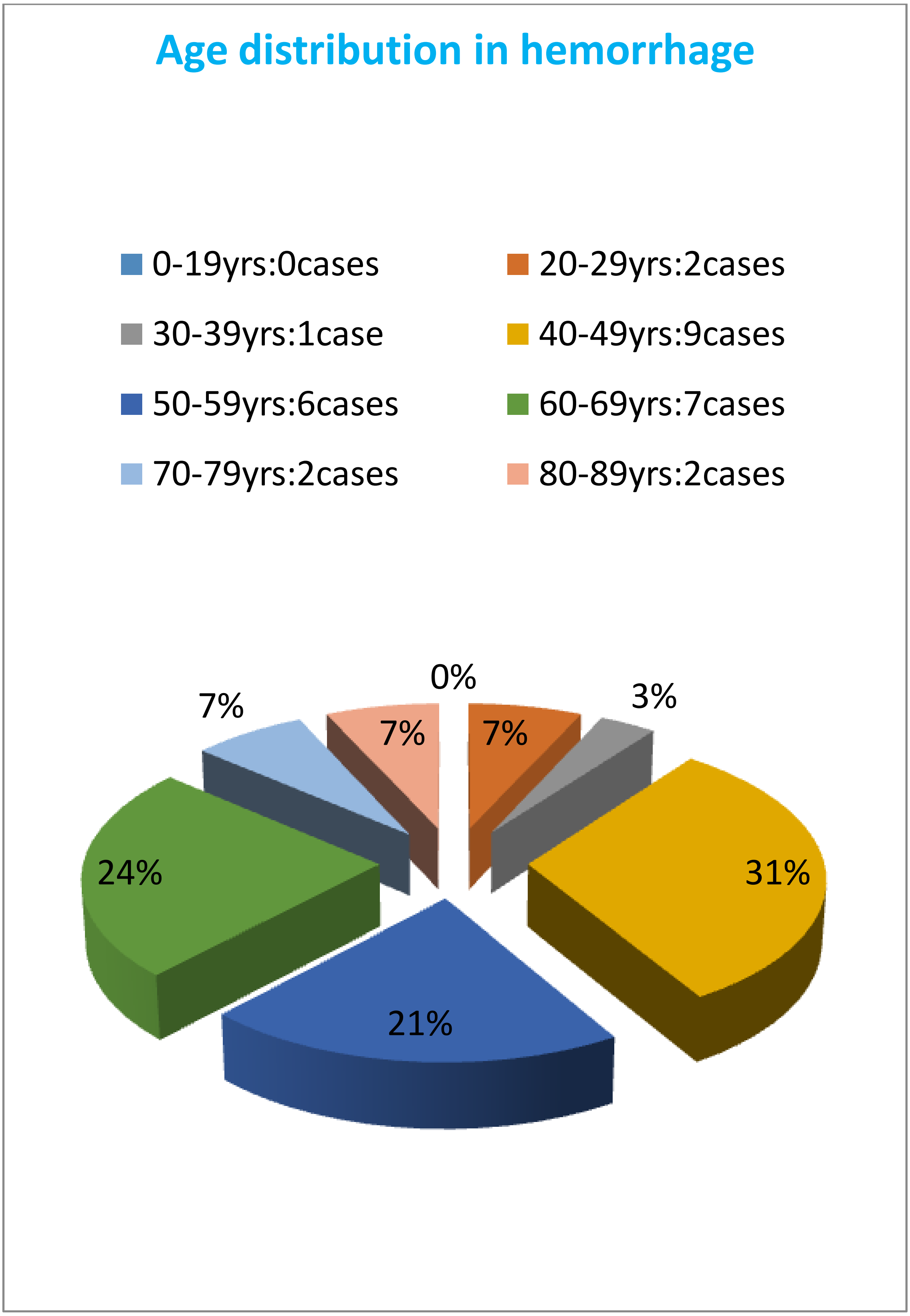
Age distribution in hemorrhage
0-19yrs:0cases
20-29yrs:2cases
30-39yrs:1case
40-49yrs:9cases
50-59yrs:6cases
60-69yrs:7cases
70-79yrs:2cases
80-89yrs:2cases
0%
7%
7%
3%
7%
31%
24%
21%

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AGE DISTRIBUTION IN INFARCT CASES:

Age	No of cases
0-19YRS	1- 2% OF CASES
20-29YRS	1- 2% OF CASES
30-39YRS	1- 2% OF CASES
40-49YRS	17- 34% OF CASES
50-59YRS	10- 20% OF CASES
60-69YRS	9- 18% OF CASES
70-79YRS	9- 18% OF CASES
80-89YRS	1- 2% OF CASES

AGE DISTRIBUTION IN HEMORRHAGE CASES:

Age	No of cases
0-19YRS	0
20-29YRS	2- 6% OF CASES
30-39YRS	1- 3% OF CASES
40-49YRS	9- 31% OF CASES
50-59YRS	6- 20% OF CASES
60-69YRS	7- 24% OF CASES
70-79YRS	2- 6% OF CASES
80-89YRS	2- 6% OF CASES

COMPARISON OF MALES AND FEMALES IN INFARCTS:

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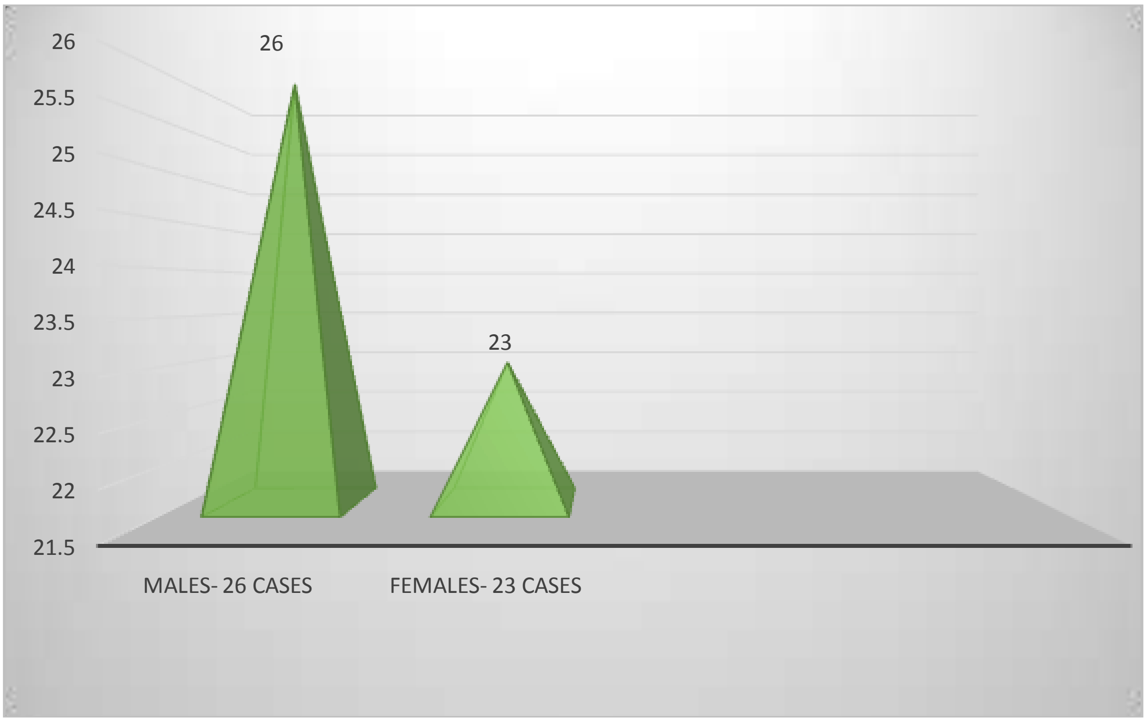
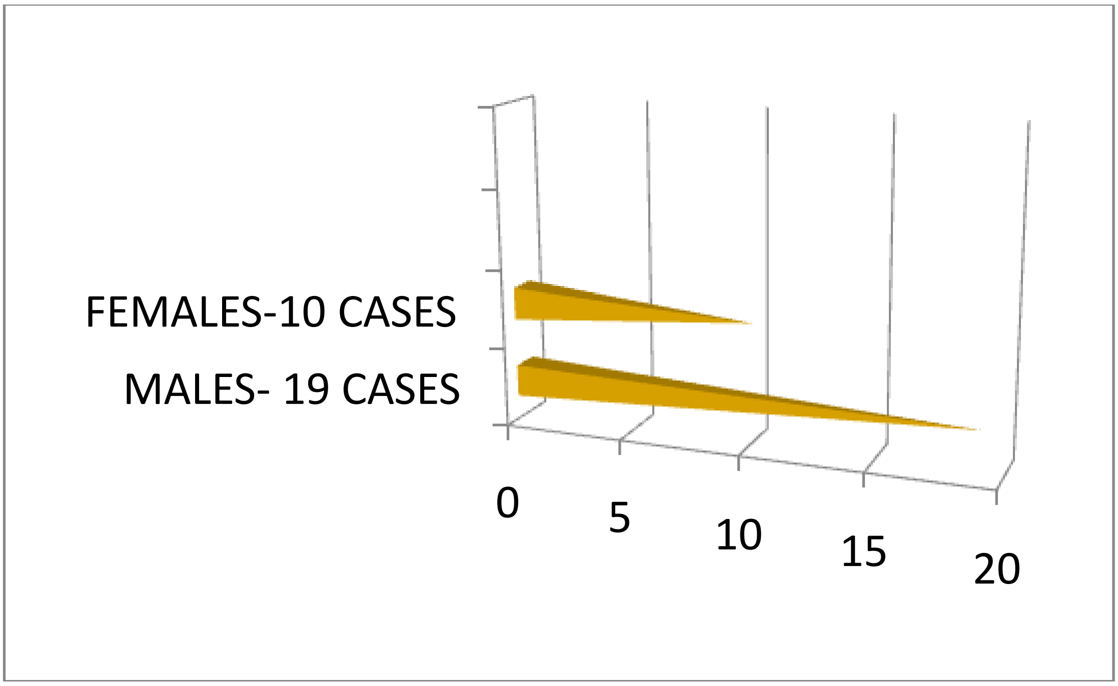


COMPARISON OF MALES AND FEMALES IN HEMORRHAGES:



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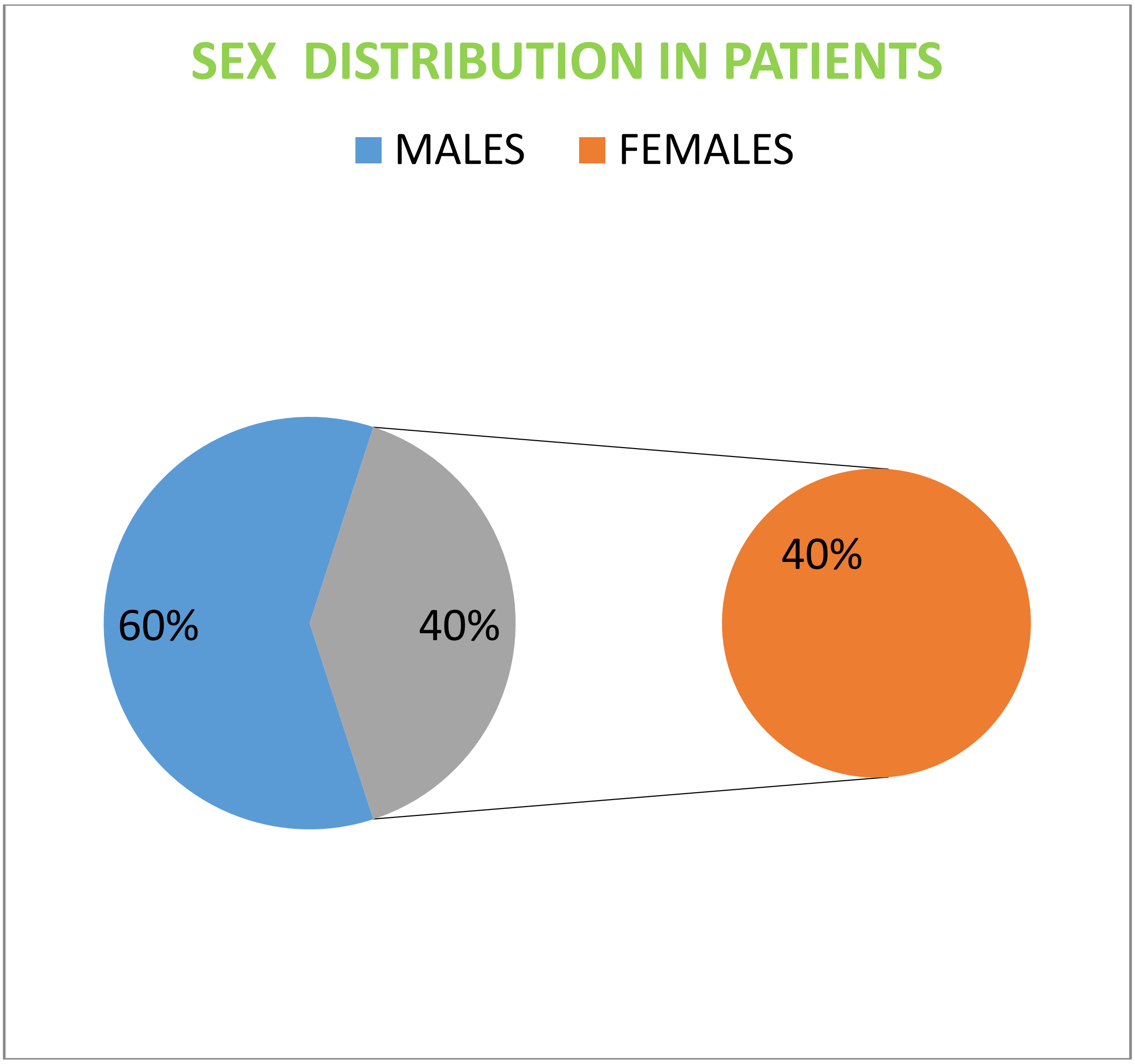

CT findings	Number of cases	Percentage among total number of cases	
SAH	7 cases	7% of cases	
NORMAL CT REPORT	9 cases	9% of cases	

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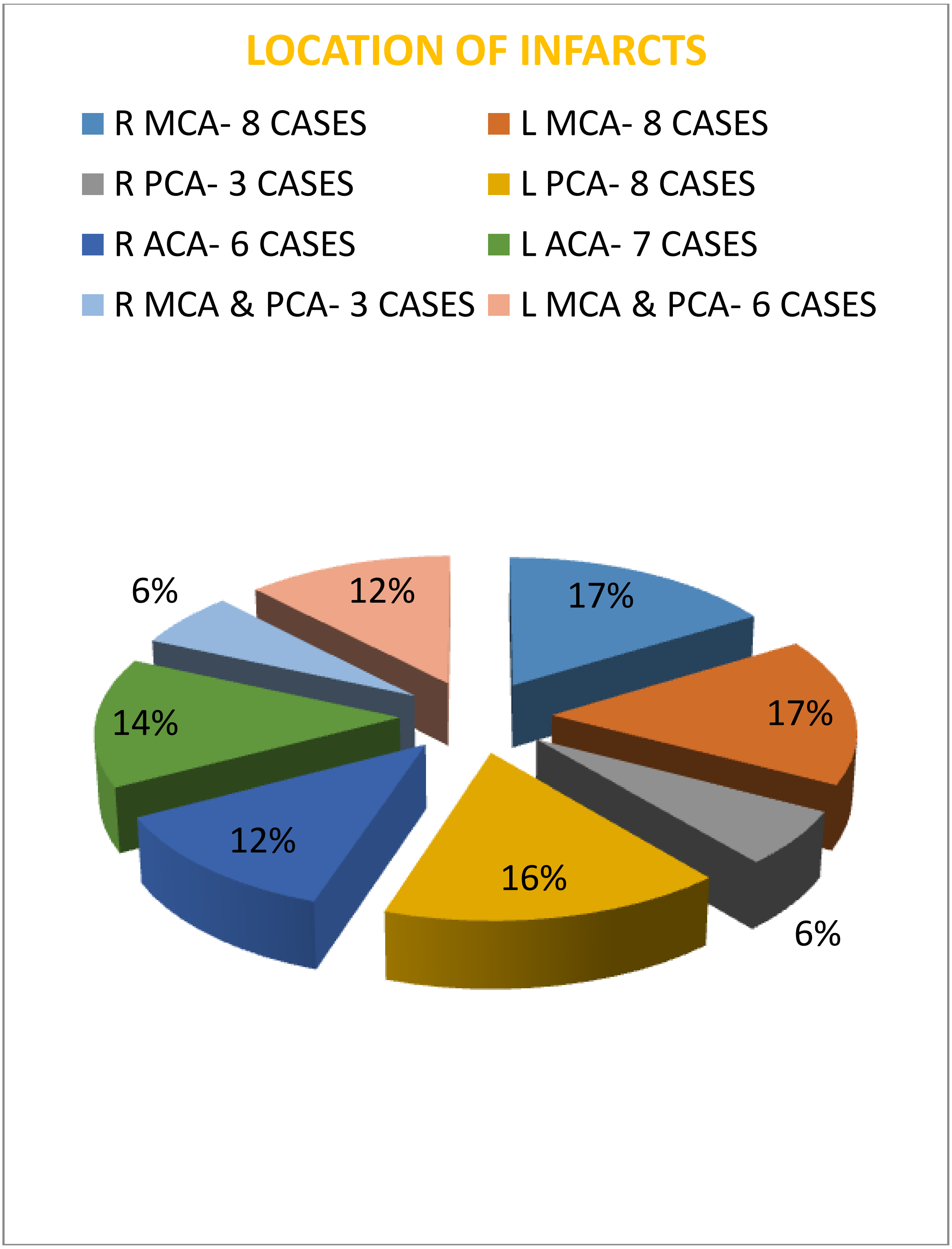

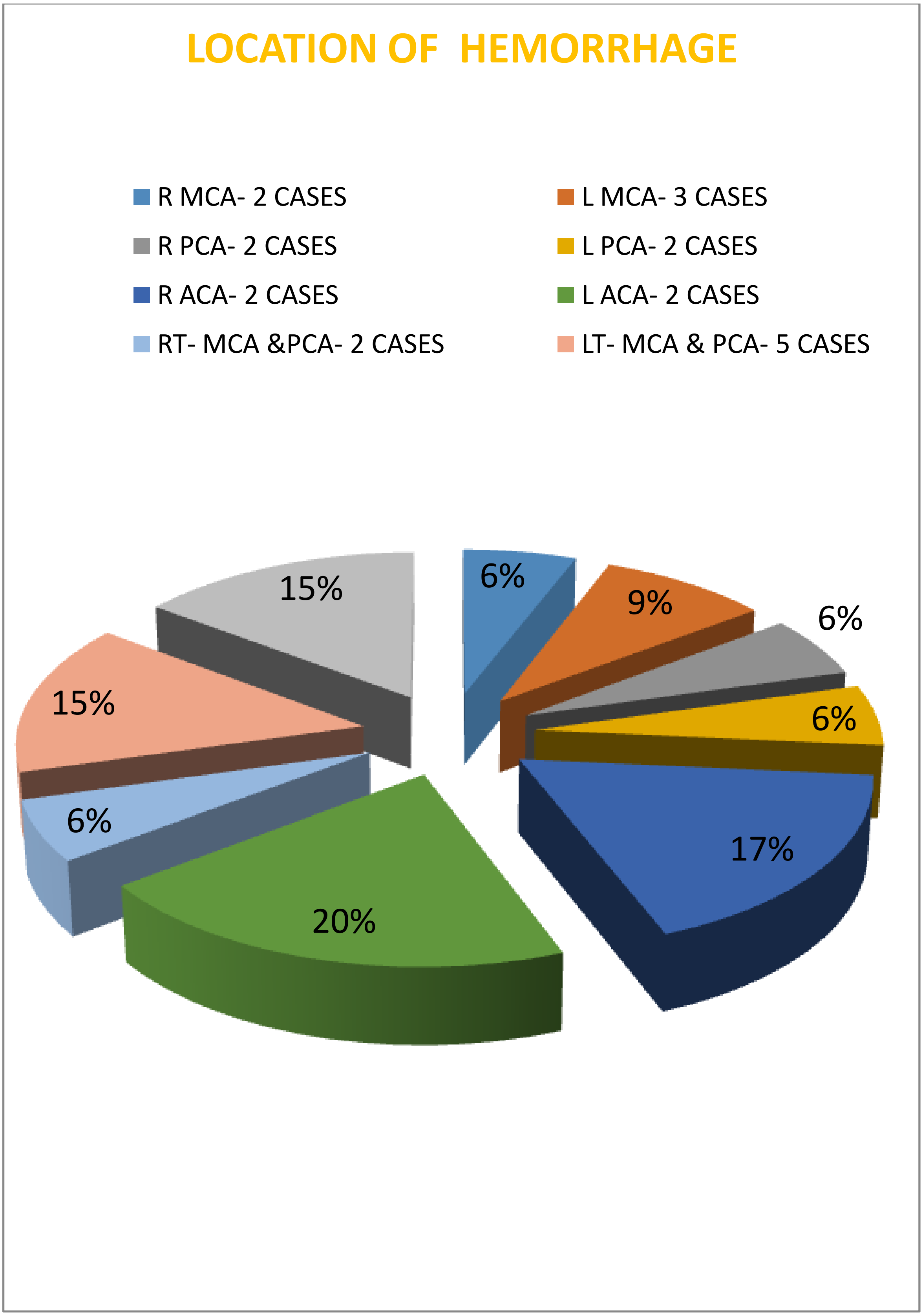
LOCATION OF HEMORRHAGE
R MCA- 2 CASES
L MCA- 3 CASES
R PCA- 2 CASES
L PCA- 2 CASES
R ACA- 2 CASES
L ACA- 2 CASES
RT- MCA &PCA- 2 CASES
LT- MCA & PCA- 5 CASES
6%
9%
6%
6%
17%
20%
6%
15%
15%

III. DISCUSSION:

Out of **100** patients clinically suspected of CVA submitted for CT scan study of brain, **49%** Patients had infarction, **29%** Patients had hemorrhage,**7%**Patients had SAH, **6%**Patients had cortical atrophy, **9%** Patients had normal study.

Age distribution in infarction- **2%**cases were seen in **0-9yrs**, **2%**cases were seen in **20-29yrs**,**2%**cases were seen in **30-39yrs,34%**cases were seen in **40-49yrs, 20%**cases were seen in **50-59yrs, 18%**seen in **60-69yrs** and **70-79yrs** each, **2%**seen in **80-89yrs** age groups

Age distribution in hemorrhage- **0%** cases were seen in **0-9yrs, 6%**cases were seen in **20-29yrs, 3%**cases were seen in **30-39yrs,31%**cases were seen in **40-49yrs, 20%**cases were seen in **50-59yrs, 24%**seen in **60-69yrs, 6%**in **70-79yrs** each, **6%**seen in **80-89yrs** age groups

Sex distribution shows **40%** female involvement and **60%** male involvement in overall CVA cases

Sex distribution in infarction: **53%** in males and **47%** in females

Sex distribution in hemorrhage: **65%** in males and **35%** in females

Location of infarction- R MCA-**16.3%**cases,L **MCA-16.3%** cases, R PCA- **6.1%** cases, L PCA- **16.3%** cases, R ACA- **12.2%** cases, L ACA-**14.2%** cases, R MCA &**PCA-6.1%** cases, L MCA & PCA-12.2% cases

Location of hemorrhage: R MCA-**6%**cases,L MCA-**10%** cases, R PCA- **6%** cases, L PCA- **6%** cases, R ACA- **20%** cases, L ACA-**21%** cases, R MCA & PCA-**6%** cases, L MCA & PCA-**17%** cases

SAH included **7%** cases and normal study included **9%** cases

IV. CONCLUSION:

- The following conclusions were made:
- 1. 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.
- 2. The results and factors obtained from our study correlates well with studies done in different parts of the world. 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.

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