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Original Research Article

Clinical and Imaging Profile of Ischemic Verses Hemorrhagic Stroke

Virendra C. Patil[1], Supriya Jatal[2], Amardip Rajput[2], Kushal Bangar[2]

[1]Associate Professor, [2]Resident,
Department of Medicine, Krishna Institute of Medical Sciences University (KIMSU), Dhebewadi Road, Karad Dist: Satara, Maharashtra, India.

Corresponding Author: Virendra C. Patil

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ABSTRACT

Background and Purpose: Limited data exist on the comparative recovery patterns and outcomes of patients with ischemic stroke (IS) and intracerebral hemorrhage (IH) in India. The goal of this study is to assess the specific influence of stroke etiology by neuro-imaging (hemorrhagic or non-hemorrhagic) on outcome of the patients.
Aims and Objectives: To study clinical profile, brain imaging and to compare outcome of ischemic and hemorrhagic stroke.
Materials & methods: Consecutive patients (aged >18 years) admitted to a hospital with a recent acute stroke due to ischemic stroke (IS) or hemorrhagic stroke (HS) were included during a one year (Jan 2013 to Dec 2013) period in tertiary care teaching hospital. This retrospective observational and non-interventional study was approved by ethical committee KIMSU Karad.
Results: Of total 298 patients with stroke, 259 (86.91%) had ischemic stroke (IS) and 39 (13.08%) had hemorrhagic stroke with predominance of ischemic stroke ['p' value <0.001 ratio of 6.64]. IS had mean age of 62±13 years and HS had mean age of 68±12 years. Total 173 (66.79%) male and 86 (33.20%) female had ischemic stroke with predominance of male population ['p' value <0.001]. Total 29 (74.35 %) male and 10 (25.64%) female had hemorrhagic stroke with predominance of male population ['p' value <0.001]. The mean duration of hospital stay was less in HS compared to IS. Total 134 (77.45%) male and 55 (63.95%) female had hypertension in patient with ischemic stroke. Total 29 (100%) male and 7 (70%) female had hypertension in patient with hemorrhagic stroke. Total 92 (53.17%) male and 22(25.58%) female had tobacco consumption in patient with IS. Total 17(58.62%) male and 7 (70%) female had tobacco consumption in patient with HS. Total 56(32.36%) male with IS and 7 (24.13%) male had alcohol consumption in patient with HS. Total 89 (51.44%) male and 29(33.72%) female had dyslipidemia among IS. Total 19 (65.51%) male and 6 (60%) female patient had dyslipidemia among HS. Total 45(26.01%) male and 32(37.20%) female had Diabetes among IS group. Total 12(41.37%) male and 5(50%) female had type 2 DM among HS group. Hypertension was the most prevalent risk factor among IS and HS in both the gender as a risk factor in present study ['p' < 0.002] and next was tobacco consumption. In both the genders basal ganglionic bleed was more common than other site [male 'p' <0.001; female: 0.007290358]. The MCA territory infarct was the most common vessel involved in ischemic stroke in both gender ('p' < 0.002; RR: 2.08; OR: 4.36 'p'=0.00605156; RR: 1.5; OR: 2.339). HS had more mortality compared to IS in present study (statistically insignificant with 'p' = 0.168; OR: 0.5320; RR: 0.5808).

Conclusions: Present study highlighted predominance of ischemic stroke and predominance of male population in both stroke. The mean duration of hospital stay was less in HS compared to IS. Hypertension was the most prevalent risk factor among both, IS and HS in both the gender as a risk factor and next was tobacco consumption. The basal ganglionic hypertensive bleed was common site of HS and thalamic bleed with interventricular extension was with 100% case fatality rate. The MCA territory infarct was the most common vessel involved in ischemic stroke in both gender and HS had more mortality compared to IS in present study.

Key words: Ischemic stroke (IS). Haemorrhagic stroke (HS), hypertension, neuro-imaging.

INTRODUCTION

Cerebrovascular accidents rank first in the frequency and importance among all neurological disease. Stroke is the second leading cause of mortality worldwide and remains the leading cause of adult physical disability. Like in many nations across the world, stroke is one of the leading causes of mortality and morbidity in India. The high incidence of stroke results in significant mortality and disability leading to immense health care costs. Strokes can be broadly classified as hemorrhagic or non-hemorrhagic. Intracerebral hemorrhage (ICH), classified as either primary or secondary, occurs in 10% to 15% of all strokes and is associated with a higher risk of fatality compared with cerebral infarction (CI). [1] Primary ICH, ranging from 78% to 88% of all hemorrhages, derives from the spontaneous rupture of small vessels damaged by chronic hypertension or amyloid angiopathy. Regarding recovery, it is generally believed that hemorrhagic stroke survivors have better neurological and functional prognoses than nonhemorrhagic stroke survivors, but currently available data do not definitively answer all questions. Comparisons between hemorrhagic (HS) and ischemic stroke (IS) in respect to prognostic determinants are hampered by the disproportionate distribution of the two types of stroke, with IS being 10-times more frequent than HS. Klaus Kaae Andersen Commonest cause of cerebral ischaemia and infarction are atherosclerosis with thromboembolism and cardiogenic thromboembolism. Even in large stroke cohorts absolute numbers of HS are low, rendering statistical validation of differences between the 2 types of stroke difficult. Hence, our knowledge of this issue is still incomplete. HS are considered to have a higher mortality risk than IS. [2] So far there are few hospital based published data of IS vs HS in Indian contest, this study was conducted to assess differences and similarities between patients with HS and IS with respect to risk factors, outcome, mortality and imaging profile.

MATERIALS & METHODS

Consecutive patients (aged >18 years) admitted to a hospital with a recent acute stroke due to ischemic stroke (IS) or hemorrhagic stroke (HS) were included during a one year (Jan 2013 to Dec 2013) period in Krishna institute of medical sciences Karad, a tertiary care teaching hospital. This retrospective observational and non-interventional study was approved by ethical committee KIMSU Karad.

Aims and Objectives: To study clinical profile, brain imaging and to compare outcome of ischemic and hemorrhagic stroke. Patients underwent assessments at baseline (done as soon as possible after notification) and at the time of discharge. Baseline information on demographics and medical history was obtained predominantly from medical records, whereas those

pertaining to functional outcome as measured by clinical neurological examination. The required investigations including neuro-imaging was done. The privacy and identity of patients was strictly protected. This was study was conducted at medicine wards and ICU's of KIMS Karad. This was time bound study of 1 year [include all patients with diagnosis of ischemic and hemorrhagic stroke.] consecutive patients (aged >18years) admitted to a KIMSU hospital with a recent acute stroke due to ischemic (IS) or hemorrhagic (ICH) stroke were included during a one year period. The end point of the study will be discharge/ recovery or death. A stroke is caused by the interruption of the blood supply to the brain, usually because a blood vessel bursts or is blocked by a clot. This cuts off the supply of oxygen and nutrients to the brain, causing damage to the brain tissue. The WHO clinically defines stroke as 'the rapid development of clinical signs and symptoms of a focal neurological disturbance lasting more than 24 hours or leading to death with no apparent cause other than vascular origin. [1] Distinction between IS and primary HS was determined after CT/MR scan. HS was considered without distinction between lobar and nonlobar hemorrhage. Hemorrhagic infarction was considered IS. *Stroke* was defined according to the WHO criteria. [2] Stroke is a clinical syndrome divided into two broad categories that define its pathophysiology: *Haemorrhagic strokes* are caused by subarachnoid haemorrhage – bleeding from one of the brain's arteries into the brain tissue or intra-cerebral haemorrhage - arterial bleeding in the space between meninges. *Ischemic stroke:* Ischaemic strokes are caused by sudden occlusion of arteries supplying the brain, either due to a thrombus at the site of occlusion or formed in another part of the circulation. Typical ischaemic stroke presents with the abrupt onset of a focal neurological deficit and is characterized by subsequent clinical course. Ischaemic stroke (IS) can be, reversible ischaemic neurological deficit (RIND); *Completed stroke*; Progressive stroke or stroke in evolution. *Thrombotic strokes* often present with stuttering, fluctuating symptoms that worsen over several minutes or hours. Thrombotic strokes occur without warning symptoms in 80-90% of patients and 10-20% is heralded by one or more transient Ischaemic attacks (TIA). *Embolic strokes* usually present with a neurologic deficit that is maximum at onset. Lacunar infarcts are small infarcts in deep white mater, usually due to hypertension induced Lipohyalinosis or arteriosclerosis of small perforating arteries. *Cardioembolic:* presence of potential cardiac sources of embolism as documented from the ECHO cardiograph. *Neuroradiological classifications* [1] From CT and/or MRI findings, patients' strokes were classified as ICH or IS. CT scans and MRI were read independently and blindly by 2 hospital radiologists. Results were compared. IS were classified, according to Bamford and coworkers, as total anterior circulation infarcts (ACA), partial anterior circulation infarcts, posterior circulation infarcts (PICA), and lacunar infarcts. ICH were divided into deep and lobar hemorrhages. Deep hemorrhages included putaminal and thalamic hemorrhages; lobar hemorrhages included frontal, parietal, temporal, and parieto-occipital bleedings. [1] *Hypertension:* diagnosed if known hypertensive on treatment or diagnosed at the time of admission (140/90 mmHg). *Atrial fibrillation* was diagnosed on ECG. Diabetes mellitus type -2 was diagnosed if known DM on treatment or diagnosed at the time of admission with or without HbA1C. *Tobacco consumption* in any form and *alcohol* intake was confirmed from history. *Dyslipidemia* was diagnosed according to

NCCP guidelines. *Statistical analysis:* Results were given as mean ± SD. Means are compared by unpaired Students *t*-test. Chi-square was used as appropriate. The observations and data were analyzed in the statistical package social sciences (SPSS) trial version 11. The level of significance was set at 'p' <0.05.

RESULTS

Total 298 patients were admitted with diagnosis of ischemic and hemorrhagic stroke, fulfilling inclusion criteria of stroke for present study admitted during one year period. Of total 298 patients with stroke, 259 (86.91%) had ischemic stroke (IS) and 39 (13.08%) had hemorrhagic stroke with predominance of ischemic stroke ['p' value <0.001 ratio of 6.64]. IS had mean age of 62±13 years and HS had mean age of 68±12 years with male to female ratio of 2.01:1in IS and 2.9:1 in HS. Total 173 (66.79%) male and 86 (33.20%) female had ischemic stroke with predominance of male population ['p' value <0.001] with mean duration of stay 13±5 days. Total 29 (74.35 %) male and 10 (25.64%) female had hemorrhagic stroke with predominance of male population ['p' value <0.001] with mean duration of stay 9±3 days. The mean duration of hospital stay was less in HS compared to IS. Total 134 (77.45%) male and 55 (63.95%) female had hypertension in patient with ischemic stroke. Total 29 (100%) male and 7 (70%) female had hypertension in patient with hemorrhagic stroke. Total 92 (53.17%) male and 22(25.58%) female had tobacco consumption in patient with IS. Total 17(58.62%) male and 7 (70%) female had tobacco consumption in patient with HS. Total 56(32.36%) male with IS and 7 (24.13%) male had alcohol consumption in patient with HS. There was no history of alcohol consumption in female population in both IS and HS. Total 19 (10.98%) male and 9(10.46%) females had atrial fibrillation in IS. Total 4(13.79%) male and 1(10%) females had atrial fibrillation in HS. Total 17 (9.82%) male and 7 (8.13%) female patient had history of previous stroke in IS group. Total 5(17.24%) and 1(10%) female had history of previous stroke. Total 89 (51.44%) male and 29(33.72%) female had dyslipidemia among IS. Total 19 (65.51%) male and 6 (60%) female patient had dyslipidemia among HS. Total 45(26.01%) male and 32(37.20%) female had Diabetes among IS group. Total 12(41.37%) male and 5(50%) female had type 2 DM among HS group. Hypertension was the most prevalent risk factor among IS and HS in both the gender as a risk factor in present study ['p' < 0.002] and next was tobacco consumption. [Table no. 1] Total 23(79.31%) male and 8(80%) female patient had Basal ganglionic bleed. [Figure no.1] Total 3(10.34%) male and 1(10%) female patient had thalamic bleed with interventricular extension with 100% mortality and case fatality rate. Total 2(6.89%) male and 1(10%) female patient had subarachnoid hemorrhage. One (3.44%) male patient had pontine hemorrhage. [Figure no.3] In both the genders Basal ganglionic bleed was more common than other site [male 'p' <0.001; female: 0.007290358]. [Graph no. 1] There was no statistically significant correlation for HS in genders ['p'= 0.962853274; RR: 0.99; OR: 0.9583]. [Table no. 2] Total 117(67.63%) male and 52(60.46%) female patient in IS had Middle cerebral artery (MCA) infarct. Total 37(21.38%) male and 27(31.39%) female patient in IS had posterior cerebral artery (PCA) infarct. Total 12(6.93%) male and 4(4.65%) female patient in IS had anterior cerebral artery (ACA) infarct. Total 7(4.04%) male and 3(3.48%) female patient in IS had posterior inferior cerebellar artery (PICA) infarct. The MCA territory infarct was the most common vessel involved in ischemic stroke in both gender ('p' < 0.002; RR: 2.08; OR: 4.36 'p'=0.00605156; RR:

1.5; OR: 2.339). [Table no.3] [Figure no. 1, 2] [Graph no. 2] Total 154(89.01%) male and 78(90.69%) female patient in IS and 24(82.75%) male and 8(80%) female patient in HS group were discharged after partial recovery. Total 19(10.98%) male and 8(9.30%) female patient in IS and 5(17.24%) male and 2(20%) female patient in HS group died due to cerebral edema, aspiration pneumonia and trastentorial herniation. HS had more mortality compared to IS in present study (statistically insignificant with 'p' = 0.168; OR: 0.5320; RR: 0.5808). [Table no. 4]

Table no. 1: Demographic and risk profile of patient with IS and HS

Variables	Ischemic stroke (n=259) 86.91%				Hemorrhagic stroke (n= 39) 13.08%			
	'p' value <0.001							
	Mean duration of stay 13±5 days				Mean duration of stay 9±3 days			
	Male (n=173) 66.79%	%	Female (n=86) 33.20%	%	Male (n=29) 74.35%	%	Female (n=10) 25.64%	%
	'p' value <0.001				'p' value <0.001			
Hypertension	134	77.45	55	63.95	29	100	7	70
Tobacco consumption	92	53.17	22	25.58	17	58.62	7	70
Alcohol consumption	56	32.36	0	0	7	24.13	0	0
Atrial fibrillation	19	10.98	9	10.46	4	13.79	1	10
Previous stroke	17	9.82	7	8.13	5	17.24	1	10
Hyperlipidemia	89	51.44	29	33.72	19	65.51	6	60
Diabetes	45	26.01	32	37.20	12	41.37	5	50

Table no.2: Neuro-imaging profile of hemorrhagic stroke

Variables	Hemorrhagic stroke (n= 39) 13.08%			
	Male (n=29)	%	Female (n=10)	%
Basal ganglionic bleed	23	79.31	8	80
Thalamic bleed	3	10.34	1	10
Subarachnoid hemorrhage	2	6.89	1	10
Pontine bleed	1	3.44	0	0
Total	29	100	10	100
'p' for BG bleed VS other site	'p' <0.001		0.007290358	
'p' for HS in male and female	'p'= 0.962853274;RR:0.99; OR:0.9583			

Table no.3: Neuro-imaging profile of ischemic stroke

Variables	Ischemic stroke (n=259) 86.91%			
	Male (n=173) 66.79%	%	Female (n=86) 33.20%	%
MCA territory infarct	117	67.63	52	60.46
PCA territory infarct	37	21.38	27	31.39
ACA territory infarct	12	6.93	4	4.65
PICA territory infarct	7	4.04	3	3.48
Total	173	100	86	100
'p' for MCA territory *vs* PCA and ACA territories	'p' < 0.002; RR: 2.08;OR: 4.36		'p'=0.00605156; RR:1.5; OR: 2.339	

Table no.4: Mortality and outcome of patients with IS and HS

Variables	Ischemic stroke (n=259) 86.91%				Hemorrhagic stroke (n= 39) 13.08%			
	Male (n=173) 66.79%	%	Female (n=86) 33.20%	%	Male (n=29) 74.35%	%	Female (n=10) 25.64%	%
Discharge	154	89.01	78	90.69	24	82.75	8	80
Death	19	10.98	8	9.30	5	17.24	2	20
IS/HS 'p' value	'p' =0.67684995; RR: 0.981; OR:8313				0.844594901; RR:1.05; OR:1.2			
'p' for mortality rate in IS/HS	0.168253409; OR: 0.5320; RR: 0.5808							

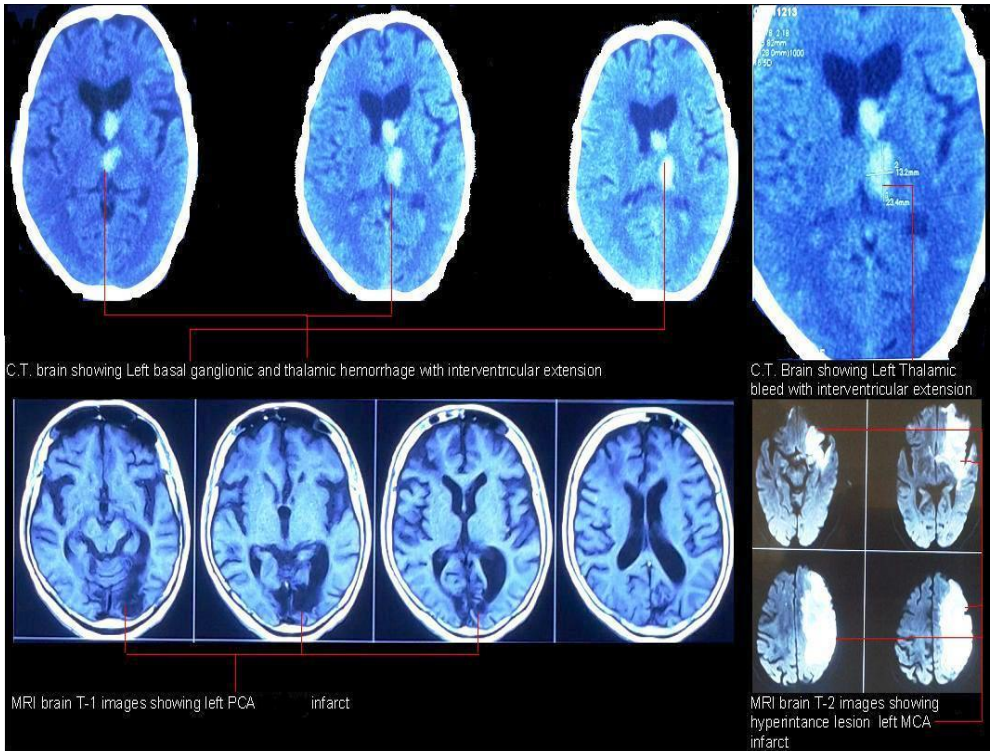


Figure no. 1: CT brain showing thalamic, basal ganglionic bleed, with MRI brain showing MCA and PCA territory infarct

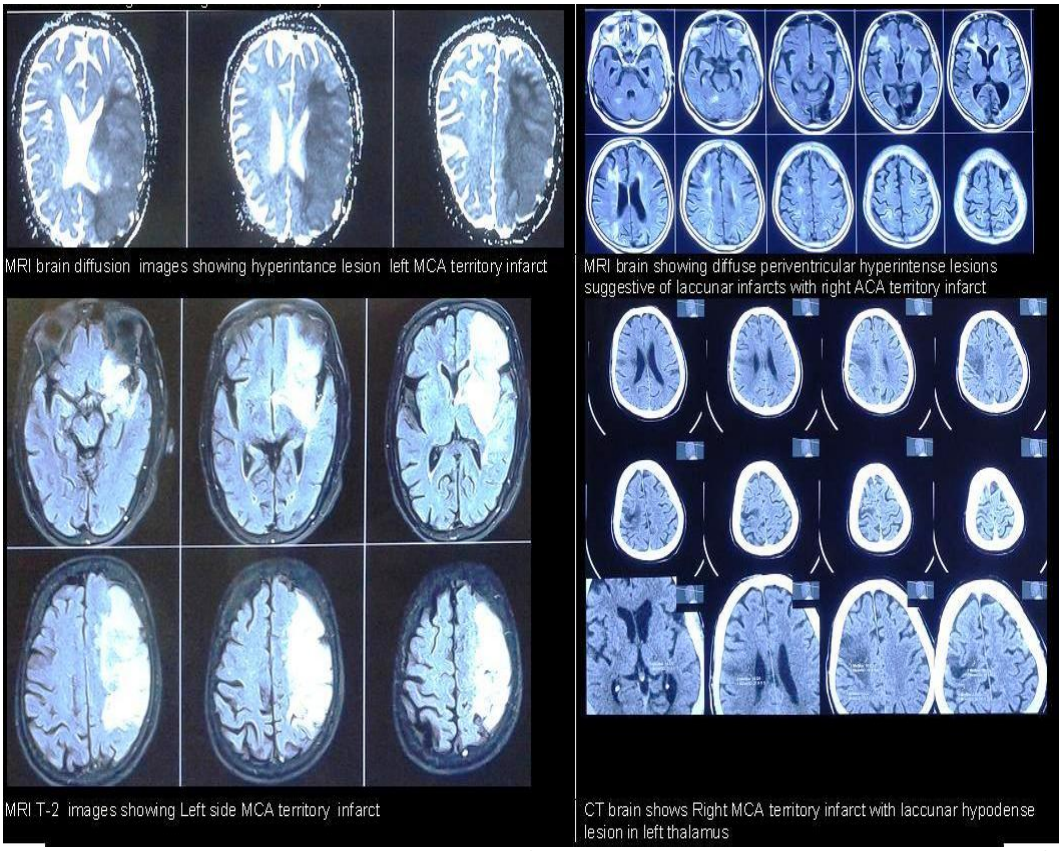


Figure no. 2: MRI brain showing MCA and PCA territory infarct with CT brain showing ACA MCA and thalamic infarct.

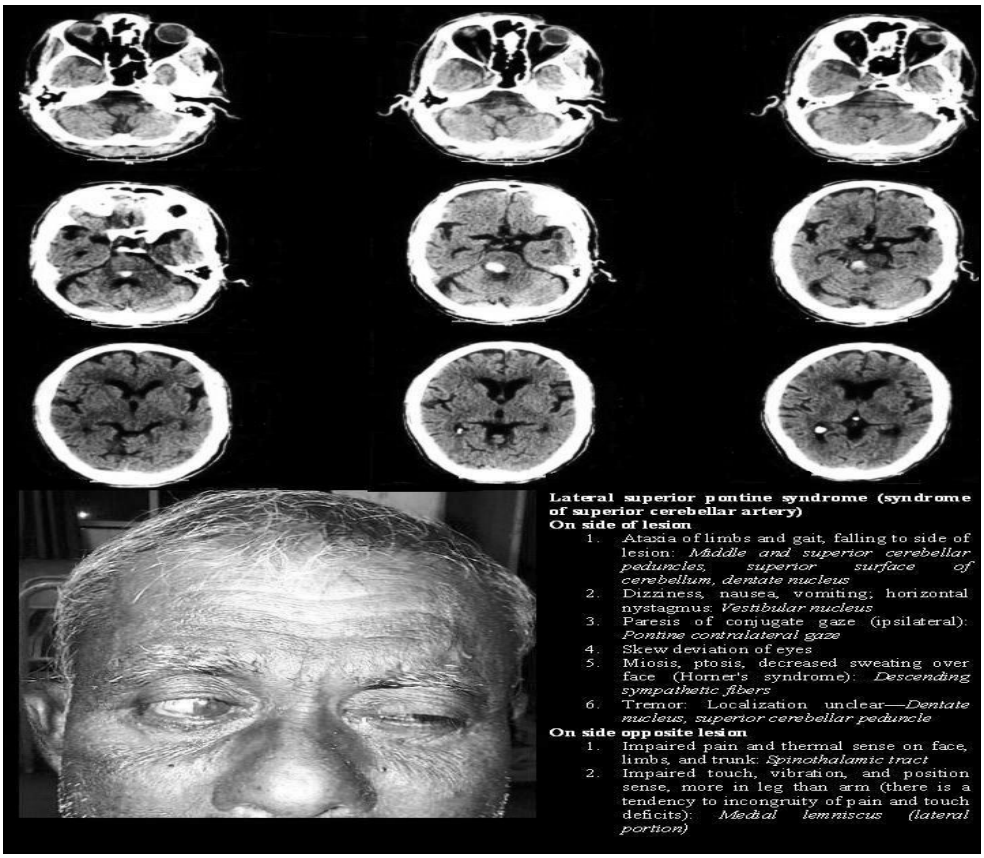
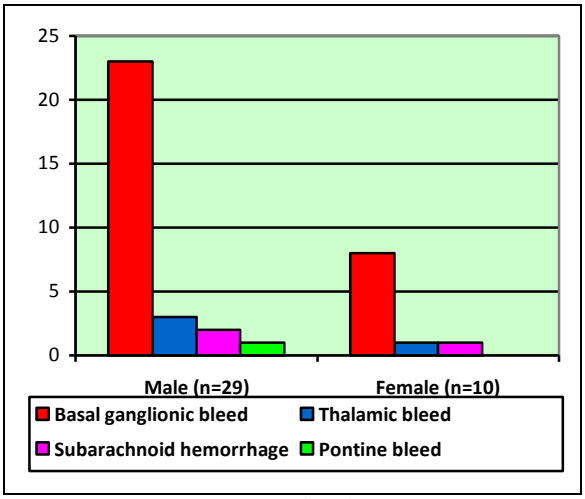


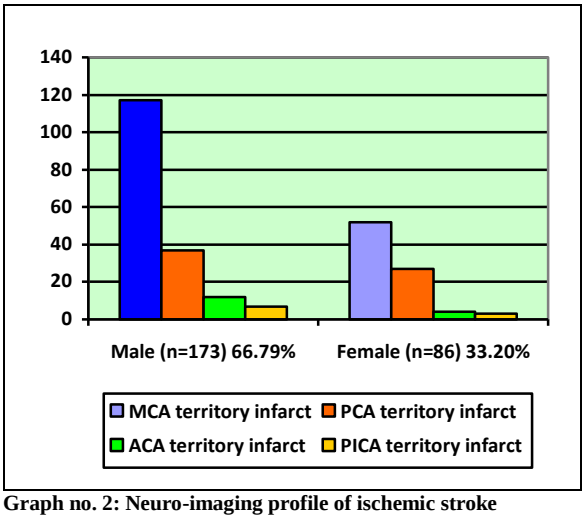
Figure no. 3: CT scan brain shows Pontine hemorrhage



Graph no. 1: Neuro-imaging profile of hemorrhagic stroke

DISCUSSION

This study presents an overview of the outcome and recovery patterns in hospitalized patients after acute stroke in KIMS Karad, Maharashtra, India. We compared our results with various studies from India and abroad.



Graph no. 2: Neuro-imaging profile of ischemic stroke

Jade W. Wei et al [3] in their 300 patients with stroke found that, patients with ischemic stroke were on average twice as

likely to experience a good outcome (OR: 1.98, CI: 1.76 to 2.24). Similarly in our study mortality in ischemic stroke was relatively less than hemorrhagic stroke, Total 154(89.01%) male and 78(90.69%) female patient in IS and 24(82.75%) male and 8(80%) female patient in HS group were discharged after partial recovery. Total 19(10.98%) male and 8(9.30%) female patient in IS and 5(17.24%) male and 2(20%) female patient in HS group died, additionally in present study significant mortality was found in patients with thalamic bleed with interventricular extension. Similar findings were reported by *Klaus Kaae Andersen et* al [2] were compared with ischemic strokes, HS was associated with an overall higher mortality risk (HR, 1.564; 95% CI, 1.441–1.696). Hemorrhagic Stroke is associated with a considerable increase of mortality. Ischemic stroke is 10-times more frequent than HS. In contrast to our findings, *Stefano Paolucci et al* [1] in their case-control study of 270 patients found that, the better functional prognosis in stroke survivors with hemorrhagic stroke. *Asad Mahmood et al* [4] in their 100 Patients with diagnosis of stroke comprising of ischaemic and haemorrhagic strokes with the mean age of 64.2±12 years with a male to female ratio of 3.6:1. Similarly in our study IS had mean age of 62±13 years and HS had mean age of 68±12 years with male to female ratio of 2.01:1in IS and 2.9:1 in HS. *Ivica Bilic et* al [5] studied, in their 1066 stroke patients found that, the Ischemic stroke patients had a higher prevalence of hypertension atherosclerotic diseases and atrial fibrillation (15.5% *vs.* 4.2%), than those with hemorrhagic stroke with fatal outcome was more common in the HS. These findings are comparable with our results. *HN Harsha Kumar et* al [6] reported 61 (56%) were ischemic stroke, 25 (22.9%) were hemorrhagic stroke and 23 (21.1%) were embolic stroke. Overall, there is male preponderance (74 out of 109) in all subtypes of stroke. Of total 298 patients with stroke, 259 (86.91%) had ischemic stroke (IS) and 39 (13.08%) had hemorrhagic stroke with predominance of ischemic stroke [‘p’ value <0.001]. Total 173 (66.79%) male and 86 (33.20%) female had ischemic stroke with predominance of male population [‘p’ value <0.001]. Total 29 (74.35 %) male and 10 (25.64%) female had hemorrhagic stroke with predominance of male population [‘p’ value <0.001].There were 76 (69.7%) smokers, 53 (48.6%) alcoholics, 59 (54.1%) diabetics and 79 (72.5%) hypertensives. These findings are comparable with our results. Hypertension was the most prevalent risk factor among IS and HS in both the gender as a risk factor in present study [‘p’ < 0.002] and next was tobacco consumption. Mortality was lower (8, 7.3%) than disability (60, 55%), and 41 (37.6%) had good outcome. Similarly in our study Total 154(89.01%) male and 78(90.69%) female patient in IS and 24(82.75%) male and 8(80%) female patient in HS group were discharged after partial recovery. Total 19(10.98%) male and 8(9.30%) female patient in IS and 5(17.24%) male and 2(20%) female patient in HS group died. *Shiber JR et* al [7] reported 41.9% hemorrhagic and 58.1% ischemic stroke. There were a much greater percentage of hemorrhagic strokes in this population than would have been predicted from previous studies. These findings are contradictory to our findings were ratio of IS to HS was 6.64:1 this could be due to differences in race and geographic factors. *Prasad K et* al [8] reported that, persistent neurological deficit more in patients with cerebral infarction from arterial lesions. Similarly *Kelly PJ et* al [9] reported that, patients with ICH had greater functional impairment than the cerebral infarction patients at admission, but made greater gains. Patients with the

most severely disabling ICH improved more than those with cerebral infarction of comparable severity. Similar to our results *Harsha Kumar H N et* al [6] quoted that, males, smoking and hypertension were have significant association with both IS and HS. *Katrak PH et al* [10] stated that, patients with ICH had a greater level of disability on admission to rehabilitation; they achieved significantly greater gains in function than patients with CI after rehabilitation. This was found regardless of the severity of disability on admission; these findings are comparable with our results. *M. Nasir Shamas et al* [11] reported hypertension, diabetes mellitus, age and lipid derangements levels and occurrence of acute ischaemic stroke similar to our results. The recovery were different by stroke type with patients with ICH [mean duration of stay 9±3 days] improving faster initially than patients with IS [mean duration of stay 13±5 days] finding consistent with existing literature. *Klaus Kaae Andersen et al* [2] stated that, HS are considered to have a higher mortality risk than IS, similarly in our study HS had relatively higher mortality than IS.

CONCLUSIONS

Present study highlighted predominance of ischemic stroke and predominance of male population in both stroke. The mean duration of hospital stay was less in HS compared to IS. Hypertension was the most prevalent risk factor among both, IS and HS in both the gender as a risk factor and next was tobacco consumption. The basal ganglionic hypertensive bleed was common site of HS and thalamic bleed with interventricular extension was with 100% case fatality rate. The MCA territory infarct was the most common vessel involved in ischemic stroke in both gender and HS had more mortality compared to IS in present study. Hypertension is the most common risk factor predisposing patients for all subtypes of ischemic and hemorrhagic stroke. Risk factors like hypertension, smoking, diabetes and alcohol consumption are common for both HS and IS. The ischemic stroke is a poly-etiologic disturbance, our study confirmed this statement Present study confirms the synergistic action of hypertension, diabetes and hyper-lipidemia predisposes patients for stroke. Stroke is relatively more severe in patients with HS, and is associated with a considerable increase of mortality, which is specifically associated thalamic hemorrhage with interventricular extension. Of the known controllable risk factors, hypertension and diabetes are most important. Since treatment measures for stroke are still rather limited, and knowing the high number of patients suffering stroke every year, it is important to be familiar with the stroke risk factor profile for each patient and its prevention. Timely identification and therapy for stroke risk factors, is the most efficacious method of stroke treatment. The individuals with a relatively high risk profile can take steps to modify other risk factors through lifestyle changes and medical treatment. Similarly, public awareness programs aimed at increasing the recognition of stroke warning signs and altering modifiable risk factors can be designed to address the high-risk groups. This study did not produce any new or surprising results, the value of small hospital-based studies suggest to strengthening the awareness of the important role of stroke prevention by reducing risk factors. Health care professionals can contribute to stroke prevention by promoting healthy lifestyle and avoiding known risk factors for stroke.

Limitations of study:

There are some limitations in our study. This was retrospective observational study and not all the patients underwent all the

investigations due to resource limitations, thereby making analysis and interpretations difficult. This was single centre study conducted at tertiary care center, the referred patients profiles may not be representative, creating a bias.

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