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**Original Research Article**

# Clinical study of acute stroke with special reference to Greek stroke scoring system

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## ABSTRACT

**Background:** Stroke is becoming an important cause of premature death and disability in low-income and middle-income countries like India, largely driven by demographic changes and enhanced by the increasing prevalence of the key modifiable risk factors. Rapid access to CT is virtually impossible for all patients with a cerebrovascular event especially in resource poor countries like ours. Aims and objectives of the study were to study the clinical characteristics of patients suffering from acute stroke and to study the efficacy of Greek stroke scoring system in differentiating acute intracerebral infarction and hemorrhagic stroke
**Methods:** Present study was carried out in 50 consecutive patients of stroke admitted to department of Medicine, Guru Nanak Dev Hospital (attached to Government Medical College), Amritsar, Punjab, India. It was a prospective, observational, hospital based study.
**Results:** Maximum number of stroke patients i.e. 36% were in the age group of 61-70 years. Mean±sd age for ischemic and hemorrhagic stroke was 67.9±11 and 57±9 years respectively. 36 patients (72%) had ischemic stroke and hemorrhagic stroke was seen in 14 patients (28%). Among the modifiable risk factors of stroke-hypertension was the most common (68% cases) followed by dyslipidemia (64%), DM (30%), chronic alcohol intake (28%). In the present study, Greek score had a high sensitivity (97%) and positive predictive value (97%) in diagnosing ischemic stroke. It also had excellent specificity (97%) and negative predictive value (97%) in diagnosing hemorrhagic stroke
**Conclusions:** Targeting the risk factors for preventing stroke in the first place will help in reducing burden of this often-disabling disease. The CT scan remains as a gold standard in differential diagnosis of stroke and Greek scoring system may be used as a guide in management only when resources are limited and CT scan facilities are not available.

**Keywords:** Clinical features, Clinical presentation, CT scan, Greek score, Hemorrhagic stroke, Ischemic stroke, Risk factors

## INTRODUCTION

Stroke is a global health problem. It is the second commonest cause of death and fourth leading cause of disability worldwide.[1] Approximately 20 million people each year will suffer from stroke and of these 5 million will not survive.[2] Stroke is no longer a disease of the developed world: Low and middle-income countries account for 85.5% of total stroke deaths worldwide and the number of disability-adjusted life years in these countries was approximately seven times that in high-income countries.[3]

In India, the estimated adjusted prevalence rate of stroke range, 84-262/100,000 in rural and 334-424/100,000 in urban areas.[4]

The term "stroke" should be broadly used to include all of the following:[5]

***CNS infarction***

CNS infarction is brain, spinal cord, or retinal cell death attributable to ischemia, based on 1. pathological, imaging, or other objective evidence of cerebral, spinal cord, or retinal focal ischemic injury in a defined vascular distribution; or 2. clinical evidence of cerebral, spinal cord, or retinal focal ischemic injury based on symptoms persisting ≥24 hours or until death, and other etiologies excluded.

***Ischemic stroke***

An episode of neurological dysfunction caused by focal cerebral, spinal, or retinal infarction. (Note: Evidence of CNS infarction is defined above. Definition of silent CNS infarction: Imaging or neuropathological evidence of CNS infarction, without a history of acute neurological dysfunction attributable to the lesion.

***Intracerebral hemorrhage***

Rapidly developing clinical signs of neurological dysfunction attributable to a focal collection of blood within the brain parenchyma or ventricular system that is not caused by trauma.

***Stroke not otherwise specified***

An episode of acute neurological dysfunction presumed to be caused by ischemia or hemorrhage, persisting ≥24 hours or until death, but without sufficient evidence to be classified as one of the above.

Diagnosis and onset of treatment has to be immediate because the tolerance of the brain tissue to ischaemia is lower than any other tissue. Optimal patients' management largely depends on whether the stroke is haemorrhagic or ischaemic. Because rapid access to CT is virtually impossible for all patients with a cerebrovascular event, several investigators have attempted to formulate scoring systems determining on the basis of clinical data the relative likelihood of infarction or haemorrhage as an aid to physicians involved in stroke management.

***Greek score***

Greek score proposed by a team from Athens claimed that the sensitivity, specificity, positive predictive value and negative predictive value were much better as compared to the previous scores.[6] Another validation and comparison study concluded that Greek score and Allen score have similar specificity in diagnosing hemorrhage but the latter can be calculated only at the end of 24 hours, hence Greek score is better than Allen's score.[7]

## METHODS

This was a prospective, observational and hospital based study which was conducted at Department of Medicine, Government Medical College, Amritsar, Punjab, India. Where total 50 patients of stroke were studied.

***Inclusion criteria***

- Patients presenting within 72 hours of onset of symptom
- Patients who are admitted to Guru Nanak Dev Hospital, attached to Government Medical College, Amritsar with acute onset of stroke

***Exclusion criteria***

- Age less than 40 years (stroke in young)
- Stroke due to tumors, trauma, infections
- Stroke due to bleeding diathesis, vasculitis
- Patient presenting after 72 hours of onset
- Pure subarachnoid hemorrhage

Patients fulfilling inclusion criteria and not having any of the above-mentioned exclusion criteria were enrolled. A written informed consent was taken from all patients for participation. The patients were assessed by thorough medical history, clinical examination and various routine and special investigations. For all patients who fulfil the inclusion and exclusion criteria the Greek score is calculated and later subjected to CT/MRI scan brain.

***Evaluation of Greek score***

Four independent correlates of intracerebral hemorrhage were identified in the Greek stroke scoring system. They were:

- Decreased level of consciousness (defined as a score less than 4 in the subscale of Glasgow coma scale regarding eye opening): If present-3 points and if absent-0 points.
- Neurological deterioration (ND) within 3 hours of admission: If present – 6 points and if no ND – 0 points. [ Neurological deterioration defined as: (a)Decline from an initial Glasgow coma scale of >12 by > or equal to 4 points and / or (b) New deficit i.e. not found at presentation.]
- Vomiting: If present-4 point and If absent – 0 points
- WBC count: if >12,000 cells/cu.mm - 4 points and if <12,000 cells/cu.mm-0 points.

These points were added up to calculate the Greek score.

***Interpretation of score***

Less than or equal to 3: Infarct; between 4-10: Equivocal; greater than or equal to 11: Intracerebral haemorrhage

Overall neurological status and Glasgow coma scale were assessed at admission and at 3 hours. Patient data was analysed using paired student's t test. The p value of <0.05 was considered significant and p value <0.001 was considered highly significant. Sensitivity, specificity, positive predictive value, negative predictive value and measures of central tendency were applied to the data collected.

## RESULTS

The following observations were made in this prospective, observational, hospital based study involving 50 patients who presented with stroke in the department of Medicine, Guru Nanak Dev Hospital, Amritsar, Punjab, India.

Maximum number of patients i.e. 36% (18 subjects) were in the age group of 61-70 years followed by 20% patients (10 subjects) in age group of 51-60 years. Mean age was 64.92 with minimum age as 45 years and maximum age as 85 years. In present study, there was marginal male predominance - 54% were males and 46% were females.

**Table 1: Age and sex wise distribution of stroke patients.**

| Age (years) | Male | Female | Total | Percent |
|---|---|---|---|---|
| 41 - 50 | 5 | 4 | 9 | 18 |
| 51 - 60 | 7 | 3 | 10 | 20 |
| 61 - 70 | 9 | 9 | 18 | 36 |
| 71 - 80 | 3 | 6 | 9 | 18 |
| 81 - 90 | 3 | 1 | 4 | 8 |
| Total | 27 (54%) | 23 (46%) | 50 | 100 |

**Table 2: Distribution of ischemic and hemorrhagic infarct.**

| Stroke Type | Total | Percent |
|---|---|---|
| Ischemic | 36 | 72 |
| Haemorrhagic | 14 | 28 |
| Total | 50 | 100 |

In the present study 72% (36 subjects) suffered from ischemic stroke and hemorrhagic stroke was seen in 28% (14 subjects).

**Table 3: Distribution of ischemic and hemorrhagic infarct with reference to sex.**

| Stroke type | Male | | Female | | Total | Percent |
|---|---|---|---|---|---|---|
| | Number | Percentage | Number | Percentage | | |
| Ischemic | 18 | 50 | 18 | 50 | 36 | 72 |
| Haemorrhagic | 9 | 64.28 | 5 | 35.71 | 14 | 28 |
| Total | 27 (54%) | | 23 (46%) | | 50 | 100 |

In the ischemic stroke group, 18 patients were male and 18 patients were female.

Among the hemorrhagic stroke patients there were 9 males (64.28%) and 5 females (35.71%). Overall out of the total 50 patients, 27 were male (54%) and 23 were female (46%).

**Table 4: Age and sex distribution in ischemic stroke patients.**

| Age (years) | Male | Female | Total |
|---|---|---|---|
| 41-50 | 2 | 1 | 3 (8.3%) |
| 51-60 | 5 | 3 | 8 (22.2%) |
| 61-70 | 6 | 7 | 13 (36.1%) |
| 71-80 | 2 | 6 | 8 (22.2%) |
| 81-90 | 3 | 1 | 4 (11.1%) |
| Total | 18 | 18 | 36 (100%) |

Age: Mean±SD= 67.9±11 years

From the above its clear that maximum numbers of ischemic stroke patients were in age group 61-70 years i.e.13 subjects (36.1%) and least number of patients were in age group 41-50 i.e. 3 subjects (8.3%).

**Table 5: Age and sex distribution in hemorrhagic stroke patients.**

| Age group | Male | Female | Total |
|---|---|---|---|
| 41-50 | 3 | 3 | 6 (42.8%) |
| 51-60 | 2 | 0 | 2 (1.4%) |
| 61-70 | 3 | 2 | 5 (35.7%) |
| 71-80 | 1 | 0 | 1 (0.7%) |
| 81-90 | 0 | 0 | Nil |
| Total | 9 | 5 | 14 (100%) |

Age: Mean±SD= 57±9 years

In haemorhrgic stroke patients maximum number of patients were seen in age group 41-50 years (42.8%), followed closely by age group 61-70 years in which there were 35.7% cases.

Most common risk factors observed were hypertension and dyslipidemia which were seen in 68% and 64% subjects respectively. Other common risk factors were diabetes mellitus, chronic alcohol intake, history of cardiovascular system disease or TIA/ stroke, smoking and atrial fibrillation.

**Table 6: Risk factor profile of stroke patients.**

| Risk factors | Number of patients | Percentage |
|---|---|---|
| Dyslipidemia | 32 | 64 |
| Hypertension | 34 | 68 |
| Smoking | 7 | 14 |
| Diabetes mellitus | 15 | 30 |
| Alcoholic | 14 | 28 |
| H/o CVS disease | 13 | 26 |
| H/o TIA or stroke | 5 | 10 |
| Atrial fibrillation | 3 | 6 |

**Table 7: Association of risk factors with type of stroke.**

| Risk factor | Ischemic stroke | | Hemorrhagic stroke | | P-value |
|---|---|---|---|---|---|
| | NO. | % | NO | % | |
| Dyslipidemia | 29 | 80.5 | 3 | 21.4 | <0.001 |
| HTN | 23 | 64 | 11 | 78.5 | n.s |
| Smoking | 4 | 11 | 3 | 21.4 | n.s |
| DM | 12 | 33.3 | 3 | 21.4 | n.s |
| Alcohol | 5 | 13.8 | 9 | 64.2 | <0.001 |
| H/o CVS disease | 12 | 33.3 | 1 | 7 | n.s |
| H/o TIA/ stroke | 5 | 13.8 | NIL | NIL | n.s |
| AF | 3 | 8.3 | NIL | NIL | n.s |

In the present study, dyslipidemia is the most common risk factor in ischemic stroke patients (seen in 80.5% subjects) followed by hypertension seen in 64% subjects. On the other side in hemorrhagic stroke patients, hypertension is the commonest risk factor seen in 78.5% of patients followed by history of chronic alcohol intake which was seen in 64.2%. P-value was highly significant ($p<0.001$) in dyslipidemia as a risk factor in ischemic stroke patients as compared to patients with hemorrhagic stroke. P-value was highly significant ($p<0.001$) in chronic alcohol intake as a risk factor in hemorrhagic group.

**Table 8: Pattern of clinical presentations.**

| Clinical presentation | Number of patient | Percentage |
|---|---|---|
| Headache | 21 | 42 |
| Vomiting | 13 | 26 |
| Convulsion | 2 | 4 |
| Altered sensorium | 20 | 40 |
| Motor weakness | 44 | 88 |
| Sensory symptoms | 8 | 16 |
| Speech difficulty | 19 | 38 |

Motor weakness was present in 88% of patients. Headache and vomiting was seen in 42% and 26% respectively. Speech difficulty was seen in 38% of subjects whereas altered sensorium was seen in 40% case. Least common was convulsions, seen in 4% cases.

**Table 9: Association of clinical presentation with type of stroke.**

| Clinical presentation | Ischemic stroke (n = 36) | | Hemorrhagic stroke (n = 14) | | P- value |
|---|---|---|---|---|---|
| | Number | Percentage | Number | Percentage | |
| Headache | 12 | 33.33 | 9 | 64.28 | <0.05 |
| Vomiting | 4 | 11.11 | 9 | 64.28 | <0.001 |
| Convulsion | 1 | 2.77 | 1 | 7.14 | N.s |
| Altered sensorium | 7 | 19.44 | 13 | 92.85 | <0.001 |
| Motor weakness | 33 | 91.66 | 11 | 78.57 | N.s |
| Sensory symptoms | 7 | 19.44 | 1 | 7.14 | N.s |
| Speech difficulty | 16 | 44.44 | 3 | 21.42 | N.s |

**Table 10: Pattern of clinical examination findings.**

| Clinical features | No. of patients (n = 50) | Percent |
|---|---|---|
| Dysarthria | 8 | 16 |
| Aphasia | 11 | 22 |
| Cranial nerve- 7 palsy | 22 | 44 |
| Cranial nerve- 9,10 palsy | 1 | 2 |
| Right hemiparesis | 23 | 46 |
| Left hemiparesis | 19 | 38 |
| Monoparesis | 2 | 4 |

In this study p-value was highly significant (<0.001) with vomiting and altered sensorium as a presenting feature in hemorrhagic stroke patients. P- value was significant (<0.05) with headache as presenting feature in hemorrhagic stroke.

When clinically examined, right hemiparesis (in 46% cases) was more common than left hemiparesis (38% cases). Among cranial nerve lesions facial nerve palsy was most common (44% subjects). Aphasia and dysarthria was seen in 22% and 16% cases respectively. Monoparesis was present in 4% cases while cranial nerve 9 & 10 involvement was seen in only 2% subjects.

As a total of 8 patients (16%) fall in the category of equivocal, meaning it was not certain to label the cases as hemorrhagic or ischemic stroke, further analysis was based on only 42 (84%) cases.

**Table 11: Comparison of Greek stroke score with CT scan.**

| Greek score | Patients | | Infarct in CT scan | Haemorrhage in CT scan |
|---|---|---|---|---|
| | Number | % | | |
| 0-3 (infarct) | 34 | 68 | 33 | 1 |
| 4-10 (equivocal) | 8 | 16 | 2 | 6 |
| >11 (haemorrhage) | 8 | 16 | 1 | 7 |

**Table 12: Sensitivity, specificity, positive predictive value and negative predictive value of Greek scoring system for diagnosing stroke.**

| Type of Stroke | Sensitivity | Specificity | +ve predictive value | -ve predictive value |
|---|---|---|---|---|
| Ischemic | 97 % | 87.5 % | 97 % | 87.5 % |
| Hemorrhagic | 87.5 % | 97 % | 87.5 % | 97 % |

## DISCUSSION

### *Age distribution of patients*

The mean age of the patients in this study was 64.92 years which was comparable to most of the Asian studies (65.9%yrs-Mumtaz Ali et al, 58.27years- Naik et al).[8-9] Majority of patients were seen in age group of 61-70 years i.e. 36% patients. Age is the important non-modifiable risk factor. It is well established that the greater the age, greater the risk for ischemic stroke.[10]

Maximum numbers of ischemic stroke patients were in age group 61-70 yrs i.e.13 subjects (36%) and least number of patients were in age group 41-50 i.e. 3 subjects (8.3%). In hemorrhagic stroke patients, maximum number of patients were seen in age group 41-50 years i.e. 6 subjects (42.8%), followed closely by age group 61-70 years in which there were 5 subjects (35.7%). Hence it was observed that below 50 years of age ICH was more common than cerebral ischemia. Mean age for ischemic stroke was 67.9 years and for hemorrhagic stroke it was 57 years.

### *Sex distribution of patients*

In present study, there was marginal male predominance - 54% were males and 46% were females with male to female ratio of 1.17:1. This was not statistically significant. Similar trend was seen in study by Abu Naser et al.11 in which male to female ratio was 1.35:1. Incidence of stroke was more common in male sex. Similarly, in studies by Eapen et al and Baidya et al there was male predominance in stroke.[12,13]

Ratio of male is to female among ischemic stroke patients was seen at 1:1 and among hemorrhagic stroke patients the ratio was 1.8:1. This study agrees with Sotaniemi et al and Vila and Irimia that ischaemic CVD was more predominant in both sexes but it was discovered that haemorrhagic CVD had a much higher predominance in men.[14,15] This implies that gender variation has relatively no role in incidence of ischaemic stroke, or that males tend to suffer more from factors that predispose to haemorrhage.

### *Type of stroke*

Out of total 50 subjects 36 patients (72%) had ischemic stroke, out of these affected – 18 (50%) were males and 18(50%) were females. Hemorrhagic stroke was seen in 14 patients (28%) comprising of 9 males (64.28%) and 5 females (35.7%).

This is nearly comparable with the study done by Vaidya C et al16 who found clinical diagnoses of infarction in 74.8% of cases and Sotaniemi KA et al who found 66.2% infarcts and 33.8% hemorrhages.[14]

### *Risk factor profile in stroke patients*

In the present study hypertension was the most common risk factor at 68% (n=32). The result correlates with that of a study in the urban population of Calcutta where hypertension was found to be the most important risk factor.[17] In a study in Himachal Pradesh by Mahajan et al hypertension was found in 62% and in a Pakistan study it was seen in 68% cases.[8,18]

In present study, the frequency of dyslipidemia in patients with stroke was found to be 64% (n=32). This incidence is very high compared to any other studies. This may be due to dietary habits e.g. desi ghee is widely used in this region. Most of our patients were not on statins at the time of admission. Most of the previous studies has taken 240mg/dl as the cut off value for total

cholesterol. In this study, it is taken as 200mg/dl. This may be one reason for higher incidence. Moreover, instead of fasting lipid profile, blood sample at the time of admission was sent for lipid analysis.

Dyslipidemia was seen in 80.5% patients with ischemic stroke and 21.4% patients with hemorrhagic stroke. P-value was highly significant (p<0.001) in dyslipidemia as a risk factor in ischemic group as compared to ICH group. This finding is in accordance with study conducted by Bharosay, Anuradha et al where mean value for serum TC, LDL-C, TG was found to be high and mean value for serum HDL was found to be less in ischemic stroke patients as compared to hemorrhagic stroke.[19]

Diabetes mellitus has long been recognized as a risk factor for vascular disease. It doubles the risk of stroke compared with non-diabetics. In this study diabetes appears to be associated with stroke in about 30% people. 10-14% cases of stroke are attributable to diabetes was found in Framingham study. The higher prevalence seen in our study may be due to higher prevalence of diabetes in Punjab from where most of the population under study hails.[20] The data is in agreement with several other Indian studies.[21]

Fourteen (28%) patients were found to be alcoholic. For cerebral infarction, chronic heavy drinking and acute intoxication have been associated with an increased risk among young adults. 112 in older adult's risk is increased among heavy-drinking men. Some studies have supported a J-shaped dose-response curve between alcohol intake and ischemic stroke risk, with protection for those drinking up to 2 drinks per day and an increased risk for those drinking >5 drinks per day compared with non-drinkers.[22] The deleterious effects of alcohol for stroke may occur through various mechanisms, including increasing hypertension, hypercoagulable states, and cardiac arrhythmias and reducing cerebral blood flow. The limitation of the study was that the daily quantity and the type of alcohol could not be specified.

Alcohol as a risk factor was seen in 13.8% subjects among ischemic stroke patients as compared to 64.2% subjects in hemorrhagic stroke patients. P-value was highly significant (p<0.001) in chronic alcohol history as a risk factor in hemorrhagic group. This is in accordance with the study conducted by Goldman MR et al which showed alcohol abuse more in hemorrhagic stroke.[23]

Thirteen (26%) patients had concomitant cardio vascular diseases and 6% patients had atrial fibrillation (AF) which acted as the potential source of cerebral embolism. In Mahajan et al study, AF was present in 6%.[14,18] It is estimated that approximately 20% ischemic strokes are cardioembolic. So it is obvious from this study that any finding suggestive of underlying heart disease in a patient of stroke should raise the suspicion of ischemic stroke. Similar trend was seen in study by Misbach and Wendra in which ischemic heart disease was seen in 19.9% subjects.[24]

Smoking does not appear to be an important risk factor for ischemic stroke in this study. Only seven patients (14%) out of total 50 with stroke were smokers. This study does not correlate with Donnan et al, who found smoking as a strong risk factor for cerebral infarction.[25] The lesser incidence of smoking appears to be related to the predominant religion of Sikhism in the state of Punjab, India.

In this study 10% patients had previous history of stroke or transient ischemic attack (TIA). History of previous stroke was present in 10% in Mahajan et al18 and 16.6% in Kora SA et al.[26] Actually TIA is a major risk factor for disabling stroke, implying a 13-fold increased risk of stroke in the next one year.[27]

In the present study, dyslipidemia was the most common risk factor in cerebral ischemia patients seen in 80.5% of ischemic stroke patients followed by hypertension seen in 64%. On the other side in hemorrhagic stroke patients, hypertension was the commonest risk factor seen in 78.5% of patients with intracerebral hemorrhage followed by history of chronic alcohol intake which was seen in 64.2%.

***Clinical features in patients with stroke***

In our study, most common clinical presentation was motor weakness (88%) followed by headache (42%), speech involvement (38%), altered sensorium (40%). Similar trend was seen in the study by Baidya et al in which (80%) hemiplegia, (60%) speech involvement, and (54%) altered sensorium was noted.[13] Altered sensorium was present in 19.1% of patients with ischemic stroke as compared to 92.8% patients with hemorrhagic stroke and it was statistically highly significant (p<0.001).

In the present study, headache was present in 42% of the cases, which is comparable to the studies of Foulkes et al27 who reported headache in 41% of cases. Headache was more common in ICH patients (64.28%) as compared to ischemic stroke patients (33.33%) and the result was significant (p<0.05).

Vomiting was present in 26% of present patients with 11.1% of subjects of ischemic stroke and 64.2% of subjects with ICH. This result was highly significant (p<0.001). Similar result was also seen in another study by EL Tallawy HN et al.[19]

Convulsions in the present series were present only in 4% of the total patients, which is comparable to that of Mohr et al and Foulkes et al, who reported frequency of 7% and 9% respectively.[27,28] On clinical examination right hemiparesis was seen in 23 cases (46%), left hemiparesis in 19 cases (38%), facial nerve palsy was seen in 44%, aphasia and dysarthria in 22% and 16% respectively,

monoparesis in 4% and cranial nerve 9,10 were involved in one patient (2%).

***Comparison of Greek stroke score with CT scan***

Proper stroke management depends on the distinction between ICH and CIF. Whilst CT imaging remains the golden standard for differential diagnosis, availability of this important diagnostic tool is not always feasible. Clinical stroke score can help in this direction.

Classification of the 50 stroke patients by using Greek score diagnosis into ischemic stroke, hemorrhagic stroke or equivocal was done. As a total of 8 (16%) fall in the category of equivocal, meaning it was not certain to label the cases as hemorrhagic or ischemic stroke, further analysis was based on only 42 (84%) cases. From the total 14 patients who were diagnosed to have hemorrhagic stroke by CT scan only 7 (50%) were diagnosed correctly by the Greek Stroke Score and 36 of those who were diagnosed as having ischemic stroke on CT scan, 33 (91.6%) were correctly diagnosed by the Greek Score to have ischemic stroke.

From the total 42 patients who were included in the analysis, 8 had hemorrhagic stroke giving a proportion of 19.0%. Sensitivity of the Greek Score to diagnose hemorrhage is calculated to be 87.5% and the specificity is 97%. For ischemic stroke these values were 97% and 87.5% respectively. Positive and negative predictive values were also calculated. A positive predictive value for hemorrhage (true positive) is 87.5% and the negative predictive value for hemorrhage (true negative) 97%.

In this study, for hemorrhagic stroke the sensitivity (87.5 vs 97%), positive predictive value (87.5vs.97%) are inferior and specificity (97 vs 99%), negative predictive values (97 vs 99%) calculated are comparable to the original Greek study. This study yielded a proportion of uncertain cases relatively higher than the Greek study (16% vs. 7.8%). Another study by Goswami RP et al produced similar results with sensitivity and specificity of 80.2% and 99.22% for diagnosing hemorrhagic stroke; 78.4% and 98.59% for ischemic stroke.[29]

In the present study, Greek score had an high sensitivity and positive predictive value in diagnosing ischemic stroke. It also had excellent specificity and negative predictive value in diagnosing hemorrhagic stroke. Using Greek score a large number of ischemic stroke patients could be diagnosed at bedside (91.66%). A substantial number of patients may be started with anti-platelet therapy while awaiting CT scan of brain.

It is being suggested that these scoring systems should be used as "rule-out" measures rather than "rule-in" measures for methodical evaluation of stroke patients. Indeed, for the majority of our patients, thrombolytics are not a therapeutic option, either due to logistic or financial reasons. Using a score that could exclude intracranial hemorrhage with a reasonable degree of medical certainty would encourage physicians in remote areas to initiate an early aspirin therapy.

The CT scan remains as a gold standard in differential diagnosis of stroke and Greek scoring system may be used as a guide in management only when resources are limited and CT scan facilities are not available. As our study had a small cohort more studies are required with large sample of patients to further validate this score.

## CONCLUSION

Maximum number of stroke patients were in the age group of 61-70 years showing that greater the age, greater the risk for stroke. Mean+SD age was 64.92±11.6 years. Mean+sd age for ischemic stroke was 67.9±11 years and for hemorrhagic stroke it was 57±9 years. In our study, overall there was marginal male predominance with male to female ratio of 1.17:1. This was not statistically significant. Ratio of male is to female among ischemic stroke patients was seen at 1:1 and among hemorrhagic stroke patients the ratio was 1.8:1, showing that hemorrhagic stroke had a higher predominance in men. Among the strokes more common etiology was ischemia which comprised 72% of patients followed by hemorrhagic stroke which was seen in 28% patients.

It was observed that in this study population among all the modifiable risk factors of stroke, hypertension was the most common (68% cases) followed by dyslipidemia (64%), DM (30%), chronic alcohol intake (28%), history of cardiovascular system disease (26%). In ischemic stroke patients, dyslipidemia is the most common risk factor followed by hypertension. On the other side in hemorrhagic stroke patients, hypertension is the commonest risk factor seen followed by history of chronic alcohol intake.

Vomiting was more common in ICH patients as compared to ischemic stroke patients and the result was highly significant ($p<0.001$). Headache was more common in ICH patients as compared to ischemic stroke patients and the result was significant ($p<0.05$). In the present study, Greek score had an high sensitivity (97%) and positive predictive value (97%) in diagnosing ischemic stroke. It also had excellent specificity (97%) and negative predictive value (97%) in diagnosing hemorrhagic stroke. Using Greek score a large number of ischemic stroke patients could be diagnosed at bedside (91.66%). A substantial number of patients may be started with anti-platelet therapy while awaiting CT scan of brain.

The CT scan remains as a gold standard in differential diagnosis of stroke and Greek scoring system may be used as a guide in management only when resources are limited and CT scan facilities are not available. As our study had a small cohort more studies are required with large sample of patients to further validate this score.

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