"BLOOD UREA NITROGEN/CREATININE RATIO AND URINE SPECIFIC GRAVITY IN ACUTE ISCHEMIC STROKE PATIENTS AS A PREDICTOR OF EARLY NEUROLOGICAL DETERIORATION-ONE YEAR HOSPITAL BASED CROSS SECTIONAL STUDY."

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ENDORSEMENT

This is to certify that the dissertation entitled **"BLOOD UREA NITROGEN/CREATININE RATIO AND URINE SPECIFIC GRAVITY IN ACUTE ISCHEMIC STROKE PATIENTS AS A PREDICTOR OF EARLY NUEROLOGICAL DETERIORATION"** is a bonafide research work done by **(REG NO: BG0117002).**

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LIST OF ABBREVIATIONS

Glossary	Abbreviations
DALY	Disability adjusted life years
IS	Ischemic Stroke
HS	Hemorrhagic stroke
ICMR	Indian council of medical research
NIHSS	National institute of health stroke scale
CT	Computerised tomography
TPA	Tissue plasminogen activator
END	Early neurological deterioration
SIE	Stroke in evolution
HT	Hemorrhagic transformation
MRS	Modified rankin scale
DM	Diabetes mellitus
HDL	High density lipoprotrein
VTE	Venous thromboembolism
ICU	Intensive care unit
ROC	Reciever operating curve
CI	Confidence interval
BP	Blood pressure
MmHg	Millimetres of mercury
Mg/dl	Milligram per decilitre

ABSTRACT

TITLE: Blood urea nitrogen/Creatinine ratio and Urine specific gravity in Acute ischemic stroke patients as a predictor of early neurological deterioration- One-year hospital based cross sectional study

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' (WHO 2005).

Stroke has two main subtypes: Ischemic and Hemorrhagic stroke.

An ischemic stroke may result in dysphagia which impairs fluid intake leading to dehydration. Acute stroke individuals with dysphagia are at higher risk for dehydration.Patients with stroke associated with dehydration are at increased risk of early neurological damage. Early neurological deterioration occurs in about 20 to 40% of these patients and results in functional disability and mortality Usually they exhibit elevated BUN/Creatinine and Urine specific gravity (biomarker for hydration status), acute stroke patients in a volume contracted status demonstrate worse short-term outcomes compared to euvolemic patients, independent of infarct size.

Early neurological deterioration is defined as worsening of neurological condition as indicated by an increase in NIHSS score by 3 or more points within first 3 days. Early identification of dehydration is essential for timely intervention to improve outcome of stroke in evolution patients.

Blood urea nitrogen to Creatinine ratio (BUN/Cr) and Urine specific gravity are frequently used in subjects with cerebral infarction as a measurement of renal

function and by various studies has shown BUN/creatinine ratio and USG are both used in the prediction of ill outcomes in individuals with stroke.

The effect of dehydration at presentation on the risk and outcome of ischemic stroke has been evaluated using Blood urea nitrogen (BUN) and urine specific gravity Bun/creatinine ratio and urine specific gravity as a laboratory investigation on day 1,2,3 is used for measurement of hydration status in our study.

Methods and materials:

60patients admitted in the Wards and ICU of General medicine and Neuromedicine at KLES Dr.Prabhakar kore hospital, Belagavi (Karnataka) with Acute ischemic stroke within 24 hours of onset above 18 years

NCCT/MRI head was done. National institute health stroke scale (NIHSS) was calculated on the day of admission and worsening is seen based on NIHSS score increment of ≥ 3 points.

Parameters like blood urea/creatinine ratio and urine specific gravity was repeated for 3 continuous days and at the time of discharge

Results

In our present study, out of 60 patients admitted with 1st episode of acute ischemic stroke various demographic like age, sex, clinical parameters neurological signs, habits, co-morbid condition like hypertension and coronary artery disease and laboratory parameters were compared with NIHSS score

In our study group we did not found any correlation with day wise estimation BUN/creatinine ratio and urine specific gravity with early neurological deterioration

Discussion:

We did not find any significant correlation between urine specific gravity and BUN/creatinine ratio although some authors have found Urine specific gravity and BUN/Creatinine as an independent predictors for END in acute ischemic stroke patients this was in sharp contrast with our study of 60 patients which can be attributed to small sample size and various demographic conditions like age, sex, habits, co morbid conditions.

Conclusions: On comparing different lab parameters like urea, creatinine, BUN/Creatinine ratio and Urine specific Gravity with NIHSS scoring did not have significant correlation as far as patient outcome was concerned**.**

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INTRODUCTION:

Patients presenting with Acute ischemic stroke exhibit Early neurological deterioration (END) which results in increased mortality and functional disability. It has been established in recent studies that relative dehydration is associated with END in such patients.[1] Many stroke patients appear to be clinically dehydrated with laboratory markers depicting dehydration at the time of hospital presentation, which could lead to an increase in blood viscosity and alteration in cerebral perfusion. Impaired cerebral perfusion can cause hemispheric dysfunction, which can be rapidly quantified with bedside tests of hemispatial neglect.[2] It has been acknowledged that hydration status at the time of stroke is an important determinant in early stroke recovery. But it is challenging to accurately diagnose dehydration or volume-contracted state at the time of stroke as currently there are no consensus diagnostic criteria. [3]

Despite of widespread consensus regarding treatment of dehydration, a consensus for clinical diagnosis can only be made biochemically rather than relying upon clinical signs and symptoms. Biochemical markers in blood (i.e., osmolality and blood urea nitrogen/creatinine) and in urine (i.e., osmolality and specific gravity), blood pressure assessment and clinical symptoms in the eye (i.e., tear production and palpitating pressure) and the mouth (i.e., thirst and mucous wetness) can help in diagnosing dehydration.[4] Even if venous thromboembolism (VTE) has frequent relation with dehydration, the influence of dehydration on VTE in acute ischemic stroke (AIS) is unclear. [5] Hydration status is associated with the development of collateral flow after acute MCA occlusion thus early hydration therapy could be important for acute stroke management.[6]

The most common age group for strokes is elderly due to water balance disturbances. Considerable variation in water homeostasis occurs in stroke, in the form of over-hydration and other underhydration. Initial dehydration causes hyperosmolarity secondary to an inadequate water intake due to drowsiness or dysphagia, a reduction in thirst, or the presence of infection which leads to a rise in hematocrit and a reduction in blood pressure, which can worsen the ischemic process during stroke and also predispose to recurrence of stroke. Hemodilution also has an effect on cerebral blood flow and cerebral hemodynamics by altering plasma viscosity. [7]

Adequate hydration is important in general for everyone, more so in people who are hospitalized with illness. An ischemic stroke may result in dysphagia which impairs fluid intake leading to dehydration. [8] Acute stroke individuals with dysphagia are at higher risk for dehydration. Usually they exhibit elevated BUN/Cr (biomarker for hydration status) compared to non-dysphagia cases during acute care. [9] Acute stroke patients in a volume contracted status demonstrate worse short-term outcomes compared to euvolemic patients, independent of infarct size. Clinical diagnosis of dehydration can only be made biochemically and blood urea nitrogen-to-creatinine ratio (BUN/Cr) is a biomarker of hydration status.[10] Urine specific gravity is another indicator of hydration status which can be more easily obtained, and also an independent predictor of early deterioration or stroke-in-evolution.[11]

In an observational study conducted K Bhatia et al observed “Various parameters comprising demographic, clinical, laboratory and radiological variables along with stroke severity to assess predictors of early neurological deterioration (END). BUN/creatinine >15 and USG >1.010 were studied as markers of relative

dehydration contributing to END. Amongst markers of relative dehydration, BUN/creatinine >15 at admission was found to be an independent risk factor for END, as also USG >1.010.[1]" Dehydration is associated with early neurological deterioration, worse discharge outcome and higher admission costs in acute ischemic stroke

Need of the study

There have been tremendous efforts in the research for drug therapies and management of acute stroke but no standard treatment has been found to be effective in acute stroke. With the advent of Stroke Units to manage and mitigate the disability in the outcome of acute stroke through coordinated rehabilitation, new interest is being focused towards limiting acute neurological deterioration. As a standard practice, most of the stroke units monitor and attempt to stabilize acute physiological parameters such as temperature, hydration status, blood pressure, glucose levels and oxygen saturations. It has been observed that by correcting these parameters one can potentially try to decrease neuronal damage in the acute phase of stroke and subsequently enhance functional outcome and survival.[7] On studies conducted on patients with acute infarction due to occlusion of the middle cerebral artery, hydration status is associated with the development of collateral flow after acute MCA occlusion. [6] As dehydration is a pretty treatable physiological parameter, the use of BUN/creatinine >15 as a marker of relative dehydration, can be helpful in detecting patients with dehydration early and thus play a role in preventing END.[1] The other independent maker for dehydration is urine specific gravity and USG>1.010 for dehydration. A cross-sectional study of these two parameters on hospitalized acute stroke patients would be helpful in predicting early neurological deterioration.

AIMS AND OBJECTIVES:

- To find relationship between Blood urea nitrogen/Creatinine ratio and urine specific gravity as a measure of dehydration to predict outcome in acute ischemic stroke patients.

REVIEW OF LITERATURE:

Global burden of stroke

Stroke was the second most common cause of mortality in 2013 (11.8% of all deaths) worldwide, after ischemic heart disease (14.8% of all deaths), and the third most common cause of disability (4.5%) of DALYs from all causes after ischemic heart disease (6.1%). Eastern European countries and Russia had the highest stroke DALYs and mortality rates.[12]

Stroke mortality and DALYs rates have declined to 110/100,000 person-years (95% UI, 102–122) and 1807 person-years (95% UI, 1667–1992) in 2013. Feign et al reported that " the number of people who died from stroke, remained physically disabled from stroke (as measured by DALYs), affected by stroke (as measured by incidence of new strokes), or survived stroke has increased statistically significant (1.4- to 1.8-folds for IS and 1.2- to 1.9-folds for HS). Globally, in 2013 there were almost 25.7 million stroke survivors (71% with IS), 6.5 million deaths from stroke (51% died from IS), 113 million DALYs due to stroke (58% due to IS), and 10.3 million new strokes (67% IS)." The upsurge in prevalence modifiable stroke risk factors along with aging, improved stroke care, and growth of the population are likely to be the main factors in the raised number of stroke survivors.[13]

The GBD 2013 Study recognized significant disparities in stroke burden between males and females, with males having consistently increased incidence of IS than women (133/100,000 person-years [95% UI, 125–143] and 99/100,000 person-years [95% UI, 92–107], respectively). The number of prevalent and incident strokes was significantly greater in 2013 compared with 1990 for both males and females.

The risk and absolute number of IS and HS events in 2013 were significantly greater in men than in women, suggesting variations in the sex distribution burden of stroke globally [14]

Indian stroke burden

In developed countries, stroke was the 1st major cause for disability, 2nd leading cause of dementia and 3rd leading cause of death. Epilepsy, falls and depression were observed among people in developed countries in which Stroke remained to be a predisposing factor. Stroke has now extended to low and middle-income countries accounting for 85.5% of total stroke mortality worldwide and the number of disability-adjusted life years in these countries was approximately 7 times that in developed countries .[15]

In India prevalence of stroke is 90-222 per 100,000. There are 102, 620 million deaths reported by ICMR. WHO estimated the incidence of stroke to be 1.44-1.64 million cases every year and 6,398,000 Disability Adjusted Life Years. 12% of strokes were observed in the population aged less than 40 years.[16] The Global Burden of Disease Study projects that "mortality from stroke in India will trump established market economies by 2020".[17]

Among the elderly, stroke prevalence in rural India was 1.1% and urban India was 1.9%. Prevalence of stroke increases as age increases and decreases with the education levels. Recent evidence suggests that seventy two percent of stroke survivors in rural India have severe disability and unmet needs for stroke care.[18]

Types of strokes

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' (WHO 2005).[19] Stroke is a clinical syndrome and basically, it is divided into two types:

Ischemic strokes are "strokes which 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. Globally they account for 50%–85% of strokes" .[20]

Brain tissue ceases to function if deprived of oxygen, and after approximately three hours will suffer irreversible injury possibly leading to the death of the tissue, i.e., infarction.[21]

Hemorrhagic strokes can be subarachnoid hemorrhage caused by bleeding from one of the brain's arteries into the brain tissue or intra-cerebral hemorrhage which causes arterial bleeding in the space between meninges and accounts for 1%-7% and 7%-27% respectively.[20] Some causes of hemorrhagic stroke are hypertensive hemorrhage, ruptured aneurysm, ruptured AV fistula, transformation of prior ischemic infarction, and drug induced bleeding.[22]

Site and severity of brain injury are the important components on which stroke depends. Sudden death is caused by a severe stroke. Sudden weakness or numbness of the face, arm or leg, most often on one side of the body are the most common symptoms of a stroke. Other symptoms include: dizziness, loss of balance or coordination, confusion, severe headache with no known cause difficulty seeing with

one or both eyes, difficulty walking, difficulty speaking or understanding speech; fainting or unconsciousness.[19]

Risk factors for stroke.

Patients with first stroke event, particularly evaluating the stroke risk based on combination of risk factors, is an important factor of primary care. There are two types of risk factors non modifiable and modifiable risk factors.[23]

Nonmodifiable risk factors

Age – Aged people are more prone to stroke. As age increases the stroke incidence increases and after 55 years of age incidence doubles for every decade. Gender to stroke risk relationship depends on age. Higher risk of stroke was observed in women at young ages and increased risk for men at older ages.[24]

Racial disparities Stroke has well-documented racial disparities. Kissela BM reported that "Blacks are at twice the risk of stroke when compared with their white counterparts and have higher death rates associated with stroke. Hispanic/Latino Americans also have an increased risk of stroke in some cohorts." Furthermore, American Indians have an more incidence of stroke compared with non-Hispanic whites.[25]Other factors that determine racial-ethnic differences are social determinants of disease, nativity and language.[26]

Genetic factors family history and parental history upsurges the risk for stroke. The genetic risks factors of stroke differ by age, gender and race.[27]

Modifiable risk factors

Hypertension

A linear, direct, strong, and continuous relationship exists between hypertension and stroke. It is the most imperative risk factor for stroke.Ezzati et al reported that "intraindividual variability in BP measurements, or differences in BP measures taken at various points in time within a patient, are associated with more stroke risk than elevated mean blood pressure alone."[28]

Diabetes mellitus

Diabetes mellitus has 2-fold elevated risk for stroke and an independent risk factor of stroke. stroke accounts for twenty percent of deaths in diabetic patients. Prediabetics have also marked up risk for stroke.[29]

Atrial fibrillation

The patients with atrial fibrillation have stasis of blood in the fibrillating left atrium causing thrombus formation and embolization to the brain. left atrial dysfunction in AF, is another marker of stroke. The risk of AF is further increased, with stroke by autonomic derangements and a post stroke inflammation.[30]

Dyslipidemia

The relationship between dyslipidemia and stroke is complicated, with an increased risk for ischemic stroke with increased total cholesterol and minimal risk with elevated high-density lipoprotein cholesterol.[31]

Sedentary Behavior, Diet/Nutrition, Obesity, and Metabolic Syndrome

Physical inactivity leads to many bad health effects, like stroke. Physically active people have a decreased risk of stroke mortality. physical activity is associated with decrease in hypertension, reduction in glucose levels, and decreased obesity.[32]

Diet has a major influence on stroke and other stroke risk factors, such as diabetes mellitus, hypertension, and dyslipidemia. Some distinct components of nutrition such as Salt intake, is associated with an elevated blood pressure and stroke risk, whereas raised potassium intake of foods is associated with reduced stroke.[33] Stroke risk is reduced with diet high in fruits and vegetables or a Mediterranean diet.[34]

Obesity and Body weight are important risk factors, although the specific ways in which they elevate the stroke is ambiguous. Obesity is related to stroke risk factors such as hypertension and diabetes mellitus.[35]

Metabolic syndrome comprises of hypertension obesity, dyslipidemia, and diabetes. Its double the risk of ischemic stroke from metabolic syndrome, with the risk raising as the number of factors in the syndrome increase.[36]

Alcohol Consumption, Substance Abuse, and Smoking

A J-shaped relationship is observed between alcohol consumption and ischemic stroke, with protective against with light-to-moderate alcohol consumption and increased risk of ischemic stroke with heavy drinking.[37] A direct linear relationship is observed with alcohol consumption and hemorrhagic stroke, that even small amounts of alcohol consumption increases the risk of hemorrhage.

Abuse of illicit substances, like cocaine, heroin, amphetamines, are associated with an elevated risk of hemorrhagic and ischemic strokes.[38] Smoking is a important risk factor for stroke, doubling the risk with a dose–response relationship between pack-years and stroke risk. Annually cigarette smoking contributes to nearly fifteen percent of stroke mortality. Decreased risk of stroke is observed with smoking cessation, with excess risk disappearing within two to four years after quitting smoking.[39]

Factors associated with prognosis after stroke

Factors that have been shown up as predictors of early neurological deterioration (END) include clinical parameters like history of diabetes mellitus stroke, low and high Blood pressure, severity at presentation, high NIHSS score, low Canadian Stroke Severity score, body temperature, and laboratory tests like markers of inflammation, markers of coagulation, and serum glucose at admission. Further, CT scan and alterations in cerebral blood flow affecting the ischemic penumbrahave been regarded as predictors of early neurological deterioration.[40]

National Institutes of Health Stroke Scale

"The National Institutes of Health Stroke Scale, or NIH Stroke Scale (NIHSS) is a tool used by healthcare providers to objectively quantify the impairment caused by a stroke." The NIHSS consists of 11 items, each of which scores a specific ability between a 0 (normal function) to 4. A higher score is indicative of some level of impairment. The individual scores are summed and a patient's total NIHSS score is calculated. The maximum possible score is 42, with the minimum score being a 0.[41]

Score	Stroke severity
0	No stroke symptoms
1-4	Minor stroke
5-15	Moderate stroke
16-20	Moderate to severe stroke
21-42	Severe stroke

1. Level of Consciousness

Level of consciousness testing is divided into three sections.

A. LOC Responsiveness (0-2)

B. LOC Questions (0-2)

C. LOC commands (0-2)

2. Horizontal Eye Movement

   Score (0-2)

3. Visual field test

   (Score 0-3)

4. Facial Palsy

   Score (0-3)

5. Motor arm: score (0-4)

6. Motor Leg: Score (0-4)

7. Limb Ataxia: Score (0-2)
8. Sensory loss: Score (0-2)
9. Language :Score (0-2)
10. Speech:Score (0-2)
11. Extinction and Inattention: Score (0-2)

The National Institutes of Health Stroke Scale is used for assessing stroke severity and it is an excellent predictor for patient outcomes of stroke.

OTHER ASSESSMENT SCALES

Modified National Institutes of Health Stroke Scale

"The Modified NIH Stroke Scale (mNIHSS) is a shortened, validated version of the NIHSS. It is equally, accurate than the longer, older NIHSS. It discards questions 1A, 4, and 7. This makes the mNIHSSshorter and easier to apply" used for patients who are at high risk of hemorrhage when tissue plasminogen activator (tPA) . Only medical records can be used by the mNIHSS without seeing the patient [42]

Intracerebral Hemorrhage Scale[43]

Uses a 5-item scale

- Predictor of 30-day mortality
- Developed to standardize clinical grading to improve communication and consistency between healthcare providers.
- Sensitivity = 66% in predicting 30-day mortality

GLASGOW COMA SCALE (GCS)[44]

- Identifies ocular, verbal, and motor response to examination
- Tool is used to communicate the level of consciousness (LOC) of patients with an acute brain injury
- The scale was developed to complement and not replace assessments of other neurological functions
- Strength: Fast and easy to use
- Limitation: Developed as a trauma scale. Stroke patient with plegic arm can be scored a 6 on the motor response if they follow commands.

Blood urea nitrogen/creatinine ratio and urine specific gravity association with stroke Blood urea nitrogen to creatinine ratio (BUN/Cr) and urine specific gravity are frequently used in subjects with cerebral infarction as a measurement of renal function and by various studies has shown BUN/creatinine ratio and USG are both used in the prediction of ill outcomes in individuals with stroke.[45] Hydration status is important to maintain physiologic homeostasis in individuals which can be maintained by osmoregulation by the intake of fluid and adjustments in the concentration of urinary excretion.

Euvolemia is important for adequate blood flow, proper organ function and oxygen delivery. Dehydration among stroke patients is multifactorial process. blood viscosity is increased with dehydration and decreases cerebral blood flow due to lower intravascular volume and causes blunting of cerebral autoregulatory response.

In states of dehydration the blood flow to organs like muscle and kidney is significantly decreased As Cardiac output also reduces.[46] Various mechanisms to prevent dehydration are present in the body including the release of hormones renin and vasopressin to stimulate renal water reabsorption.[47]

Patients with cerebral infarction have elevated hematocrit and causes a larger infarct volume ,Recurrent embolic stroke and thrombotic events like venous thromboembolism. [48]

The effect of dehydration at presentation on the risk and outcome of ischemic stroke has been evaluated using plasma osmolality , blood urea nitrogen (BUN) and urine specific gravity.[1]

MOST RELAVENT STUDIES:

Bhatia, K. (2015) et al[1] did assessment of clinical, laboratory, radiological, demographic variables along with stroke severity in one hundred and fourteen consecutive patients presenting to the Emergency department in a prospective cohort study. As dehydration was found to be associated with early neurological deterioration (END), dehydration markers USG >1.010and BUN/creatinine >15 were examined as predictors of END. Of the 114 patients enrolled in the study, END was observed in 25 (21.9%) patients. Their study found achievable association of relative dehydration, as indicated by BUN/creatinine ratio >15. As dehydration is a pretty treatable condition, it was concluded that using BUN/creatinine >15 as a predictor for END associated with dehydration is an effective method.

Davalos, A. (1999) et al[49] analysed 615 patients “Biochemical, clinical, and radiological data recorded to find potential predictors of and factors having

association with early and late progression in acute stroke, in the acute phase of stroke patient's enrolled their European Cooperative Acute Stroke Study." It was found in their study that if "there was a decrease of >/= 2 points in consciousness or motor power or decrease of >/=3 points in speech scores in the Scandinavian Neurological Stroke Scale from baseline to 24-hour evaluation it is rated as Early progressing stroke (EPS) and when one of these decreases occurred between 24-hour to day-7 evaluation it is rated as late progressing stroke (LPS)." "Of the 615 patients studied, (37.5%) worsened during the first 24 hours after inclusion. The overall incidence of EPS was 37% in the placebo group and 38% in the recombinant tissue plasminogen activator group." "Longer delay until treatment and history of coronary heart disease and diabetes, focal hypodensity and hyper density of the middle cerebral artery sign on baseline computed tomography, were independent prognostic factors for EPS." 20.3% patients found to have LPS. It was concluded that "LPS and EPS are majorly related to CT signs of cerebral oedema and haemorrhagic transformation, treatment with recombinant tissue plasminogen activator, and moderate changes in systolic blood pressure do not impact the early clinical course."

Lin, L. C. (2011) et al[11] on an earlier study observed that "Blood urea nitrogen/creatinine (BUN/Cr) ratio>15 for early neurological deterioration after acute ischemic stroke acts as an independent predictor as a marker of dehydration and to determine if urine specific gravity, which is also an indicator of hydration status and can easily be obtained, is also an independent predictor of early deterioration or stroke-in-evolution (SIE)." AIS patients from October 2007 to June 2010, were observed based on an increase of three or more points on the National Institutes of Health Stroke Scale within three days,and comparison was done between patients with and without stroke-in-evolution. A total of three hundred and seventeen patients

(43 SIE and 274 non-SIE) were considered as study participants; the first 196 patients formed the cohort of their previous study. After adjusting for gender and age, patients with a urine specific gravity>1.010 were 2.78 times more likely to develop. Thus, it was concluded that urine specific gravity is an early predictor of early deterioration in patients with AIS.

Lin, L. C. (2011) et al[50] conducted a study with an aim "To identify predictors or factors of early deterioration after stroke." They recorded patient histories, demographic data, and initial stroke severity with laboratory measurements of one ninety-six first-time acute ischemic stroke patients. Among them patients were diagnosed with stroke-in-evolution (SIE). After multivariate analysis, it was found that only a BUN/Cr higher than 15 was independent predictor of SIE and those who have this were 3.41-fold more likely to have SIE (P = .008). It was concluded that BUN/Cr could be a newer predictor of SIE.

Rowat, A. (2011) et al[51] conducted a pilot study to determine the efficacy of urine specific gravity and urine colour as markers for dehydration in stroke patients instead of standard blood indicators. As dehydration after stroke is associated with increased blood viscosity, venous thrombo-embolism and stroke mortality at 3-months, earlier detection of dehydration might help is improving patient outcomes. "Urine specific gravity was measured in 20 stroke patients with a refractometer, urine test strips, and urine colour of specimens taken daily on ten consecutive days and comparison with the routine blood urea: creatinine ratios over the similar period was done." Out of the twenty stroke patients 9 (45%) had clinical signs of dehydration and had a significantly higher admission median urea: creatinine ratio. The study showed urine test strip urine specific gravity is not a reliable indicator of dehydration and

hence further research is required to determine a better predictor for detection of dehydration in stroke patients.

Schrock, J. W. (2012) et al[52] conducted "A prospective cohort study on patients with AIS from 10/2007 through 6/2009 to evaluate if elevated blood urea nitrogen to creatinine ratio (BUN/Cr) can be used as a marker of dehydration." Dehydration is associated with poor clinical outcome in the form of death, placement in a nursing home for purposes other than rehabilitation, or hospital within 30 days of ED presentation. This study showed that in the patients with AIS, "the variables associated with a poor clinical outcome were: high NIHSS, age >64 years and BUN/Cr ratio of >/=15. Hence it was concluded that an elevated BUN/Cr ratio in patients with AIS is associated with poor outcome at 30 days."

Toni, D. (1995) et al[53] conducted a case series study "To identify predictors and possible pathogenetic mechanisms of early neurological deterioration in patients with acute ischemic strokes and to evaluate their impact on clinical outcome". A continuous series of 152 first ischemic stroke patients hospitalized within 5 hours of onset were studied and it was observed that "39 patients (26%) deteriorated during the initial 4 days; 20 patients (51%) had an impaired level of consciousness, and 19 patients (49%) had impaired limb strength and/or speech , the repeated CT scan of (144 patients) or at autopsy (eight patients), patients with a progressing course more frequently had large infarcts, severe mass effect, and haemorrhagic infarction." "Twenty-two (27%) of the 80 patients who underwent angiography had a progressing course, of whom 20 (91%) had an intracranial and/or extracranial arterial occlusion, with collateral blood supply in seven patients (35%). By logistic regression analysis it was found that "The independent predictors of progression were the early focal

hypodensity with cortical and corticosubcortical locations and the serum glucose levels at admission." Among patients who underwent angiography, logistic regression analysis showed a significant correlation between carotid siphon occlusion and a progressing course. The study concluded that "Prediction of early stroke deterioration is difficult and can largely be determined by cerebral oedema following an arterial occlusion, as indicated by an early focal hypodensity and initial mass effect on the baseline CT scan".

Deng, Linghui (2019) et al[54] studied AIS patients in the West China Hospital, admitted within 7 days from stroke onset from (2012–2016) "To know the effect of the blood urea nitrogen (BUN) to creatinine (Cr) ratio (BUN/Cr) on haemorrhagic transformation (HT)." In a study of total 1738 participants of AIS, a relationship between BUN/Cr and HT and DM was explored in a dose-dependent manner and showed positive correlation with HT in DM patients but no significant relationship with HT in patients without diabetes mellitus. The study concluded that "BUN/Cr positively correlated with HT in AIS patients with diabetes mellitus."

Deng, L. (2019) et al[10]conducted a study "To analyse the relationship between BUN/Cr as hydration marker and three-month outcome as assessed by the modified Rankin Scale (mRS) score in AIS patient on 1738 AIS patients admitted to West China Hospital from 2012 to 2016." The study showed that "BUN/Cr showed a positive correlation with the three-month outcome, However, after adjusting for potential confounders, the correlation was no longer significant" ,but showed a significant correlation between "BUN/Cr and three-month outcome in patients with higher HDL showed an interaction between BUN/Cr and high-density lipoprotein

(HDL) was found". They concluded "Elevated BUN/Cr had association with poor three-month outcome in AIS patients with high HDL levels."

Kim, H. (2017) et al[5] conducted a study on 182 newly diagnosed AIS patients between January 2012 and December 2013 on 182 patients. VTE patients more commonly comprised of female population and had higher National Institutes of Health Stroke Scale (NIHSS) score, elevated blood urea nitrogen BUN/Cr ratio on admission and more weakness in lower limbs. Independent risk factors for VTE by multivariate analysis were BUN/Cr ratio >15 and severe lower limb weakness. Thus, it was concluded that dehydration on admission in cases of AIS might be a significant independent risk factor for VTE.

Li, S. S. (2017) et al[55] studied subjects with acute ischemic stroke post thrombolysis and divided them into two groups as per modified Rankin scale (mRS) 90 days post stroke into mRS 0-2 (n = 191) and mRS 3-6 (n = 103). The two markers for dehydration were USG > 1.010 combined with BUN/Cr >/= 15 or any one of them. They found "Significant differences were found in Age, blood glucose, fibrinogen, NIHSS score at admission, the systolic blood pressure (SBP) before thrombolysis, hyperlipidaemia, BUN/Cr, dehydration status (BUN/Cr >/= 15 plus USG > 1.010), USG and D-dimer on admission day, and TOAST classification between two groups." Further stratification analysis showed that "BUN/Cr >/= 15, NIHSS >/= 6, blood glucose >/=8, and SBP > 150 had association with poor outcome (mRS 3-6, $p < .05$)." The study concluded that "BUN/Cr >/= 15 combined with USG > 1.010 were predictors for long-term poor prognosis in AIS patients."

Lin, C. J. (2016) et al[56] conducted a prospective study of patients with acute ischemic stroke and effect on BUN/Cr ratio on 15 controls It was a non-blinded study

in which the hydration group received intravenous bolus (300-500 mL) saline followed by maintenance saline infusion (40-80 mL/h for the first 72 hours), whereas the control group received maintenance saline infusion (40-60 mL/h for the first 24 hours and 0-60 mL/h for 24-72 hours after stroke). Among the two hundred and seventy patients enrolled (hydration, n = 134; control, n = 103), it was found that "The mean volume of saline infused within the first 72 hours was significantly larger , and the rate of favourable outcome at three months after stroke was significantly higher in the hydration group than in the controls." It was found that "Blood urea nitrogen/Cr ratio-based saline hydration therapy in patients with AIS has a better clinical outcome with functional independence at three months after stroke."

Lin, Wei-Chun (2015) et al[57] conducted a non-blinded, phase II single-arm prospective study with a historical control group of patients with acute ischemic stroke and a BUN/Cr ratio of 15 or higher. The study group participants (n = 134) received an intravenous saline bolus which was followed by maintenance saline for the first seventy two hours. The participants in control group (n = 103) were on maintenance saline infusions (40-60 mL/hour for the first 24 hours and 0-60 mL/hour for the next 24-72 hours). The hydration group showed a significantly lower post-stroke infection rate than the control group and significantly shorter LOS in the neurology ward. The results suggested that might decrease in the post-stroke infection rate and shorten LOS can be achieved by correcting the BUN/Cr ratio through saline hydration therapy.

Shi, Z. (2019) et al[58] conducted a retrospective study in "Patients presenting with mild or moderate stroke according to (National Institutes of Health Stroke Scale score </=14) within 24 hr of onset between Jan 2016 and Dec 2017 and (BUN/Cr) of

>/=15 as a marker of dehydration and blood coagulation activity was assessed with thromboelastography (TEG)." Of 244 patients, 64 (26.2%) developed END within three days after admission. Patients with END had significantly higher BUN/Cr, shorter R and K on TEG test. There was no difference in TEG parameters as related to dehydration. Multivariate regression suggested that dehydration status and shorter R tercile on TEG, were independently associated with END. The study showed "The contribution of dehydration to END after ischemic stroke was mediated by blood coagulation activation."

Wu, Fei-Fan (2017) et al[59] conducted a study to determine if dehydration remains a negative prognostic factor after treatment with tissue plasminogen activator (tPA) on three hundred and forty six IS patients between 2007 and 2012. Participants were divided into two groups on the basis of their blood urea nitrogen/creatinine (BUN/Cr) ratio. Dehydration was measured as BUN/Cr ratio ≥ 15. The dehydration group had a greater mean age; more women; lower mean levels of triglycerides, haemoglobin, and sodium; and higher mean potassium and glucose levels. A favourable outcome as assessed by the mRS (≤2) was significantly less frequent among dehydrated subjects, but a favourable outcome by the BI (≥60) was not. The study indicated hydration status still remains a predictor for END even after thrombolytic therapy.

Lacunae in literature

There are very limited studies investigating BUN/creatinine ratio and Urine specific gravity as a laboratory test forthe measurement of hydration status as an independent predictor for early neurological deterioration. These are practical and reliable assessing tools for early identification of dehydration so as to improve outcome of stroke in evolution patients.

MATERIALS AND METHODS:

Study site: This study was conducted in the department of General Medicine at Jawaharlal Nehru Medical College KLE Dr Prabhakar kore hospital and MRC, Belagavi.

Study population: All the patients admitted in the wards and ICU of General Medicine and Neuromedicine at KLES Dr.Prabhakar Kore Hospital, Belgaum fulfilling the inclusion criteria were considered as study population.

Study Design: Cross sectional, hospital-based cross-sectional study.

Sample size: Sample size is calculated by the following formula:

N= 4PQ/D2

Where N=Sample size

P = Prevalence of the disease

Q= 100- P

D = Absolute error taken as 10%

(P = 76; Q = 24; D=10)

Sampling method: All the eligible subjects were recruited into the study consecutively by convenient sampling till the sample size is reached.

Study Duration: 1 year (1 January 2018- 31 December 2018)

Inclusion criteria:

- All Acute ischemic stroke patients above 18 years.
- Patient admitted in wards and ICU in medicine and neuro medicine department with diagnosis of acute ischemic stroke within 24 hrs.

Exclusion criteria:

- Known cases of Type 2 Diabetes mellitus.
- Known case of Chronic Kidney Disease.
- Known case of Chronic Congestive Failure.
- Transient Ischemic Stroke patients.
- Known cases of Cirrhosis of liver.
- Acute hemorrhagic stroke patients.

Ethical considerations: Study was approved by institutional human ethics committee. Informed written consent was obtained from all the study participants and only those participants willing to sign the informed consent were included in the study. The risks and benefits involved in the study and voluntary nature of participation were explained to the participants before obtaining consent. Confidentiality of the study participants was maintained.

Data collection tools: All the relevant parameters were documented in a structured study proforma.

Methodology:

Informed written consent was obtained from all the study participants. Structured proforma was used to collect all the data. Detailed history and clinical examination was done before admission.

NCCT HEAD was done. National institute health stroke scale (NIHSS) was calculated.

Lab investigations to be done are:

Complete blood count

Serum creatinine,

Blood urea,

Urine specific gravity,

Plasma osmolality

Parameters like Blood urea/Creatinine ratio and Urine specific gravity were repeated for 3 continuous days.

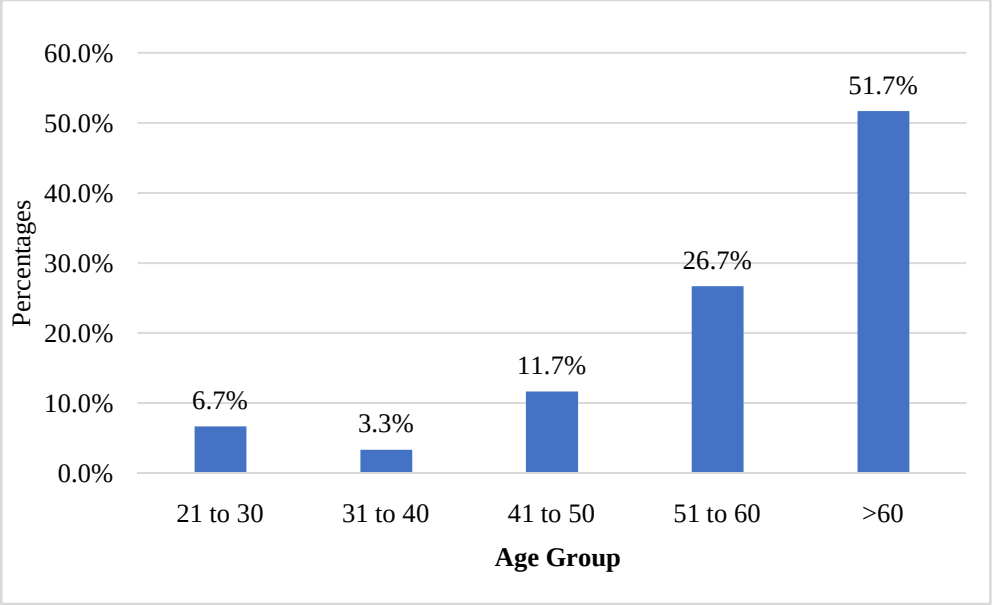
RESULTS

The present study was conducted on 60 patients and were subjected to Blood urea nitrogen/Creatinine ratio and Urine specific gravity as a predictor of Early Neurological Deterioration in patients of Acute Ischemic Stroke in KLES Dr. Prabhakar kore and Medical research Centre, Belagavi during period of January 2018 to December 2018.

Table 1: AGE DISTRIBUTION

Age Group (years)	Number of patients (N=60)	Percentage
21 to 30	4	6.7%
31 to 40	2	3.3%
41 to 50	7	11.7%
51 to 60	16	26.7%
>60	31	51.7%
Mean	61.02 ± 15.9	

Figure 1: AGE DISTRIBUTION

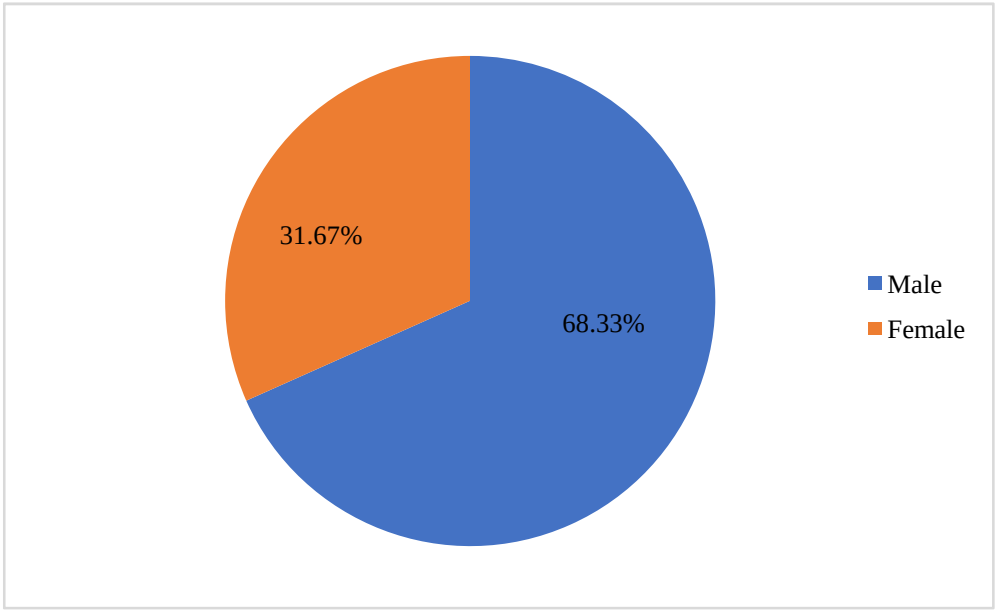


In the present study maximum number of patients were in the age group ≥60 years that is 31 patients (51.70%) , 16 patients(26.7%) were in the age group of 51-60 years,7 patients (11.7 %) were in the age group of (41-50) years , 2 patients in the age group of (31-40) years and only 4 patients were in the age group of (21-30) years. The youngest patient was 21 years old and the oldest was 90 years. The mean age was 61.02±15. 9 years.

Table 2: SEX DISTRIBUTION

Gender	Number of patients (N=60)	Percentage
Male	41	68.3%
Female	19	31.7%

Figure 2: SEX DISTRIBUTION (N=60)

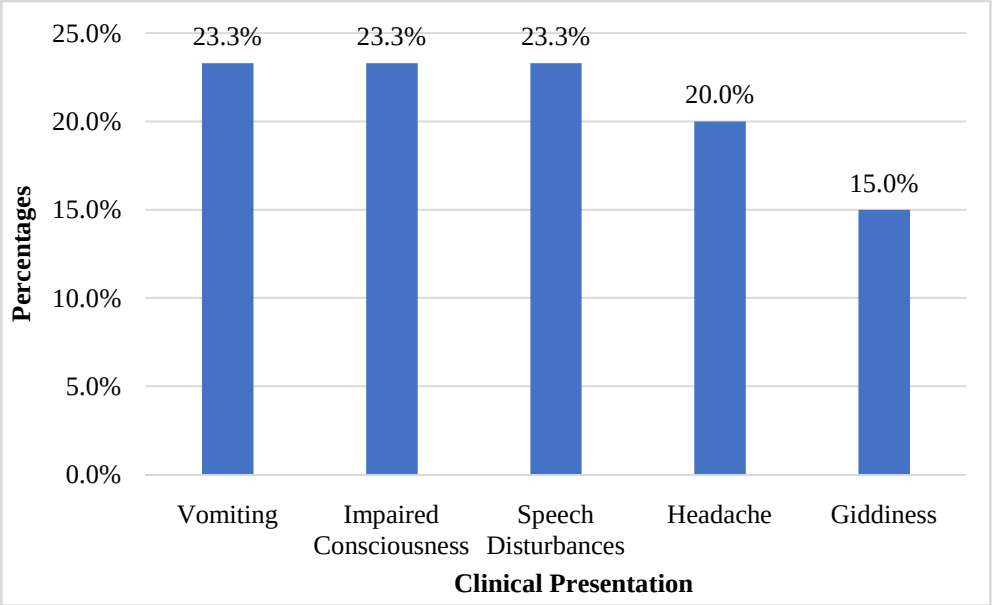


In the present study out of 60 cases 41 patients (68.3%) were males and 19 patients (31.7%) were females. Male preponderance was seen with Male to Female ratio of 2.15:1.

Table 3: CLINICAL PRESENTATION

Clinical Presentation	Number of patients (N=60)	Percentage
Speech disturbance	14	23.3%
Vomiting	14	23.3%
Impaired consciousness	14	23.30%
Headache	12	20.0%
Giddiness	9	15%

Figure 3: CLINICAL PRESENTATION (N=60)

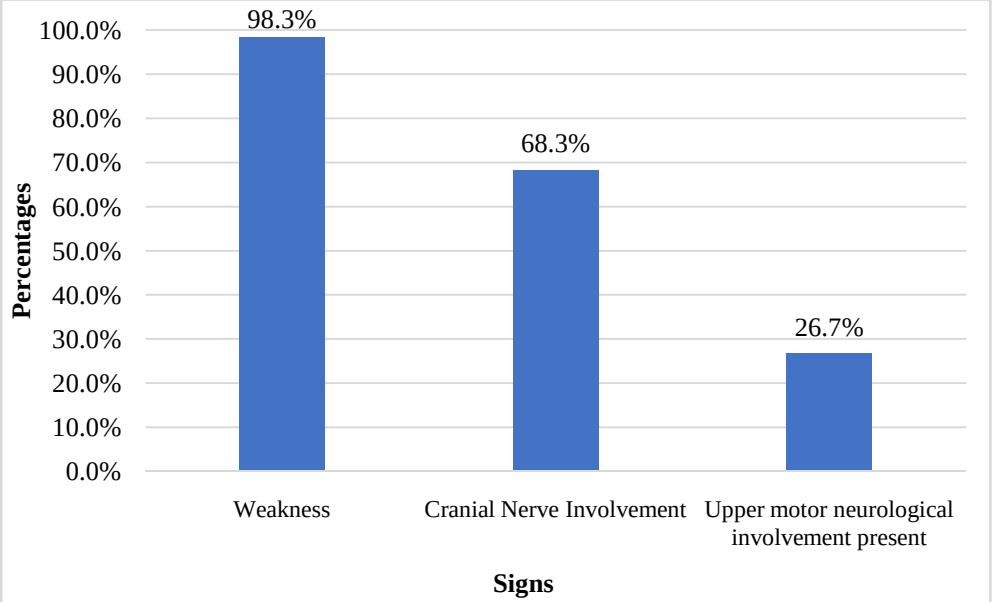


In our study we observed most of the patients presented with speech disturbances i.e. 14 patients (23.30%), vomiting 14 patients (23.30%),impaired consciousness 14 patients (23.30%), headache 12 patients (20.00%), and giddiness 9 patients (15.00%).Few patients presented with overlapping symptoms which is not depicted in the above table**.**

Table 4: CLINICAL SIGNS (N=60)

Signs	Number of patients	Percentage
Limb Weakness	59	98.3%
Cranial Nerve Involvement	16	26.7%
Upper motor neuron signs	41	68.3%

Figure 4: NUEROLOGICAL SIGNS (N=60)



Most of our patients in the present study presented with neurodeficits (limb weakness) i.e. 59 patients (98.3%), 16 patients (26.7%) had involvement of the cranial nerves. Majority of the patients 41 patients (68.3%) had signs of upper motor neuron lesion. We noted overlapping signs which is not depicted in the above table.

Table 5: CO-MORBID CONDITIONS

Comorbid conditions	Number of patients(N=60)	Percentage
Hypertension	37	61.7%
Coronary artery disease	5	8.3%
Nil co-morbidities	18	30.00%

Most of the patients had hypertension i.e. 37 patients (61.7%) ,5 patients (8.3%) had coronary artery disease, remaining 18 patients (30.00%) did not have any co-morbid conditions. No patients had diabetes mellitus in our study group.

Table 6. HABITS

Habits	Number of patients(N=60)	Percentage
Tobacco Chewer	24	40.0%
Alcohol	23	38.33%
Smoking	2	3.3%
Overlapping	9	15.00%
Nil habits	11	18.33%

In our present study 24 patients (40.00%) were chronic tobacco chewer, 23(38.33%) patients were alcoholic, some patients had overlapping habits as shown in the below table. 6.11 patients (18.33%) did not have any habits

Figure 5: RISK FACTORS (N=60)

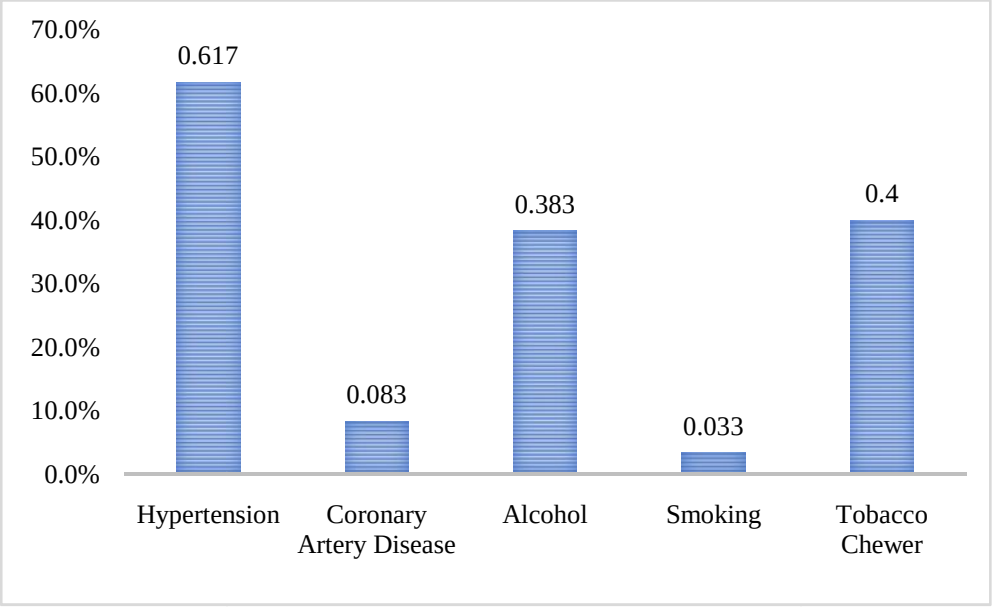


Table 7: BLOOD PRESSURE MEASUREMENTS AT ARRIVAL

	BLOOD PRESSURE	NUMBER OF PATIENTS(N=60)	PERCENTAGE	MEAN
HYPERTENSIVE (N=37)	Controlled BP	15	25%	136.66 ±14.25
	Uncontrolled BP	22	36.66%	149.26 ±16.85
	Total number	37	61.66%	
NON-HYPERTENSIVE (N=23)	Normal BP	13	21.66%	136.08 ± 14.10
	Raised BP	10	16.67%	141 ± 16.60
	Total number	23	38.33%	

Above table depicts in Non-Hypertensive patients i.e. 23 patients (38.33%) ,10 (16.67%) patients had raised blood pressure at the time of arrival to the hospital, 13 (21.66%) patients had normal blood pressure recordings. In patients who were hypertensive i.e. 37 patients (61.66%), 22 patients (36.67%) did not have control of their hypertension at arrival, remaining 15 patients (25%) had controlled blood pressure at presentation. The mean blood pressure in non -hypertensive and hypertensive patients is depicted in above table.

Table 8: MEAN BLOOD PRESSURE MEASUREMENT (N=60)

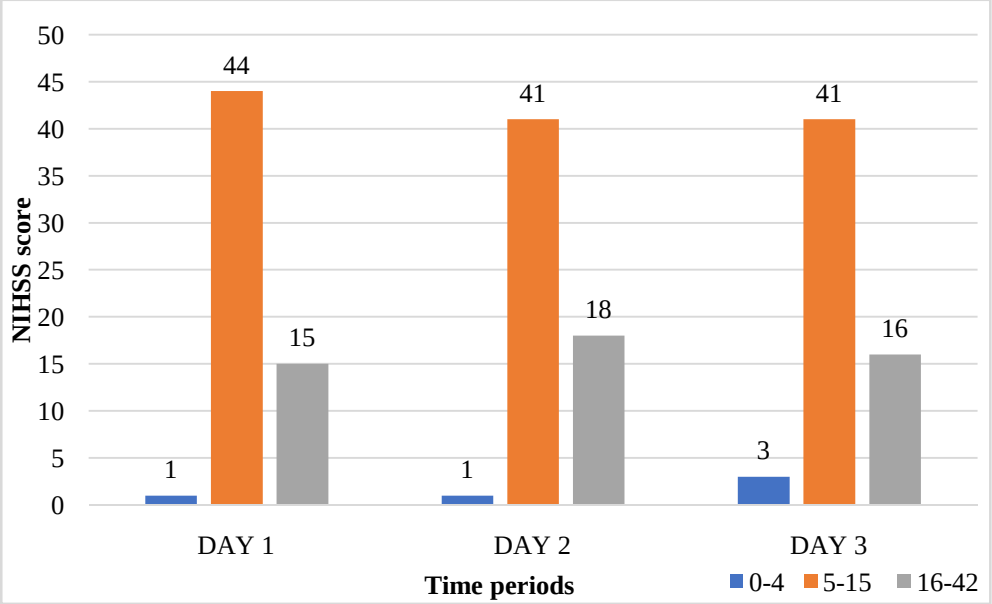
Parameter	Minimum	Maximum	Mean ± SD
Systolic Blood Pressure	120.00	190.00	148.83 ± 15.95
Diastolic Blood Pressure	70.00	120.00	92.67 ± 11.77

The mean blood pressure in both hypertensive and non-hypertensive patients is depicted in the above table.

Table 9: DISTRIBUTION OF PATIENTS ACCORDING TO NATIONAL INSTITUTE OF HEALTH STROKE SCALE (NIHSS) ON DAY 1,2 AND 3

NIHSS SCORE	NUMBER OF PATIENTS(N=60)		
	DAY 1	DAY 2	DAY 3
0-4	1	1	3
5-15	44	41	41
16-42	15	18	16
TOTAL	60	60	60
Mean	14.33 ± 7.58	14.22 ± 7.46	13.83 ± 7.67

Figure 6: Distribution of patients according to NIHSS

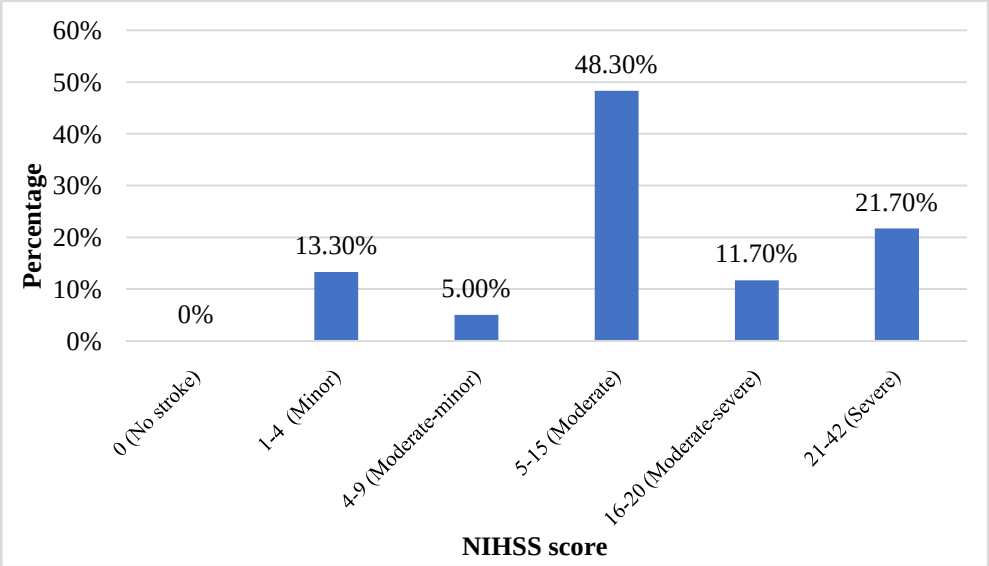


All our 60 patients were subjected to NIHSS scoring on Day 1 we followed them up on Day 2 and Day 3 and found to have the observation as depicted in the above Table 9.

Table 10: DISTIBUTION OF PATIENTS ACCORDING TO SEVERITY OF NATIONAL INSTITUTE OF HEALTH STROKE SCALE (NIHSS)

NIHSS Severity	Number of patients(N=60)	Percentage
0 (No stroke)	**0**	**0.00**
1-4 (Minor)	8	13.3%
4-9 (minor-moderate)	3	5.0%
5-15 (Moderate)	29	48.3%
16-20 (Moderate-severe)	7	11.7%
21-42 (Severe)	13	21.7%

Figure 7: Distribution of patients according to severity of National Institute of Health Stroke Scale (NIHSS)



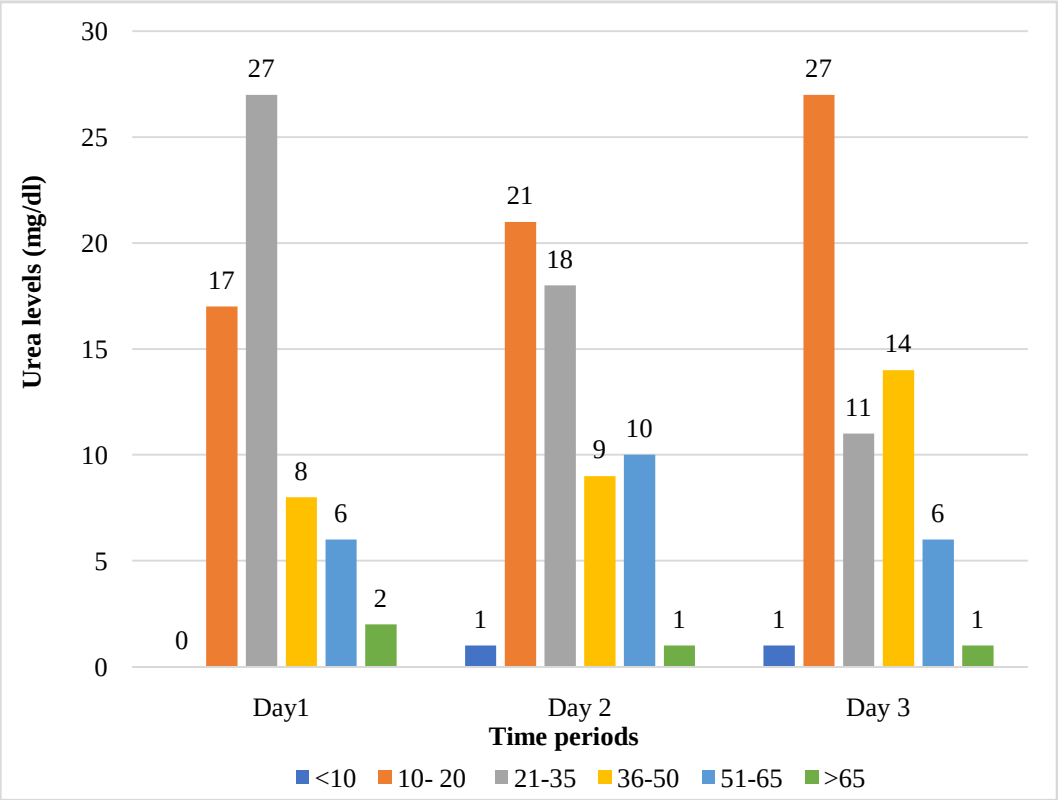
Based on severity of stroke according to NIHSS score, we found to have maximum number of patients in the moderate group i.e. 29 patients (48.30%) , 13 patients (21.70%) were in severe category(21-42) , 8 patients (13.30%) were in Minor (1-4), 7 patients (11.70%) were in Moderately-Severe (6-20) and 3 patients (5.00%) were in minor-moderate (4-9) group.

LAB PARAMETERS

Table 11: ESTIMATION OF BLOOD UREA

Urea levels (mg/dl)	NUMBER OF PATIENTS(N=60)		
	Day1	**Day 2**	**Day 3**
<10	**0**	**1**	**1**
10-20	**17**	**21**	**27**
21-35	**27**	**18**	**11**
36-50	**8**	**9**	**14**
51-65	**6**	**10**	**6**
>65	**2**	**1**	**1**
Total number	**60**	**60**	**60**
Mean	**30.84±15.32**	**27.57±14.38**	**28.43±14.93**

Figure 8: Estimation of Blood urea levels (Day wise 1,2 and 3)

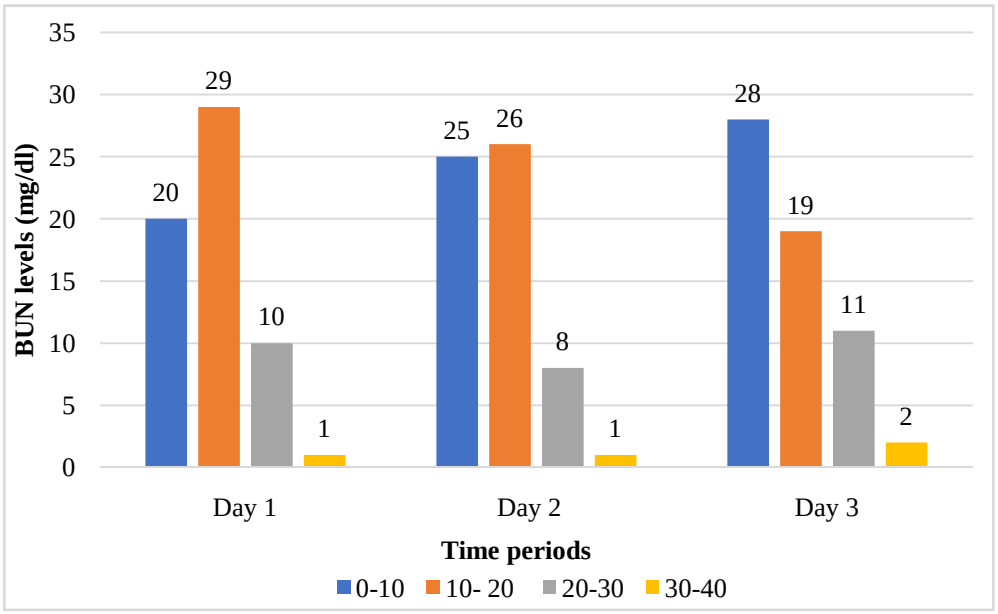


All our 60 patients were subjected to Blood Urea on Day 1, Day 2 and Day 3 and split up of patients according to Blood Urea levels on Day 1 to Day 3 is shown in the above table

Table 12: ESTIMATION OF BLOOD UREA NITROGEN

Blood urea nitrogen(mg/dl)	Number of patients(N=60)		
(N=60)	**Day 1**	**Day 2**	**Day 3**
0-10	**20**	**25**	**28**
10-20	**29**	**26**	**19**
20-30	**10**	**8**	**11**
30-40	**1**	**1**	**2**
Total	**60**	**60**	**60**
Mean	**14.41± 7.16**	**12.88±6.72**	**13.27±7.06**

Figure 9: Estimation of BUN levels (mg/dl) day wise 1,2 and 3

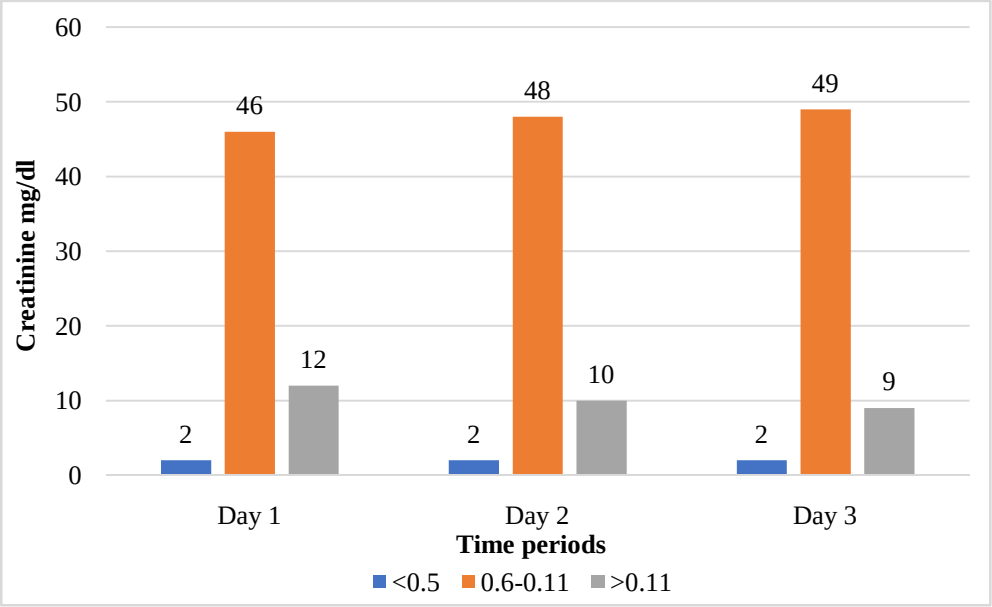


Similarly, all our patients were subjected for Blood urea nitrogen estimation on Day 1 ,2,3 and the results obtained are depicted in the above table

Table 13. ESTIMATION OF SERUM CREATININE

Serum Creatinine (mg/dl)	NUMBER OF PATIENTS(N=60)		
(N=60)	**Day 1**	**Day 2**	**Day 3**
<0.5	**2**	**2**	**2**
0.6-0.11	**46**	**48**	**49**
>0.11	**12**	**10**	**9**
Total	**60**	**60**	**60**
Mean	**0.94±0.336**	**0.91±0.339**	**0.89±0.342**

Figure 10: Estimation of Creatinine levels (mg/dl) day wise 1,2 and 3

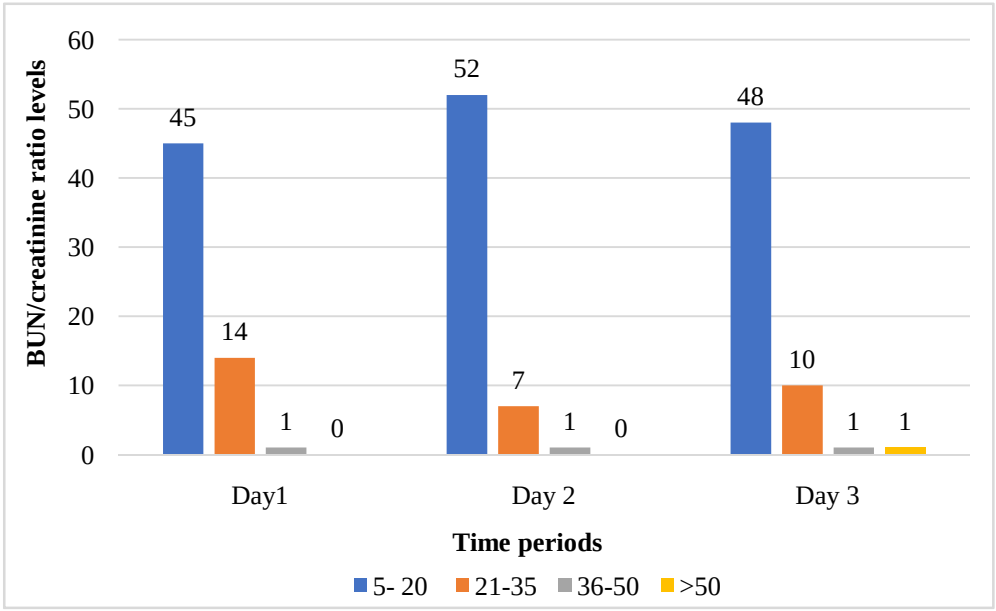


Serum creatinine estimation in our 60 patients is shown in the above table

Table 14: ESTIMATION OF BLOOD UREA NITROGEN/CREATININE RATIO

BUN/Creatinine ratio	NUMBER OF PATIENTS(N=60)		
(N=60)	**Day1**	**Day 2**	**Day 3**
5-20	**45**	**52**	**48**
21-35	**14**	**7**	**10**
36-50	**1**	**1**	**1**
>50	**0**	**0**	**1**
Mean	**16.02±7.35**	**14.62±6.45**	**15.95±8.98**

Figure11 : BUN/Creatinine ratio (mg/dl) day wise 1,2 and 3

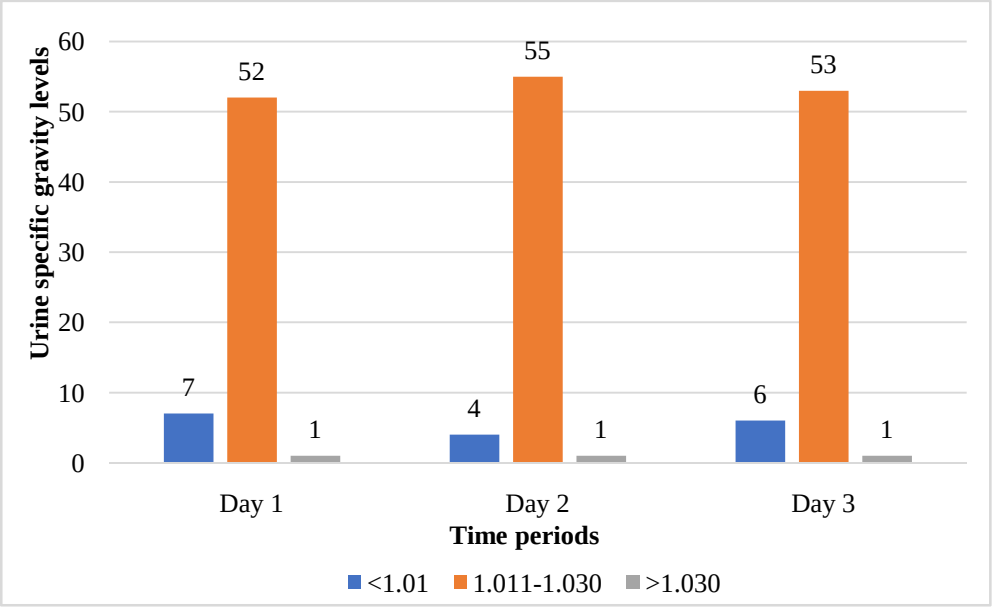


We attempted to find the ratio of blood urea nitrogen and creatinine in our study population as shown in the above table.

Table 15: ESTIMATION OF URINE SPECIFIC GRAVITY

Urine Specific Gravity	NUMBER OF PATIENTS**(N=60)**		
(N=60)	**Day 1**	**Day 2**	**Day 3**
<1.01	**7**	**4**	**6**
1.011-1.030	**52**	**55**	**53**
>1.030	**1**	**1**	**1**
Total	**60**	**60**	**60**
Mean	**1.02±0.01**	**1.02±0.01**	**1.02±0.01**

Figure 12: Distribution of Urine Specific Gravity day wise 1,2 and 3



All these patients were subjected on day wise estimation of urine specific gravity and same is mentioned in the above table.

Table 16: Comparison of Age with National Institute of Health Stroke Scale (NIHSS)

Age(years)	Number of patients with Neurological deterioration(N=60)	
	Yes (N=10)	**No (N=50)**
21 To 30	0 (0%)	4 (8%)
31 To 40	0 (0%)	2 (4%)
41 To 50	2 (20%)	5 (10%)
51 To 60	1 (10%)	15 (30%)
>60	7 (70%)	24 (48%)
Median	69	60
P value	0.167	

When we tried to compare age of the patient with NIHSS we found to have worsening of 2 patients (20%) from 41-50 years 1 patient (10%) from 51-60 years and 7 (70%) were in >60 years. In 50 patients there was no worsening based of NIHSS as depicted in the above table. The mean age in the worsening group was 69 years (10 patients) was compared with the non-worsening group which was 60 years (50 patients) P value was statistically insignificant which was 0.167.

Table 17: Comparison of Sex with National Institute of Health Stroke Scale (NIHSS)

Gender	Number of patients with Patients with Neurological deterioration(N=60)		P value
	Yes (N=10)	**No (N=50)**	
Male	8 (80%)	33 (66%)	0.480
Female	2 (20%)	17 (34%)	

When National Institute of Health Stroke Scale was compared with Sex, we found in Males the worsening is seen in 8 patients (80%), no worsening is seen in 33 patients (66%).

In female patients worsening is seen in 2 patients (20%) and non-worsening is seen in 17patients (34%). P value is 0.480 which was statistically insignificant.

Table 18: Comparison of patient's clinical presentation with National Institute of Health Stroke Scale (NIHSS)

Clinical Presentation	Number of patients with Neurological deterioration(N=60)		P value
	Yes (N=10)	**No (N=50)**	
Headache			
Yes	3 (30%)	9 (18%)	0.403
No	7 (70%)	41 (82%)	
Vomiting			
Yes	1 (10%)	13 (26%)	0.427
No	9 (90%)	37 (74%)	
Giddiness			
Yes	2 (20%)	7 (14%)	0.637
No	8 (80%)	43 (86%)	
Impaired Consciousness			
Yes	3 (30%)	11 (22%)	0.685
No	7 (70%)	39 (78%)	
Speech Disturbances			
Yes	3 (30%)	11 (22%)	0.685
No	7 (70%)	39 (78%)	

We tried to compare the patient's clinical presentation with National Institute of health stroke scale and did not find any significant co relation between them as depicted in above table. P value was statistically significant as shown in the above table.

Table 19: Comparison of Neurological signs with National Institute of health score scale (NIHSS)

Neurological Signs	Number of Patients with Neurological deterioration(N=60)		P value
	Yes (N=10)	**No (N=50)**	
Limb Weakness			
Yes	10 (100%)	49 (98%)	*
No	0 (0%)	1 (2%)	
Cranial Nerve Involvement			
Yes	2 (20%)	14 (28%)	0.715
No	8 (80%)	36 (72%)	
Plantar response			
Extensor	7 (70%)	34 (68%)	0.183
Flexor	3 (30%)	16 (32%)	

Comparison of neurological signs with NIHSS scoring, we found patient with limb weakness (total of 59), 10 had deterioration in their neurological status, patient with cranial nerve palsy (number of patients 16), 2 had neurological worsening. Similarly, patients with extensor plantar response (number of patients 41), 7 had worsening of their neurological status as depicted in the above table (Table No. 19). P value was statistically insignificant.

Table 20: Comparison of Co-morbid conditions with National institute of Health Stroke Scale

Co-Morbid conditions	Number of Patients with Neurological Deterioration(N=60)		P value
	Yes (N=10)	**No (N=50)**	
Hypertension			
Yes	4 (40%)	33 (66%)	0.161
No	6 (60%)	17 (34%)	
Coronary Artery Disease			
Yes	1 (10%)	4 (8%)	1.000
No	9 (90%)	46 (92%)	

In our Study 37 patients were hypertensive and 5 patients had Coronary Artery Disease, remaining 18 patients had no Co-morbid conditions, none had Diabetes Mellitus in our study, same were (Hypertension and Coronary artery Disease) compared with National Institute of health stroke scale, there was no correlation observed. P-Value was 0.161 for hypertension and 1.000 for coronary artery disease

Table 21: Comparison of habits with National Institute of Health Stroke Scale

Habits	Number of patients with Neurological deterioration(N=60)		P value
	Yes (N=10)	**No (N=50)**	
Alcohol			
Yes	3 (30%)	20 (40%)	0.727
No	7 (70%)	30 (60%)	
Tobacco Chewer			
Yes	3 (30%)	21 (42%)	0.725
No	7 (70%)	29 (58%)	
Tobacco chewer and Alcohol			
Yes	1(10%)	8(16%)	0.825
No	9(90.00)	42 (84%)	

In our present study of 60 patients, we did not find any relevant comparison with National institute of Health Stroke Scale. Patients with alcoholism had 3 patients (30%) with neurological deterioration and P value was 0.727 which was statistically insignificant. Similarly, patients with tobacco chewing also had 3 patients (30%) with neurological deterioration with P value of 0.725 which was statistically insignificant.

Patient with habits of both tobacco chewing and alcoholism was 1 patient (10%) with worsening of neurological state and P value was 0.825 which was statistically insignificant.

Table 22 Comparison of Hypertension with National institute of Health Stroke Scale

Blood pressure		Number of patients with Neurological deterioration(N=60)		Mean	P VALUE
		Yes	**No**		
Hypertensive (N=16)	**Controlled BP**	**1 (10%)**	**4(90%)**	**145±14.25**	**0.085**
	Uncontrolled BP	**3(30%)**	**8(70%)**	**149±16.85**	
	Total number	**4**	**12**		
Non-hypertensive (N=44)	**Normal bp**	**2(20%)**	**18(50%)**	**136±14.10**	**0.650**
	Raised bp	**4(40%)**	**20(90%)**	**141±16.60**	
	Total number	**6**	**38**		

Comparison of Hypertension alone with NIHSS scoring at presentation also did not showany co relation as shown in the above table. P value was statistically insignificant

Table 23: Comparison of Blood urea levels with National Institute of Health Stroke Scale (All 3 days)

Urea levels (mg/dl)	Number of patients with Neurological deterioration(N=60)	
(N=60)	**Yes**	**No**
<10	**1 (10%)**	**8 (16%)**
10-20	**2(20%)**	**11 (22%)**
21-35	**4(40%)**	**8 (16%)**
36-50	**2(20%)**	**12 (24%)**
51-65	**1(10%)**	**16 (32%)**
>65	**19(10%)**	**15 (30%)**
Total number	**10**	**50**
P value	**0.278**	

Blood urea estimation was compared with National institute of Health Stroke Scale and we found worsening in 10 patients and no worsening in remaining 50 patients. The levels of blood urea did not reflect on patients worsening based on NIHSS. P value was statistically insignificant i.e. 0.278.

Table 24: Comparison of Blood urea with National institute of Health Stroke Scale (Day wise: day 1, day 2 and day 3)

Urea (mg/dl)	Number of patients with Neurological deterioration(N=60)		(P value)
	Yes (N=10) Median	**No (N=50) Median**	
Day 1 (N=60)	34 (17.25,40.75)	27 (20,38)	0.416
Day 2 (N=60)	25.5 (17,40.25)	25.5 (15.75,34.5)	0.648
Day 3 (N=60)	30.5 (16.5,36.75)	24 (16,40)	0.804

When we tried to compare median blood urea levels (day wise: Day 1, Day 2 and Day 3), we found no significant correlation as depicted in the above table. P value was 0.416, 0.648 and 0.804 on Day 1,2 and Day 3 respectively which was statistically insignificant.

Table 25: Comparison of Serum creatinine levels with National institute of Health Stroke Scale (All 3 days)

CREATININE (MG/DL)	NUMBER OF PATIENTS WITH NUEROLOGICAL DETERIORATION(N=60)	
	Yes	**No**
<0.5	**2 (20%)**	**12 (24%)**
0.6-0.11	**5 (50%)**	**28 (56%)**
>0.11	**3 (30%)**	**10 (20%)**
TOTAL	**10**	**50**
P VALUE	**0.087**	

Above table depicts comparison of Serum creatinine levels with National institute of Health Stroke Scale we observed 10 patients worsened neurologically with varying levels of Serum creatinine (All 3 days). P value was 0.087 which was statistically insignificant**.**

Table 26: Comparison of Serum creatinine with National Institute of Health Stroke Scale (Day wise: day 1, day 2 and day 3)

Serum Creatinine (mg/dl)	Number of patients with Neurological deterioration(N=60)		(P value)
	Yes (N=10) Median	**No (N=50) Median**	
Day 1 (N=60)	0.84 (0.78,1.23)	0.92 (0.72,1.04)	0.953
Day 2 (N=60)	0.89 (0.76,1.14)	0.79 (0.69,1.05)	0.284
Day 3 (N=60)	0.99 (0.84,1.17)	0.8 (0.65,1.03)	0.137

When we tried to compare median Serum Creatinine levels (Day wise: Day 1, Day 2 and Day 3), we found no significant correlation as depicted in the above table. P value was 0.953, 0.284 and 0.137 on Day 1,2 and Day 3 respectively which was statistically insignificant**.**

Table 27:Comparison of Blood urea nitrogen levels with National institute of Health Stroke Scale (All 3 days)

BUN(MG/DL)	NUMBER OF PATIENTS WITH NEUROLOGICAL DETERIORATION(N=60)	
	Yes	**No**
0-10	**2 (20%)**	**6 (12%)**
10-20	**2 (20%)**	**16 (32%)**
20-30	**3 (30%)**	**18 (36%)**
30-40	**3 (30%)**	**10 (20%)**
TOTAL	**10**	**50**
P VALUE	**0.0324**	

Above table depicts Neurological worsening was seen in 2 patients (20%) with blood urea nitrogen levels of 10-20mg/dl, in 2 patients (20%) BUN was in 0-10mg/dl, 3patients (30%) with levels of 20-30mg/dl and in 3 patients (30%) the levels were in (30-40mg/dl), similarly non-worsening was seen with different levels of Blood Urea Nitrogen which was shown in the above table. P value was statistically insignificant which was 0.0324.

Table 28: Comparison of Blood urea nitrogen levels with National institute of Health Stroke Scale (Day wise- Day 1, Day 2 and Day 3)

Blood Urea Nitrogen(mg/dl)	Number of patients with Neurological deterioration(N=60)		(P value)
	Yes (N=10) Median	**No (N=50) Median**	
Day 1 (N=60)	15.89 (8.06,19.04)	12.61 (9.34,17.75)	0.416
Day 2 (N=60)	11.91 (7.94,18.81)	11.91 (7.36,16.12)	0.648
Day 3 (N=60)	14.25 (7.73,17.17)	11.21 (7.47,18.7)	0.766

Day wise comparison of Blood urea nitrogen is shown in the above table. P value was 0.416,0.648 and 0.766 on Day 1, Day 2 and Day 3 respectively which was statistically insignificant

Table 29: Comparison of distribution BUN/Creatinine ratio with National institute of Health Stroke Scale (All 3 days)

BUN/Creatinine ratio	Number of patients with Neurological deterioration (N=60)	
	Yes	**No**
5-20	**4 (40%)**	**42 (84%)**
21-35	**4 (40%)**	**7 (14%)**
36-50	**1 (10%)**	**1 (2%)**
>50	**1 (10%)**	**0**
Total	**10**	**50**
P value	**0.322**	

Comparison of Blood urea nitrogen / Creatinine ratio did not show any co relation with neurological worsening. P value being statistically insignificant as depicted in the above table which was 0.322.

Table 30. Comparison of bun/creatinine ratiowith National institute of Health Stroke Scale (Day wise- Day 1, Day 2 and Day 3)

Bun/Creatinine ratio	Number of patients with Neurological deterioration(N=60)		(P value)
	Yes (N=10) Median	**No (N=50) Median**	
Day 1 (N=60)	16.79 (9.77,20.47)	14.51 (9.58,19.93)	0.706
Day 2 (N=60)	12.59 (10.87,16.5)	14.74 (9.23,18.86)	0.766
Day 3 (N=60)	13 (8.54,17.87)	15.24 (11.4,20.02)	0.494

Above table depicts neurological worsening with Bun/creatinine and its comparison did not show any significant correlation. P value being 0.706,0.766,0.494 on Day 1, Day 2 and Day 3 respectively which was statistically insignificant**.**

Table 31. Comparison of Urine Specific Gravity with National institute of Health Stroke Scale (All 3 days)

Urine specific gravity	Number of patients with Neurological deterioration(N=60)	
	Yes	**No**
<1.01	**2**	**15**
1.011-1.030	**5**	**25**
>1.030	**3**	**10**
Total	**10**	**50**
P value	**0.167**	

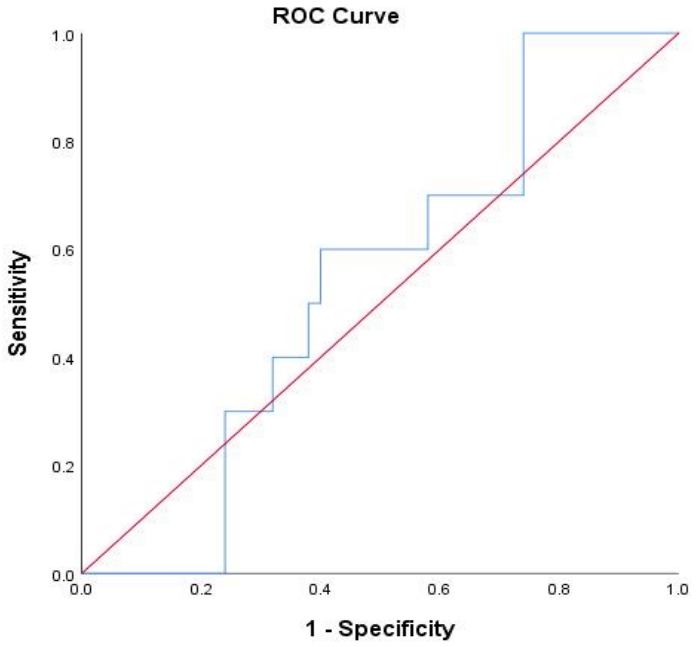
Similarly, Urine specific gravity was taken into account to see any comparison and we observed no comparison was present in our study population. P value 0.167was statistically insignificant

Table 32: Comparison of Urine Specific Gravity with National Institute of Health Stroke Scale (Day wise- Day 1, Day 2 and Day 3)

Urine Specific Gravity	Number of patients with Neurological deterioration(N=60)		(P value)
	Yes (N=10) Median	**No (N=50) Median**	
Day 1 (N=60)	1.01 (1.01,1.03)	1.01 (1.01,1.02)	0.623
Day 2 (N=60)	1.01 (1.01,1.02)	1.02 (1.01,1.02)	0.841896493
Day 3 (N=60)	1.02 (1.01,1.03)	1.02 (1.01,1.02)	0.857666723

Urine specific gravity Day wise was compared with NIHSS and found no correlation as shown in the above table**.**

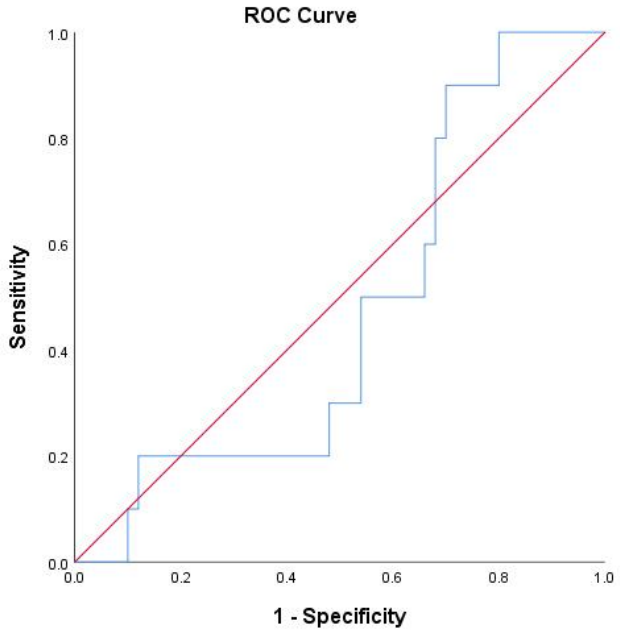
Table 33 (Figure 1):Receiver Operating Characteristics (ROC) Curve of BUN/Creatinine ratio for day 1 as compared with National Institute Health Stroke Scale (N=60)



Test Result Variable(s): BUN/creatinine day 1				
Area Under the Curve	Std. Error	Asymptotic 95% CI for AUC		P value
		Lower Bound	Upper Bound	
0.538	0.084	0.373	0.703	0.706
a. Under the nonparametric assumption				
b. Null hypothesis: true area = 0.5				

In our study on plotting ROC curve for BUN/creatinine for day 1 we observed Area under the curve to be 0.538 and failed to have validated prediction in predicting worsening as far as Neurological status was concerned.

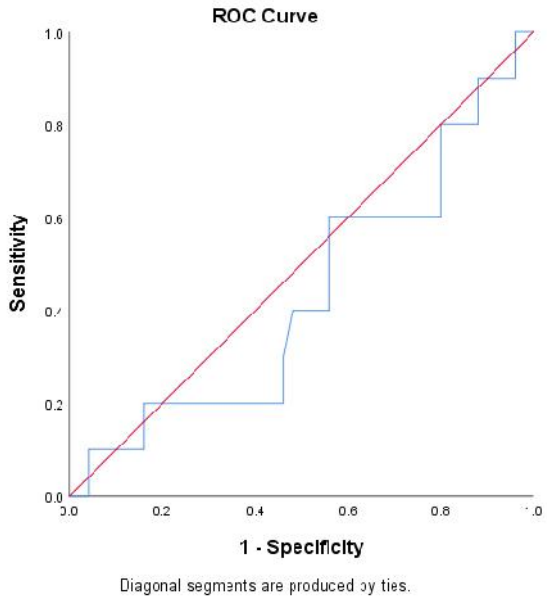
Table 33 (Figure 2): Receiver Operating Characteristics (ROC) Curve of BUN/creatinine ratio for day 2 as compared with National Institute Health Stroke Scale (N=60)



Test Result Variable(s): BUN/Creatinine day 2				
Area Under the Curve	Std. Error	Asymptotic 95% CI for AUC		P value
		Lower Bound	Upper Bound	
.470	.089	.295	.645	.766
a. Under the nonparametric assumption				
b. Null hypothesis: true area = 0.5				

In our study on plotting ROC curve for BUN/creatinine for day 2, we observed Area under the curve to be (0.470) and have failed to have validated prediction in predicting worsening as far as neurological status was concerned.

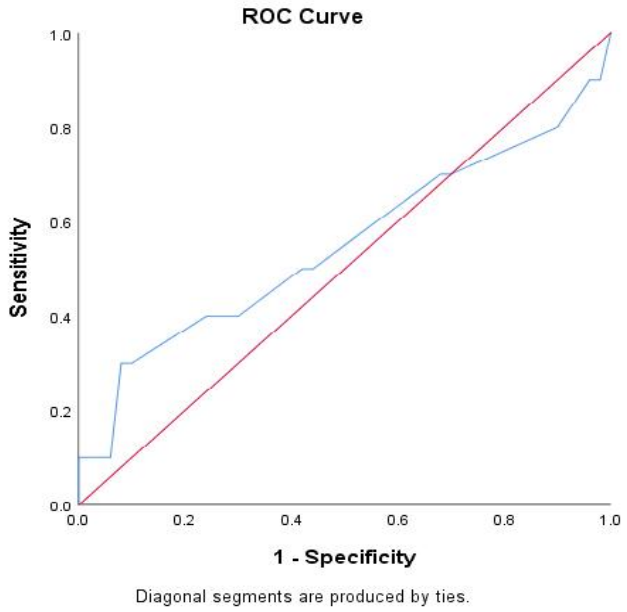
Table 33 (Figure 3): Receiver Operating Characteristics (ROC) Curve of BUN/creatinine ratio for day 3 as compared with National Institute Health Stroke Scale (N=60)



Test Result Variable(s): BUN/Creatinine day 3				
Area Under the Curve	Std. Error	Asymptotic 95% CI for AUC		P value
		Lower Bound	Upper Bound	
.431	.101	.234	.628	.494
a. Under the nonparametric assumption				
b. Null hypothesis: true area = 0.5				

In our study on plotting ROC curve for BUN/creatinine for day 3 we observed Area under the curve to be (0.431) and have failed to have validated prediction in predicting worsening as far as neurological status was concerned.

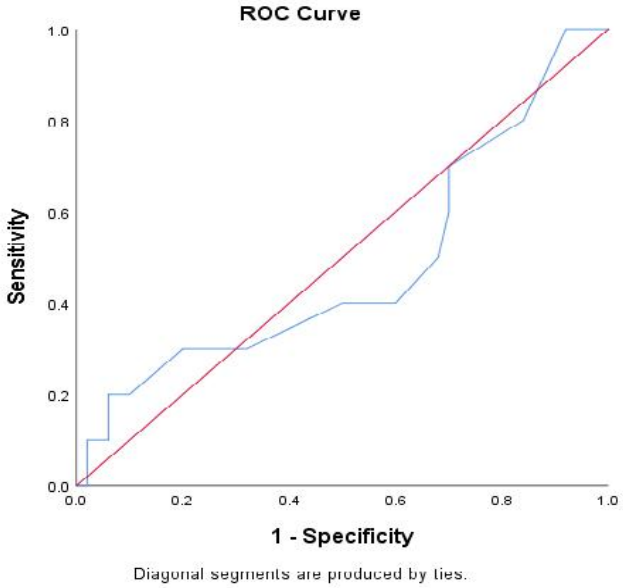
Table 33 (Figure 4): Receiver Operating Characteristics (ROC) curve of Urine Specific Gravity for day 1 as compared with National Institute Health Stroke Scale (N=60)



Test Result Variable(s): Urine Specific Gravity Day 1				
Area Under the Curve	Std. Error	Asymptotic 95% CI for AUC		P value
		Lower Bound	Upper Bound	
.549	.117	.320	.778	.627
a. Under the nonparametric assumption				
b. Null hypothesis: true area = 0.5				

In our study on plotting ROC curve for Urine specific gravity for day 1 we observed Area under the curve to be (0.549) and it was not showing any significant co-relation as far as worsening neurological status was concerned.

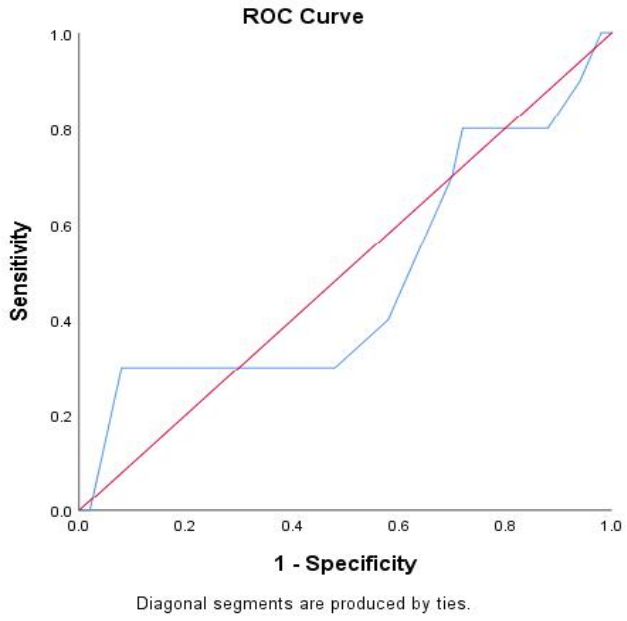
Table 33 (Figure 5): Receiver Operating Characteristics (ROC) curve of Urine Specific Gravity for day 2 as compared with National Institute Health Stroke Scale (N=60)



Test Result Variable(s): Urine Specific Gravity Day 2				
Area Under the Curve	Std. Error	Asymptotic 95% CI for AUC		P value
		Lower Bound	Upper Bound	
.480	.108	.267	.693	.843
a. Under the nonparametric assumption				
b. Null hypothesis: true area = 0.5				

In our study on plotting ROC curve for Urine specific gravity for day 2 we observed Area under the curve to be (0.480) and again it did not have co-relation with worsening neurological state.

(Table 33) (Figure 6): Receiver Operating Characteristics (ROC) curve of Urine Specific Gravity for day 3 as compared with National Institute Health Stroke Scale (N=60)



Test Result Variable(s): Urine Specific Gravity Day 3				
Area Under the Curve	Std. Error	Asymptotic 95% CI for AUC		P value
		Lower Bound	Upper Bound	
.482	.112	.263	.701	.858
a. Under the nonparametric assumption				
b. Null hypothesis: true area = 0.5				

Similarly, on Day 3 Urine Specific Gravity by ROC curve which is shown in the above ROC curve did not co-relate with neurological worsening.

DISCUSSION:

In the present study maximum number of patients were in the age group ≥60 years that is 31 patients (51.70%) , 16 patients(26.7%) were in the age group of 51-60 years,7 patients (11.7 %) were in the age group of (41-50) years , 2patients(3.3%)in the age group of (31-40) years and only 4patients (6.7%) were in the age group of (21-30) years. The youngest patient was 21 years old and the oldest was 90 years. The mean age was 61.02±15. 9 years. A study by Davalos[45] .et al though the mean age group in their study was almost similar to our study but their study population was 615 patients. Similarly, in a study by Kunal Bhatia et al[1] in their 114 patients, the mean age group was 56 ± 10.6 years.

In the present study out of 60 cases, 41 patients (68.3%) were males and 19 patients (31.7%) werefemales. There was male preponderance with male: female ratio of 2.15:1. A study by Jon Shrock et al[50] in their study of 32 patients did not have a difference as far as gender was concerned (equal number of patients in both gender).

The clinical presentation of our 60 patients, 14 patients (23.37%)each had speech disturbances, altered sensorium, vomiting and giddiness. 12(20%) patients had headache, few patients had overlapping symptoms which is not depicted in Table no 3. A study by Toni Fiorelli et al[51] have taken into consideration the neurological complaints and deterioration in their study population whereas in our study we have just taken the presentation at arrival. A study by Davalos et al[45] have also taken deterioration in neurological status of the patients but not mentioned the presenting neurological complaints.

Similarly, we attempted to categorize a patient with neurological signs at presentation and found to have 59 patients (98.3%) had limb weakness, cranial nerve involvement in 16patients (26.7%) and 41 patients (68.3%) had signs of upper motor neuron lesion. Few

patients had overlapping neurological signs not depicted in the table.4. A study by Toni Fiorelli et al[51] in their study population 19 patients (49%) had limb weakness and 12 patients (35%) had speech impairment. Most of the studies have taken worsening neurological signs during their study period but not taken separately neurological deficit at the time of presentation.

In our 60 patients, Majority i.e. 37 patients (61.7%) had hypertension as a comorbidity,5 patients (8.3%) had coronary artery disease, remaining 18 patients (30.00%) did not have any co-morbid conditions. A study by Jon W Schrock et al[50] in their study population,hypertension was noted in 244 patients (75%) dyslipidemia in 147 patients (45%), Atrial fibrillation in 49 patients (14 %), Coronary artery disease in 87 patients (27%), Diabetes Mellitus in 106 patients (33%).The sample size in their study was 324 patients. Similarly, a study by Davalos et al[45] have found hypertension in 102 patients (44%), Diabetes mellitus in 41 patients (13%), Coronary artery disease in 67 patients (29%), Congestive cardiac failure in 18 patients (8%), Atrial Fibrillation in 59 patients (29%) in their sample size of 615 patients. This difference in comorbid conditions in their study when compared to our study could be because of the small sample size in our study population.

In our present study of 60 patients, 24 patients (40.00%) were chronic tobacco chewers, 23 patients (38.3%) were alcoholics, and 2 patients (3.3%) were smokers, 9 patients (15%) had history of both tobacco chewing and smoking ,11 patients (18.33%) did not have any habits. Study by Toni Fiorelli et al[51], Wei Chun et al and Kunal Bhatia et al[1] have collected only smoking history in their study population, they have not addressed alcohol and chewing tobacco habits in their study population.

In our study population ,23 patients (28.3%) were Non hypertensive, of these 10patients (12.30%) presented with elevated blood pressure at arrival to the hospital. Remaining 13 patients (56.6%) had normal blood pressure recordings. Similarly, in hypertensive patients i.e. 37 patients (61.67 %), 15patients (25%) had controlled blood pressure at the time of presentation whereas 22patients (36.66%) had uncontrolled blood pressure at the time of presentation.

We attempted to find Mean Blood pressure of all 60 patients of our study population and found to have systolic minimum of 120 mmHg and maximum of 190 mmHg. The mean of systolic BP was 148.83± 15.95 mmHg. Similarly, diastolic BP minimum was 70 mmHg and maximum was 120 mmHg and mean was 92.87± 11.77 mmHg. A study by Kunal Bhatia et al[1] in their study observed a mean blood pressure of systolic BP of 155.4 ± 27.1 mmHg and diastolic of 90.4 ± 12.8 mmHg. The slight difference in mean blood pressure in our study (number of patients=60) and their study (number of patients =114) could be the reason. Another study by Davalos et al[35] (Number of patients= 615) found mean systolic of 154.2 ± 22.2 mmHg and diastolic blood pressure of 87.6 ± 11.4 mmHg.

We tried to categorize our patients based on NIHSS scoring on all 3 days and the observations we made has been shown in table 9. We did not find any significant correlation in deterioration in our patients based on this scoring (reason could be a small sample size). Most of the studies by Kunal Bhatia et al[1] and Davalos et al[45] have observed in their study population the deterioration based on NIHSS scoring in their patients at arrival with increasing score. They have not taken their patients into account day wise. Just they have stated that with increase in NIHSS scoring after arrival had deterioration in neurological status in their patients.There is a difference in the sample size in both the studies (KunalBhatia =114 patients and Davalos = 615).

Based on severity of stroke according to NIHSS score, we found maximum number of patients in the moderate group i.e. 29 patients (48.30%) , 13 patients (21.70%) were in severe group(21-42) , 8 patients (13.30%) were in Minor (1-4), 7 patients (11.70%) were in Moderately-Severe (6-20) and 3 patients (5.00%) were in moderate-severe group.Similarly,study by Kunal Bhatia et al.[1] have only compared stroke severity based on NIHSS and found to have NIHSS of >12 as an independent predictor of END, they have not distributed the patients according to NIHSS.

LAB PARAMETERS

In our study of 60 patients Blood urea was estimated day wise as depicted in table .11 and it was found to have mean of 30.84 ± 15.32 mg/dl on Day 1, 27.47 ± 14.38 on day 2 and 28.43 ± 14.93 on day 3. We did not find any significant observation in our patient day wise. A similar study by Anne Rowat et al[49] have compared Median blood urea in hydrated and dehydrated patients, they have not done estimation of Blood urea day wise.

All our 60 patients were subjected to Blood urea nitrogen estimation day wise and found to have results which are shown in Table 12 with mean of 14.41 ± 7.16 mg/dl on day 1, 12.88 ± 6.72 mg/dl on day 2 and 13.27 ± 7.06 mg/dl on day 3.We did not find any significant correlation in our patients' day wise. Studies by Kunal Bhatia et al[1] have not compared the estimation of Blood urea nitrogen (day wise) but they have compared mean BUN levels with patients worsening in neurological status and in those patients, they have found to have mean of Blood urea nitrogen of 15.9± 3.18 in their study population. Similarly study by Zhu Shi et al[57] who found Blood urea nitrogen meanof 14.6± 3.4 in those patients who worsened neurologically. We have not taken Blood urea nitrogen in our study with the worsening neurological status

reason being Blood urea nitrogen is not a true reflector of neurological worsening when taken alone.

Day wise Serum Creatinine was estimated in all 60patients and found to have mean of 0.94±0.336 mg/dl on Day1, 0.91±0.339 mg/dl on Day2 and Day3 0.89±0.34 mg/dl which is shown in Table13. Here also we are of the opinion, that serum creatinine alone did not reflect neurologic worsening in our study population. Study by Zhu Shi et al.[57] have found similar observation with a mean of 0.95±0.19 mg/dl in patients with worsening neurologic status as compared to non-worsening group of 0.96 ± 0.16 mg/dl.

Similarly, we compared Blood urea nitrogen / Creatinine ratio day wise and found to have a mean 16.02 ±7.35 on day1, 14.62±6.45 on day2 and 15.95±8.98 on day3. Study by Kunal Bhatia et al.[1], have found day wise blood urea nitrogen / creatinine ratio: Day1 21.1 ±5.3, 22.0±6.1 on day2 and on day3 22.1±5.8 in those patients who worsened neurologically and in those patients who did not have worsening the BUN/Creatinine ratio was 16±2.8 on day1, 16.4±2.9 on day2 and 16.6±2.8 on day3. They found significant correlation in their study population of 114 patients. In our further discussions we have highlighted correlation between BUN/Creatinine ratiowith NIHSS Score.

Urine specific gravity day wise in our 60 patients is depicted in Table 15. We have attempted to show the urine specific gravity day wise. We would like to state the comparison of the same with NIHSS score in further discussions. Study by Kunal Bhatia et al[1]., day wise urinary specific gravity showed significant correlation in their study group.

Similarly, comparison of Age with NIHSS score did not have any significance in our study group as shown in Table16. Study by Kunal Bhatia et al[1], also did not find any correlation between age and NIHSS scoring. Another study by Davalos et al[45], also did not find any correlation of age with the NIHSS scoring in their study population. In our present study of 60 patients we did not find correlation of neurological worsening with advancing age (based of NIHSS) as was observed by some authors. This we feel could be because of a small sample size in our study or could be as we have not stated the issue of dehydration in our patients. In patients with advancing age, neglected hydration with acute neurological insults could be one of the factors for deterioration in neurologicalstatus. The reason of dehydration in elderly patients could be many like a) = Drugs (diuretics), b) =Diabetes Mellitus and c) =Blunted thirst response due to age as well as due to acute neurological insult.

We did not find any significance in comparison of sex with NIHSS scoring in our study (p value being 0.480) (Table 17). Similarly, studies by Kunal Bhatia et al.[1], and Davalos et al[45], did not find any correlation between sex and NIHSS scoring. In our study number of male patients with stroke were more as compared to females.We did not find any difference in neurological deterioration based of NIHSS scoring with gender as some authors have found the incidence of stroke as well as worsening in their neurological state in post-menopausal women. This could be because of circulating ovarian hormones particularly estrogens. Sex hormones play an important role in vessel wall reactivity of cerebral vasculature. It has been observed that testerone and estrogen have opposite effect on reactivity of cerebral vasculature as estrogen has a vasodilatory effect which may counter the effect of other vasoconstrictor substances.

We also attempted comparison of clinical presentation with NIHSS scoring, with/without symptoms like headache, vomiting, giddiness, impaired consciousness and speech disturbances. We did not find any correlation (Table 18). Most of the authors have not compared the clinical presentation with NIHSS scoring in their study. Similarly, in our study group we did not have much reflection of patient's comorbid conditions prior to the stroke as well as their habits (smoking, alcohol, tobacco chewing). Some authors have found correlation with comorbid condition like hypertension and habits like tobacco use in their study. Patients with comorbid conditions like hypertension prior to the stroke could be the reason for stroke as well as deterioration in neurological status because of dysregulation of autoregulation in these individuals. In our study we had small number of Coronary artery disease patients (5 patients) but no correlation was found withtheir worsening neurological state. The reason for this could be patients with Coronary artery disease may as well have associated atherosclerotic disease of cerebral vessels that could influence their neurological state which was observed by some authors in their study, whereas we did not observe it since we had only 5 patients in our study.

Similarly, we attempted to compare, neurological signs with NIHSS scoring and found to have no significance (Table 19). Most authors have not compared neurological signs with NIHSS scoring.

Comparison of comorbid conditions with NIHSS scoring did not have bearing on their worsening neurological status (Table.20). Study by Kunal Bhatia et al[1], Davalos et al[45], did not find any correlation with comorbid conditions with worsening neurological status of their patients.

We took patients habits into consideration with NIHSS scoring system and found no correlation. Study by Dunilo Toni et al[51]., and Kunal Bhatia et al[1], also did not find correlation with worsening neurological status with habits. But in their study group, all patients were smokers unlike in our patients who were smokers, alcoholics and tobacco chewers (Table6).

Comparison of hypertension alone with NIHSS scoring, in our patients we did not find any correlation (Table.22). Most of the studies by (Kunal Bhatia et al[1], Lin LC et al[54], and JaumeRoquer et al[48].) also did not find any correlation with hypertension in their study group.

Comparison of Blood Urea levels day wise as well as all 3 days with NIHSS scoring did not find any significant correlation. Most of the authors have not compared blood urea levels day wise with NIHSS score. (table23,24). Study by Anne Rowat et al[45]. did not find any correlation of blood urea with NIHSS scoring in their study population. Similarly, we attempted to correlate the levels of blood urea with NIHSS scoring and found no correlation in our study. Some authors have found correlation of blood urea rising levels with worsening of patient's neurological status in their study group, the reason could be for this, in hypovolemic patients there is a reabsorption of water by the nephrons, leading to increase tubular urea concentration. The other reason could be during hypovolemic states due to dehydration (the levels of vasopressin is increased and as a result of this water is maximally reabsorbed.as a consequence, the medullary interistial urea concentration rises. Because of this increased concentration gradient for passive transport of urea in collecting duct system. This is because of direct effect of vasopressin on colleting ducts which may upregulate its expression. Due to this reason in patients who aredehydrated, has

reflection on increased urea concentration in medullary interstitiumi.e. vasopressin mediated elevation in urea reabsorption in the collecting duct.

Comparison of Serum creatinine day wise as well as all 3days together did not have correlation with NIHSS scoring as depicted in Table25 and 26. Most of the authors (Zhu Shi et al[57], and Anne Rowat et al[45].) have not found any correlation of Serum creatinine with NIHSS scoring. To our best of knowledge, we did not find any suitable explanation for rise in serum creatinine with worsening neurological states.

Comparison of BUN day wise as well as all 3 days together did not have correlation with NIHSS score as depicted in (Table number 27 and 28). Most of the authors (Zhu Shi et al[57] and Anne Rowat et al[45]) have not found any correlation of BUN with NIHSS score. In our study this may be because of small sample size or could be because of some unknown factors which we are not able to state but some authors have found some correlation of BUN with neurological worsening in their study population the reason for this could be rising BUN may have direct effect in hemodynamic deterioration which could in turn reflect on outcome of these patients of neurologicalinsult. The other reason could be sympathetic nervous system mediated urea reabsorption may contribute to rising blood urea levels in these patients of Acute ischemic stroke which may reflect on their increased mortality and this could be the important factor for neurological worsening and mortality in these patients of acute ischemic patients.

Comparison of BUN/Creatinine ratio with NIHSS score day wise as well as all 3 days togetherin our study did not find any correlation (Table 29 and 30) (P value 0.0324 was statistically insignificant). Studies by Kunal Bhatia et al[1], (114 patients) Zhu Shi et al[57], (244 patients) have found correlation of BUN/Creatinine ratio in their

study population this could be because of their sample size. Same authors have found correlation in their study population as compared with our study as we have not taken hydration status of our patients. Dehydration could have a negative impact on development of collateral vessels and also dehydration may affect cerebral collateral circulation. The evidence from this remain unelucidated. Once there is a major artery occlusion responsible for Acute ischemic stroke, the pressure distal to occlusion could fall immediately. As it is well known, dehydration increases the blood viscosity which would in turn reflect on cardiac stroke volume, decreased blood pressure and decreased cerebral perfusion. In animal model studies it is revealed that dehydration is known to produce decreased blood flow in cerebral arteries. The hydration status of patients is very important as dehydration may lead to ineffective development of collaterals which could reflect on overall cerebral blood flow, pressure and its perfusion. In acute ischemic stroke the neurological damage is not uniform and blood supply gets arrested due to acute block for at least first few hours of stroke. Therefore, factors like hydration of patients, development of collaterals, all influence the outcomes of these patients.

Comparison of Urine specific gravity day wise as well as 3days together did not show any significant correlation with NIHSS scoring in our study group. Studies by LC Lin et al[55]., (317 patients), Kunal Bhatia et al[1], (114 patients) and Zhu Shi et al[57]., (244 patients) have found correlation of urine specific gravity with NIHSS scoring in their study population. We feel this difference could have been because of sample size or maybe because of estimation of urine specific gravity by different methodologies and subjecting their patients to all these methods and taking into account with confidence interval of 95% for estimation of urine specific gravity like (urine test strips, refractometry and urine color of specimen) whereas in our study

population we have used only refractometry for estimation of Urine specific gravity in our 60 patients. Taking USG into consideration in our study population also did not show positive correlation (p value was 0.167 which was statistically insignificant).Again, we feel here, the hydration status of patients would have a direct influence on USG, whereas in our study we have not found a direct influence on the USG as we have not studied the hydration status of our patients on their arrival. Though USG is not a sensitive index to state a reflection of neurological deterioration in patients of Acute Ischemic Stroke as compared with BUN/Creatinine ratio reason for this could be in the setting of dehydration the changes in BUN/Creatinine ratio comes before the changes in USG which will ensue in due course of time.

Finally we attempted to compare the two parameters (BUN/Creatinine ratio and urine specific gravity) by plotting ROC curves day wise for these two parameters and comparing it with area under the curve and found to have following area under the curves: Day 1: 0.538 and 0.549 respectively, Day2: 0.470 and 0.480 respectively and for Day3: 0.431 and 0.482 respectively. From the above charting of ROC curve with AUC revealed no validated prediction in predicting worsening as far as neurological status was concerned. Most of the authors have not plotted ROC curve for their study population.

We feel it is worthwhile taking a large sample size of patients with Acute ischemic stroke and comparing it with various variables like age, sex, comorbid conditions, habits and hydration status of these patients which could have bearing in their neurological status as well as worsening. A simple laboratory tool i.e. BUN/Creatinine ratio can be done even in small settings as well as peripheral centers which may help us in dividing the Early Neurological deterioration and their outcome.

In our present study though we did not find any positive correlation with any of these variables, may be owing to small number of study patients (60 patients) or may be because we have not taken the hydration status of our patients into account on arrival which has got a direct effect on variables like urea, creatinine, BUN/Creatinine ratio as well as USG of the patients.

CONCLUSIONS:

In the present study of 60 patients with Acute ischemic stroke, we observed insignificantcorrelation with BUN/Creatinine ratio and Urine specific gravity. Based on findings of this study prominent features are mentioned below.

Among the patients with first episode of acute ischemic stroke maximum number of patients were in the age group of ≥ 60 yearsi.e. (31 patients).

Though males were more in number as compared to females but there was no conclusion drawn on the whether genderdifference influencing the stroke and its outcome.

The common clinical presentation wereneurodeficits, cranial nerve palsy followed by speech disturbances, vomiting and impaired consciousness.

Hypertension and coronary artery disease were insignificant comorbid condition in our study.

Despite tobacco chewing and alcoholism which were common in our study group, it did not show any bearing on the outcome.

On comparing different lab parameters like urea, creatinine, BUN/Creatinine ratio and Urine specific Gravity with NIHSS scoring did not have significant correlation as far as patient outcome was concerned.

Though hydration of the patients at arrival had influence on different lab parameters (urea, creatinine, BUN/Creatinine ratio and Urine specific gravity) which was not taken into account in our present study.

To overcome biases like age, gender, habits, comorbid condition like hypertension we noticed it is worth to consider these factors with large sample size along with lab parameters like Urine specific gravity and BUN/creatinine ratio to find out the correlation with early neurological deterioration.

SUMMARY

The present study was undertaken to know various demographic factors, clinical features, lab parameters and NIHSS scoring and the same were compared with various factors like age, sex, clinical presentation and neurological signs, comorbid conditions, habits, and lab parameters (urea, creatinine, BUN/Creatinine and Urine specific gravity) with NIHSS scoring. The present study was conducted on 60 patients who presented with Acute Ischemic Stroke in KLES Dr. Prabhakar kore and Medical research Centre, Belagavi during period of January 2018 to December 2018.

Stroke was common in the age group of ≥ 60 years.

Male patients were more i.e. 41 (68.3%) than female patients were 19 (31.7%). Male preponderance was seen with Male to Female ratio of 2.15:1.00

Hypertension was seen in 37 patients, Coronary artery disease in 5 patients and remaining 18 patients did not have any comorbid conditions. No patients had diabetes mellitus in our study group.

Hypertension and coronary artery disease did not have any significant correlation on the outcome in our study

Lab parameters like Blood urea, Serum creatinine,Blood urea nitrogen, BUN/ Creatinine ratio and urine specific gravity did not show any correlation with the outcome.

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ANNEXURE I – CONSENT FORM

Title Of Research Study: ESTIMATION OF BLOOD UREA NITROGEN/CREATININE RATIO AND URINE SPECIFIC GRAVITY TO ASSESS DEHYDRATION AS A PREDICTOR OF OUTCOME IN ACUTE ISCHEMIC STROKE PATIENTS- ONE YEAR HOSPITAL BASED CROSS SECTIONAL STUDY.

Principal Investigator: - **Guide: -**

Introduction and Purpose: - Patients with stroke associated with dehydration are at increased risk of early neurologicaldamage. Early Neurological deterioration occurs in about 20 to 40% of these patients and results in functional disability and mortality. Early neurological deterioration is defined as worsening of neurological condition as indicated by an increase in NIHSS score by 3 or more points Within first 3 days. Early identification of dehydration is essential for timely intervention to improve outcome of stroke in evolution patients.

Procedure: If you agree to be part of the research study, you will be asked the relevant history and will be subjected to relevant clinical examination and investigations. You will also have to give blood and urine samples for the necessary investigations.

Risk and Benefits: The only risk and possible discomfort you might get is while taking blood from your arm for the investigations. It may cause swelling, pain, redness (rarely happens) at the site from where the blood is drawn.

You may not be benefitted by these investigations but you will be part of this study which is going to be useful to others in the future.

Alternatives: Taking part in this study is voluntary. You may choose not to take part in this study.

If you decide to take part you can later change your mind and withdraw from the study. Your decision will not change the present or future health care or other services that you receive. The study doctor or sponsor may stop your participation in this study at any time. If you choose not to take part in the study, you will receive the standard treatment for patients with your condition.

Privacy and Confidentiality: All information collected about you during the course of this study will be kept confidential to the extent permitted by law. The code numbers will identify you in this research record. Information from this study may be published but your identity will be confidential in any publication.

Institution / Sponsor's policy:

Does not apply to this research

Financial incentives for participation: You will not be paid / offered any gifts /incentives for participating in the study.

Authorization to publish the results: The results of the study would be forwarded to the KLE University, Belgaum as part of requirement towards the completion of MD degree, review and publishing.

In case of the queries during study or in future you may contact following persons,

1. Dr. Roopa M.Bellad, Chairman, J.N.M.C Ethical Committee for Human Research.

CONSENT FORM

I voluntarily agree to take part in this study by signing below. I may withdraw at any time. I am not giving up any of my legal rights by signing this form. My signature below indicates that I have read this consent form, or it has Been read to me, this consent form and have had all the questions answered

Signature / Left Thumb print of the Participant or legally authorized representative

Participant's name ……...

Signature / Left thumb impression……...

of the participant

Name of the legally authorized :……...

representative / guardian

Signature / Left thumb impression :……...

Witness' name :……...

Signature / Left thumb impression :……...

Investigator's name and signature :……...

Date

ANNEXURE-II

PROFORMA

CASE NO:

NAME:

AGE/SEX:

IP NO.:

ADDRESS:

OCCUPATION:

COMPLAINTS AT PRESENTATION:

Past history:

Family history:

Personal history:

Treatment history

PHYSICAL EXAMINATION:

GENERAL CONDITION:

PALLOR-

ICTERUS-

LYMPHADENOPATHY-

CYANOSIS-

CLUBBING-

EDEMA-

VITALS:

TEMPERATURE-

PULSE-

RESPIRATORY RATE-

BLOOD PRESSURE (in mm hg)-

SYSTEMIC EXAMINATION:

Respiratory System.:

Cardiovascular System.:

Per Abdomen:

Central Nervous System:

INVESTIGATIONS

HB:

TLC:

DLC:

PLATELET COUNT:

Day	1	2	3	DISCHARGE

SERUM CREATININE:

BLOOD UREA:

URINE SPECIFIC GRAVITY

Medscape® www.medscape.com

Category	Score/Description		Date/Time Initials	Date/Time Initials	Date/Time Initials	Date/Time Initials	Date/Time Initials
1a. Level of Consciousness (Alert, drowsy, etc.)	0 = Alert 1 = Drowsy 2 = Stuporous 3 = Coma						
1b. LOC Questions (Month, age)	0 = Answers both correctly 1 = Answers one correctly 2 = Incorrect						
1c. LOC Commands (Open/close eyes, make fist/let go)	0 = Obeys both correctly 1 = Obeys one correctly 2 = Incorrect						
2. Best Gaze (Eyes open - patient follows examiner's finger or face)	0 = Normal 1 = Partial gaze palsy 2 = Forced deviation						
3. Visual Fields (Introduce visual stimulus/threat to pt's visual field quadrants)	0 = No visual loss 1 = Partial Hemianopia 2 = Complete Hemianopia 3 = Bilateral Hemianopia (Blind)						
4. Facial Paresis (Show teeth, raise eyebrows and squeeze eyes shut)	0 = Normal 1 = Minor 2 = Partial 3 = Complete						
5a. Motor Arm - Left **5b. Motor Arm - Right** (Elevate arm to 90° if patient is sitting, 45° if supine)	0 = No drift 1 = Drift 2 = Can't resist gravity 3 = No effort against gravity 4 = No movement X = Untestable (Joint fusion or limb amp)	Left					
		Right					
6a. Motor Leg - Left **6b. Motor Leg - Right** (Elevate leg 30° with patient supine)	0 = No drift 1 = Drift 2 = Can't resist gravity 3 = No effort against gravity 4 = No movement X = Untestable (Joint fusion or limb amp)	Left					
		Right					
7. Limb Ataxia (Finger-nose, heel down shin)	0 = No ataxia 1 = Present in one limb 2 = Present in two limbs						
8. Sensory (Pin prick to face, arm, trunk, and leg - compare side to side)	0 = Normal 1 = Partial loss 2 = Severe loss						
9. Best Language (Name item, describe a picture and read sentences)	0 = No aphasia 1 = Mild to moderate aphasia 2 = Severe aphasia 3 = Mute						
10. Dysarthria (Evaluate speech clarity by patient repeating listed words)	0 = Normal articulation 1 = Mild to moderate slurring of words 2 = Near to unintelligable or worse X = Intubated or other physical barrier						
11. Extinction and Inattention (Use information from prior testing to identify neglect or double simultaneous stimuli testing)	0 = No neglect 1 = Partial neglect 2 = Complete neglect						
	TOTAL SCORE						

INITIAL	SIGNATURE	INITIAL	SIGNATURE	INITIAL	SIGNATURE

Source: J Neurosci Nurs © 2006 American Association of Neuroscience Nurses

ANNEXURE-III- ETHICAL CLEARANCE LETTER

K.L.E.UNIVERSITY'S
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)
(Accredited 'A' Grade by NAAC)

Website: http/ www.jnmc.edu
E-Mail : dome@jnmc.edu

Phone: (+ 91-(0)831 Office : 2471350
Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref: MDC/DOME/ 45 **Date: 22/11/2017**

To.

REG NO: BG0117002

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"BLOOD UREA NITROGEN/ CREATININE RATIO AND URINE SPECIFIC GRAVITY IN ACUTE ISCHEMIC STROKE PATIENTS AS A PREDICTOR OF EARLE NUEROLOGICAL DETERIRATION – ONE YEAR HOSPITAL BASED CROSS SECTIONAL STUDY",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Arathi Darshan)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Roopa M Bellad)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

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S. No	IP Number	Name	Age	Sex	Clinical Presentation					Signs			Risk Factors						Blood Pressure		NIHSS Scoring				Urea			Blood Urea Nitrogen			Urine Specific Gravity			creatinine			BUN/creat		
					Headache	Vomiting	Giddiness	Impaired Consciousness	Speech Disturbances	Weakness	Cranial Nerve Involvement	Plantars	Hypertension	Coronary Artery Disease	Alcohol	Smoking	Tobacco Chewer	Systolic	Diastolic	Day 1	Day 2	Day 3	Severity	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	day 1	day 2	day 3	day 1	day 2	day 3
1	910353	NARENDRA KAUR	70	F	+	+	+	-	-	+	+	↑↑	YES	-	YES	-	NO	140	100	14	14	10	moderate	59	62	66	27.57	28.97	30.8	1.02	1.022	1.028	1.88	1.77	0.98	14.66	16.4	31.5
2	910280	ASHOK INGALAGI	59	M	-	-	+	-	-	+	-	↓↓	YES	-		-	YES	150	100	12	11	12	moderate	27	15	10	12.61	7	4.67	1.012	1.02	1.022	0.98	0.91	0.95	12.86	7.69	4.91
3	3658141	GANGABAI DHAVALE	79	F	-	-	-	-	-	+	+	↓↑	YES	-	YES	-	NO	130	80	14	13	10	moderate	30	26	25	14.01	12.14	11.7	1.008	1.012	1.011	0.92	0.74	0.96	15.22	16.4	12.2
4	909514	BASAPPA NESARGI	68	M	-	-	-	-	-	+	-	↓↑	NO	-	NO	-	YES	140	90	28	27	26	severe	15	27	30	7.01	12.61	14	1.01	1.018	1.022	0.34	0.52	0.65	20.61	24.3	21.6
5	909054	ASIF IMTYIAZ	21	M	-	-	+	+	+	+	-	↓↑	NO	-	NO	-	YES	170	110	17	18	18	moderate-severe	13	15	20	6.07	7.01	9.34	1.012	1.022	1	0.85	0.75	0.8	7.14	9.35	11.7
6	908773	PARVATHI BHOOLAPUR	86	M	-	-	-	-	-	+	-	↓↓	NO	-	NO	+	NO	160	100	8	7	6	minor	30	32	35	14.01	14.95	16.4	1.02	1.018	1.022	0.92	0.74	0.96	15.23	20	17
7	908968	NEELAWWA KATRAL	65	F	-	-	-	-	-	+	-	↑↓	YES	-	YES	-	NO	130	80	17	16	14	moderate	10	8	12	4.67	3.73	5.6	1.01	1.012	1.008	0.93	0.9	0.8	5.02	4.14	7
8	909061	REVAPPA HUDDAR	68	M	-	-	+	+	+	+	-	↑↓	NO	-	YES	-	NO	140	90	5	6	8	minor	30	31	34	14.01	14.48	15.9	1.005	1.01	1.016	0.8	1.1	1.15	17.51	13.2	13.1
9	901994	BALU BHOSALE	58	M	-	+	-	+	+	+	-	↓↑	YES	-	NO	-	YES	150	90	26	26	25	severe	34	36	40	15.88	16.82	18.7	1.015	1.018	1.02	0.55	0.6	0.72	28.87	28	26
10	944260	VITHAL RANE	87	M	-	-	-	-	-	+	-	↓↑	YES	-	YES	-	NO	140	90	36	36	36	severe	34	26	20	15.88	12.14	9.34	1.008	1.01	1.016	0.84	0.69	0.5	18.90	17.59	18.68
11	910659	PANDURANG BHAVIKATTI	72	M	-	+	-	+	+	+	+	↓↑	YES	-	YES	-	YES	150	100	16	14	16	moderate-severe	34.6	21	20	16.16	9.81	9.34	1.006	1.01	1.016	0.82	0.76	0.7	19.71	12.91	13.34
12	910706	ANAND MUNDINMANI	71	M	-	-	-	-	-	+	-	↓↓	YES	-	NO	-	NO	120	70	5	6	9	minor	32	26	20	14.95	12.14	9.34	1.015	1.015	1.016	1.1	1.09	1.02	13.59	11.14	9.16
13	911340	BASAVVA MUGALI	65	F	-	-	-	+	+	+	-	↓↓	NO	-	NO	-	NO	180	110	5	5	5	minor	21	15	12	9.81	7.01	5.6	1.016	1.018	1.02	1.34	1.28	1.14	7.32	5.48	4.91
14		NIKHIL JADHAV	25	M	+	+	-	-	-	+	-	↓↑	YES	-	NO	-	NO	160	90	26	25	24	severe	11	13	17	5.14	6.07	7.94	1.025	1.023	1.02	0.73	0.71	0.66	7.04	8.55	12.03
15	906365	SUSHILA BASTAWADE	69	F	-	-	-	-	-	+	-	↓↑	NO	-	NO	+	NO	130	80	6	7	3	minor	11	11	40	5.14	5.14	18.7	1.012	1.01	1.016	0.27	0.27	0.36	19.04	19.04	51.94
16	922743	VIRUPAXAYA TELASANG	82	M	+	-	-	+	+	+	+	↑↑	YES	-	NO	-	YES	180	120	15	17	18	moderate	36	25	18	16.82	11.68	8.41	1.008	1.01	1.005	0.89	0.88	1.84	18.90	13.27	4.57
17	934967	SHAGUFTA SANGLIKAR	40	F	+	-	-	-	-	+	-	↓↑	YES	-	YES	-	YES	150	90	10	4	4	severe	24	31	31	11.21	14.48	14.5	1.01	1.015	1.021	1.16	0.75	0.37	9.66	19.31	39.14
18	905875	CHIDAMBAR KALLUR	65	M	-	-	-	+	+	+	+	↓↓	YES	-	YES	-	NO	160	100	16	14	13	moderate-severe	21	17	15	9.81	7.94	7.01	1.008	1.005	1.01	0.89	0.95	1.03	11.02	8.36	6.81
19	5079961	UDAY CHOUGALA	53	M	-	-	-	-	-	+	-	↑↓	YES	-	YES	-	YES	140	90	10	10	8	moderate	19	12	10	8.87	5.6	4.67	1.014	1.015	1.016	0.99	0.97	1.03	8.96	5.77	4.53
20	920275	T DAVID THAYAPPA	53	M	-	-	-	-	-	+	+	↓↑	YES	-	NO	-	NO	170	100	19	20	20	moderate-severe	67	61	48	31.3	28.5	22.4	1.01	1.012	1.018	1.04	1.06	1.04	30.10	26.89	21.56
21	919688	SARALADEVI PATIL	90	F	-	-	-	-	-	+	-	↓↑	YES	-	NO	-	NO	150	90	12	13	12	moderate	27	16	17	12.61	7.47	7.94	1.012	1.016	1.02	1.75	2.1	1.89	7.21	3.56	4.20
22	944677	MAHADEVI NAVI	60	F	-	+	-	-	-	-	+	↑↑	YES	-	NO	-	NO	120	80	9	10	10	moderate	34	28	16	15.88	13.08	7.47	1.03	1.028	1.032	0.83	0.6	0.45	19.13	21.80	16.60
23	918698	KHUTUJA KIRANAGI	85	F	+	+	-	-	-	+	-	↓↑	YES	-	YES	-	NO	170	100	9	11	4	moderate	57	15	10	26.63	7.01	4.67	1.02	1.012	1.008	0.67	0.56	0.42	39.75	12.52	11.12
24	918567	SHANTA MALALI	60	F	-	-	-	-	-	+	+	↑↑	YES	-	NO	-	NO	150	90	9	8	7	moderate	47	20	20	21.96	9.34	9.34	1.012	1.01	1.016	0.68	0.59	0.47	32.29	15.83	19.87
25	918619	RAJESAB NAVALI	54	M	-	-	-	+	+	+	-	↓↑	YES	-	NO	-	YES	140	80	12	10	10	moderate	25	10	19	11.68	4.67	8.87	1.01	1.016	1.03	0.52	0.45	0.45	22.46	10.38	19.71
26	917705	MOHAMMED MULLA	40	M	-	+	-	-	-	+	-	↓↓	YES	-	NO	-	YES	140	90	31	30	31	severe	50	54	39	23.36	25.23	18.2	1.028	1.034	1.028	1.47	1.04	0.89	15.89	24.26	20.47
27	914439	LAKAVVA MAHISHAWADAGI	65	F	-	-	-	-	-	+	-	↓↑	NO	-	NO	-	NO	130	80	12	10	10	moderate	56	27	28	26.16	12.61	13.1	1.015	1.014	1.011	0.73	0.75	0.72	35.84	16.81	18.17
28	915756	SHRISHAIL VARMA	44	M	-	-	-	-	-	+	-	↓↓	NO	-	NO	-	NO	140	90	14	13	13	moderate	41	39	45	19.15	18.22	21	1.012	1.016	1.018	0.87	0.92	1	22.01	19.80	21.02
29	917700	SANJAY KAKADE	51	M	-	-	-	-	-	+	+	↑↓	YES	-	YES	-	YES	160	100	7	6	8	moderate	14	16	20	6.54	7.47	9.34	1.01	1.012	1.008	1.27	1.11	0.8	5.15	6.73	11.68
30	909196	RAVICHANDRA KURLI	29	M	-	-	-	+	+	+	-	↑↓	NO	-	NO	-	YES	150	90	18	16	13	moderate-severe	25	24	20	11.68	11.21	9.34	1.015	1.018	1.022	0.9	0.75	0.6	12.98	14.95	15.57
31	913028	RACHAYYA MATHAPATI	55	M	-	-	-	+	+	+	-	↓↑	YES	+	NO	-	YES	170	100	13	13	13	moderate	38	34	36	17.75	15.88	16.8	1.012	1.016	1.018	0.8	0.78	0.63	22.19	20.36	26.70
32	915939	MARUTI YADRANVI	42	M	-	-	-	-	-	+	-	↓↑	YES	+	NO	-	YES	190	120	4	4	4	minor	12	18	21	5.68	8.41	9.81	1.012	1.02	1.022	0.66	0.86	0.84	8.61	9.78	11.68
33	918115	RUKMAVVA JADINAVAR	70	F	+	+	-	-	-	+	-	↑↓	NO	-	NO	-	NO	180	120	23	23	23	severe	36	14	10	16.82	6.54	4.67	1.02	1.018	1.016	0.82	0.77	0.7	20.51	8.49	6.67
34	917575	MALAYYA GANACHARI	68	M	-	-	-	-	-	+	+	↓↓	YES	-	YES	-	YES	150	100	10	9	5	moderate-minor	18	12	10	8.41	5.68	4.67	1.018	1.02	1.022	0.93	0.77	0.8	9.04	7.38	5.84
35	919650	SHEKHAR MULGUND	58	M	-	-	-	-	-	+	-	↓↓	NO	-	NO	-	NO	140	90	21	21	22	severe	21	25	28	9.81	11.68	13.1	1.012	1.02	1.018	0.95	1	1.1	10.33	11.68	11.89
36	917455	PARSHWANATH SHETTI	87	M	+	+	-	-	-	+	+	↑↓	YES	-	YES	-	YES	150	100	9	8	6	moderate	24	21	18	11.21	9.81	8.41	1.01	1.008	1.012	1.52	1.27	1.25	7.38	7.72	6.73
37	918478	TULSIDAS KANEKAR	72	M	-	-	-	-	-	+	-	↓↓	YES	-	NO	-	NO	150	110	15	14	13	moderate	64	45	43	29.9	21.02	20.1	1.02	1.023	1.024	1.35	1.49	1.32	22.15	14.11	15.22
38	917456	SHIVANGOWDA PATIL	53	M	-	-	-	+	+	+	+	↑↓	NO	-	YES	-	YES	140	80	11	11	10	moderate	28	26	30	13.08	12.14	14	1.005	1.008	1.01	1.05	1.01	0.85	12.46	12.02	16.48
39	909479	MALAPPA MUGALAKHOD	55	M	-	-	-	-	-	+	+	↑↓	YES	-	YES	-	NO	140	90	10	11	10	moderate	27	11	16	12.61	5.14	7.47	1.01	1.012	1.018	0.73	0.58	0.72	17.27	8.86	10.38
40	917700	SANJEEV KAKADI	51	M	-	-	-	+	+	+	-	↓↓	YES	-	YES	-	NO	140	80	10	11	9	moderate	10	20	16	4.67	9.34	7.47	1.012	1.022	1.03	0.34	0.52	0.65	13.74	17.96	11.49
41	914430	SHIVKUMAR KONI	63	M	-	-	-	-	-	+	-	↑↓	YES	-	YES	-	NO	130	90	13	14	10	moderate	38	37	35	17.75	17.28	16.4	1.015	1.018	1.02	1.37	1.35	1.32	12.96	12.80	12.39
42	917378	VILAS GAWDE	52	M	-	-	-	-	-	+	-	↓↓	NO	+	NO	-	YES	130	90	23	21	21	severe	38	31	23	17.75	14.48	10.7	1.02	1.022	1.015	0.94	0.77	0.93	18.88	18.81	11.55

43	911863	GAJANAN JAGALE	45	M	-	-	-	-	-	+	-	↑↓	YES	-	YES	-	YES	150	100	11	12	15	moderate	81	74	75	37.85	34.57	35	1.01	1.0123	1.015	1.85	1.44	1.05	20.46	24.01	33.37
44	914048	IRRAPPA MAGI	47	M	-	-	-	-	-	+	-	↑↑	NO	-	YES	-	NO	140	90	10	11	14	moderate	36	40	45	16.82	18.69	21	1.012	1.022	1.03	0.82	0.9	0.95	20.51	20.77	22.13
45	913539	SARANGALA CHINIWALAR	76	F	-	-	+	-	-	+	-	↑↓	NO	-	NO	-	YES	150	100	20	21	22	moderate-severe	40	45	50	18.69	21.02	23.4	1.01	1.018	1.026	1.06	1.62	1.53	17.63	12.98	15.27
46	911268	SNEHAL KADAM	24	F	+	+	-	-	-	+	+	↑↑	NO	-	YES	-	NO	160	90	9	9	10	moderate	20	25	37	9.34	11.68	17.3	1.01	1.012	1.005	0.65	0.68	0.57	14.37	17.18	30.32
47	918967	BASTIN FERNANDIS	63	M	+	+	+	-	-	+	-	↓↓	NO	-	NO	-	NO	160	90	31	30	29	severe	29	37	40	13.55	17.28	21	1.02	1.018	1.016	0.95	1.07	1.1	14.26	16.15	19.11
48	917948	YALLUBAI HONGEKAR	76	F	-	+	+	-	-	+	-	↓↓	NO	-	YES	-	YES	150	100	13	11	12	moderate	34	51	60	15.88	23.83	28	1.012	1.008	1.005	1.26	1.64	1.88	12.60	14.53	14.91
49	917000	SUBBARAYADU CHANDRA	76	M	-	-	+	-	-	+	-	↓↓	NO	-	NO	-	NO	130	90	21	20	26	severe	15	17	31	7.01	7.94	14.5	1.025	1.027	1.03	0.72	0.71	0.88	9.74	11.18	16.45
50	909194	LAXMAN AINAPUR	50	M	-	-	-	-	-	+	-	↓↓	YES	-	YES	-	NO	130	90	12	12	12	moderate	31	40	53	14.48	18.69	24.8	1.02	1.015	1.022	1.02	1.15	1.31	14.20	16.25	18.90
51	909336	ANNAPPA GUJJANATTI	70	M	-	+	+	-	-	+	-	↓↓	YES	-	NO	-	NO	150	100	9	7	7	moderate-minor	31	28	25	14.48	13.08	11.7	1.015	1.02	1.022	0.97	0.79	0.6	14.93	16.56	19.47
52	917545	SARUBAI ADALLI	48	F	-	-	-	-	-	+	+	↓↑	YES	-	NO	-	YES	140	80	11	12	10	moderate-minor	27	30	45	12.61	14.01	21	1.03	1.015	1.01	0.69	0.8	1.12	18.28	17.51	18.77
53	909962	SONABAI BAGEWADI	70	F	+	-	-	-	-	+	-	↑↓	YES	-	YES	-	NO	150	80	14	14	15	moderate	26	30	42	12.15	14.01	19.6	1.012	1.022	1.028	0.57	0.68	0.82	21.32	20.60	23.93
54	910846	PUNDALIK MITAGAR	84	M	+	-	-	-	-	+	+	↓↑	YES	-	NO	-	YES	160	90	12	13	15	moderate-severe	55	41	34	25.7	19.15	15.9	1.012	1.014	1.018	1.6	1.27	1.23	16.06	15.08	12.91
55	5014546	HANAMAVVA BANDINAVVAR	65	F	-	-	-	+	+	+	-	↓↑	NO	-	NO	-	NO	150	70	24	23	15	severe	20	18	16	9.34	8.41	4.47	1.022	1.028	1.034	1	0.88	0.7	9.34	9.56	6.39
56	4740696	MUSSA GADWANKAR	75	M	-	-	-	-	-	+	-	↓↑	YES	+	NO	-	NO	150	90	13	13	12	moderate	20	19	15	9.34	8.87	7.01	1.011	1.02	1.012	0.7	0.69	0.6	13.34	12.86	11.68
57	613613	CHANDRAWWA HUBBALI	47	M	-	-	-	-	-	+	-	↓↓	NO	-	NO	-	NO	140	80	12	8	12	moderate	46	56	41	21.49	26.16	19.2	1.015	1.018	1.022	0.83	0.69	0.78	25.89	37.91	24.55
58	920853	SHANRAPPA YARAGATTI	65	M	-	-	-	+	+	+	-	↑↑	NO	+	NO	-	NO	130	90	6	14	10	minor	15	18	30	7.01	8.41	14	1.025	1.03	1.032	0.72	0.7	0.9	9.74	12.01	15.57
59	917575	MALLAYYA GANACHARI	60	M	+	+	-	-	-	+	-	↑↑	YES	-	NO	-	YES	150	70	34	35	35	severe	18	15	12	8.41	7.01	5.68	1.018	1.016	1.014	0.93	0.88	0.8	9.04	7.97	7.10
60	917922	GOURAVVA PATIL	60	F	-	-	-	-	-	+	-	↓↓	NO	-		-	NO	190	120	6	5	10	minor	18	17	12	8.41	7.94	5.68	1.12	1.012	1.008	0.86	0.79	0.6	9.78	10.05	9.47