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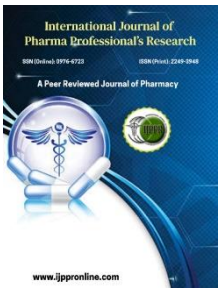

STUDY ON QUALITY OF LIFE AND MANAGEMENT OF HYPONATREMIA AND HYPERTENSION IN STROKE PATIENTS IN THE NEUROLOGY DEPARTMENT OF A TERTIARY CARE TEACHING HOSPITAL IN SOUTH INDIA

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Keywords:
Stroke. Hyponatremia, Hypertension, Stroke scales, NIHSS, Modified Rankin Scale, Barthel Index

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ABSTRACT:

Background:

A stroke or cerebrovascular accident is an abrupt onset of a neurologic deficit that lasts for at least 24 hours and is mainly of vascular origin. Stroke is one of the leading causes of death and disability in our country and leads to long-term disability and functional dependency. Hyponatremia is one of the common electrolyte abnormalities seen in patients with neurological disorders which may be due to SIADH or CSWS. Hypertension is one of the important risk factors and it is proven that anti-hypertensive therapy can reduce the risk of developing stroke. The various scales that have proved reliability and valid in stroke trials are the National Institutes of Health Stroke Scale (NIHSS), the modified Rankin scale (Mrs), the Barthel index (BI),

Methods:

A detailed history of the patient was collected using a pre-designed patient data collection form. In addition, time of onset of symptoms and treatment received were also recorded. Blood pressure of the patient was recorded every 24 hours and examined for any spikes. Serum electrolytes such as sodium and potassium were examined to find out if there were any variations. The reference range for serum sodium is 135–145 mEq/L. The time course of recovery of patients with mild, moderate and severe stroke was assessed. Regular follow up of patients included in the study was taken after one month, two months and three months after discharge. Before beginning the study, informed written consent was obtained from the patient or bystanders. Ethical clearance was obtained from the institutional

ethical committee. Analysis of the data was conducted using SPSS software version 26.

Results:

A total of 35 patients were enrolled in the study. In our study, we found that stroke affects mainly the elderly people of age >70 years (31.4%). The incidence of stroke increases with increasing age. The male population is more susceptible to stroke (60.0%) than females (40.0%). Most of the patients reported ischemic stroke (77.1%) rather than haemorrhagic stroke (22.9%). Left hemisphere stroke (57.1%) was identified more often than right hemisphere stroke (42.9%). In our study, most of the patients who were alcoholics and smokers were male. In our sample population, 40% of patients were smokers, followed by 22.85% of patients who were alcoholics, and 11.42% of patients had the habit of using both alcohol and cigarettes. Most of the patients in our study had hypertension (69%). The drug that was used the most was Telmisartan (62%). Proper management of hypertension can reduce the occurrence of stroke. In our study majority of the patients (19) showed improved BP with a Z-value 3.635 which is significant with $p < 0.001$ which is statistically significant. The medications used were normal saline for most of the patients (88%), oral salt (23%), 3% hyper-tonic saline (23%), and tolvaptan (12%), respectively. Since the significance (p-value) is less than 0.001, we can conclude that the average improvement in the sodium levels (2.706), is significant.

Conclusion:

The study concludes that proper management of the co-morbidities can prevent stroke to a limit, especially in the case of hypertension. Also, improvement in sodium levels is highly significant to show the impact of medication on patients. From the scales used for measuring the severity, quality of life, and degree of disability of stroke patients, it is concluded that remarkable improvement was shown after the 1st, 2nd, and 3rd follow-ups. The quality of life is hampered by a stroke in the majority of the patients.

Introduction:

A stroke or cerebrovascular accident is an abrupt onset of a neurologic deficit that lasts for at least 24 hours and is mainly of vascular origin [1]. It occurs when there is a loss of blood flow to different parts of the brain. This blocks the supply of oxygen and nutrients, causing damage to brain tissue [2]. Stroke is one of the leading causes of death and disability worldwide and can lead to long-term disability and functional dependency [3, 4]. As a result, the primary goals of poststroke rehabilitation are to reduce stroke disability and improve stroke survivors' independence [3].

Stroke is an important health problem faced by both developed and developing countries. Because of the high rates of incidence, prevalence, morbidity, and mortality, as well as the increased occurrence of stroke in the younger population, determining the predisposing risk factors for stroke is critical. Various risk factors are involved in the causation of stroke. The modifiable risk factors for stroke include high blood pressure and atrial fibrillation, which are more significant than others. Other factors include high blood cholesterol levels, cigarette smoking, heavy alcohol consumption, diabetes mellitus, a lack of physical activity, obesity, an unhealthy diet, etc. Among non-modifiable risk factors, age and gender are the most significant. About 95% of stroke cases occur in people age 45 and above, and 2/3rd of cases occur in those over the age of 65 [12]. The risk factors for stroke vary in young and elderly patients [6]. Men

is more prone to stroke than women, i.e., about 25% [5]. Stroke is a devastating and disabling disease that leads to economic loss.

According to the World Health Organization, stroke is the fifth leading cause of death in people aged 15 to 59 years old. Recent studies show that one in six people worldwide will have a stroke in their lifetime [7]. The major risk factors observed are hypertension, diabetes mellitus, smoking, dyslipidaemia, cardiovascular causes, family history, obesity, socioeconomic status, dietary habits, TIA, physical activity, etc. Hypertension was assessed as per JNC-7 criteria. Diabetes mellitus was diagnosed when subjects had random blood sugar levels greater than 200 mg/dl, fasting blood sugar levels greater than 125 mg/dl, or HbA1c levels greater than 6.5%. Diabetes mellitus doubles the possibility of stroke when compared to non-diabetic patients. Dyslipidaemia is defined as fasting blood cholesterol > 200 mg/dL, triglycerides > 180 mg/dL, and LDL > 100 mg/dL during a hospital stay. A smoker is defined as someone who has smoked 100 or more cigarettes in his or her lifetime. Cardiovascular causes include myocardial infarction, coronary artery bypass grafting, angina, or percutaneous transluminal angioplasty. It is determined by recording the 12 lead ECG of each patient. The presence of high QRS voltage, i.e., the sum of the S wave in the V1 lead and the R wave in the V5 or V6 lead of 35 mm or more, indicates left hypertrophy. A 1 mm depression of the ST segment indicates possible or definite myocardial ischemia, and the presence of the Q/QS pattern and atrial fibrillation, if present, indicates myocardial infarction. Family history is also considered a risk factor if a patient has a first-degree relative who has had a stroke or TIA. A BMI of more than 30 kg/sqm, i.e., obesity, is also considered a factor. Recent studies claim that TIA increases the risk of stroke 13-fold. In young adults, chronic heavy drinking and acute intoxication account for cerebral infarction. Some studies also showed that light to moderate alcohol intake decreased the risk of coronary artery disease, increased HDL cholesterol, and increased endogenous tissue plasminogen activator [8]. A stroke can affect patients in various ways. Based on the side of the brain affected, the symptoms may vary.

HYPONATREMIA

Hyponatremia is one of the common electrolyte abnormalities seen in patients with neurological disorders (stroke, subarachnoid haemorrhage, and meningitis), which may be due to the syndrome of inappropriate anti-diuretic hormone (SIADH) or cerebral salt wasting syndrome (CSWS) [9]. It is defined as having a serum sodium level less than 135 mEq/L [10]. SIADH causes hyponatremia due to water retention. The water permeability of the collecting duct and ascending limb of the loop of Henle is regulated by antidiuretic hormone (ADH) and allows the kidney to reabsorb water. ADH is produced despite the hypotonicity of body fluid. The negative feedback mechanism is disturbed, and then it is unable to control the ADH secretion. This can result in uncontrolled ADH release into the blood stream. CSWS can be explained by excessive sodium excretion in urine, dehydration, hyponatremia, and trauma in patients with intracerebral disease, trauma, and cerebral lesions. In CSWS, there is depletion of body volume, not volume expansion [11]. In elderly people, their ability to maintain water and electrolyte homeostasis in response to dietary and environmental changes is impaired, and as a result, the incidence of hyponatremia is higher in the elderly [12]. Serum osmolality is affected by two factors, such as water intake and circulating arginine vasopressin (AVP); hyponatremia may occur if these defence mechanisms are defective [13]. Sodium is one of the main cations in the extracellular fluid. Nearly 50% of body sodium is present in bones, 40% in extracellular fluid, and the rest in soft tissue. Sodium, along with chloride and bicarbonate, helps in regulating the body's acid-base balance and also in maintaining osmotic pressure and fluid balance. This plays an important part in the intestinal absorption of glucose, galactose, and amino acids and is also unavoidable for normal muscle irritability and cell permeability [14].

HYPERTENSION

Many modifiable and non-modifiable risk factors exist for stroke and transient ischemic attack (TIA). Among them, hypertension is one of the important risk factors, and it is proven that antihypertensive therapy can reduce the risk of developing stroke. Both stroke and hypertension have circadian variations. Patients with normal blood pressure experienced an increase in blood pressure within 24 hours of a stroke. This is known as the "acute hypertensive response," which is also highly prevalent and self-limiting and results in temporary or permanent damage to the regions of the brain involved in cardiovascular functioning, including BP. A U-shaped relationship was noticed between blood pressure and mortality in the international stroke trial. The ischemic penumbra (area surrounding an ischemic event such as a thrombotic or embolic stroke) remains viable for some hours in cases of acute ischemic stroke, as blood flow is maintained by the collateral channels to a certain extent, whereas on the other hand, it is highly susceptible to further ischemic injury with sudden blood pressure reduction. So, elevated blood pressure may be an advantage for patients with ischemic penumbra. The American Stroke Association (ASA)

guidelines recommend that it is not crucial to lower blood pressure in acute conditions. According to the consensus of the ASA, antihypertensive agents must be withheld unless the diastolic blood pressure is >120 mmHg or the systolic blood pressure is >220 mmHg. High blood pressure may increase the risk of intracerebral haemorrhage (ICH) caused by an aneurysmal rupture or arteriovenous malformation. This suggests that the risk-benefit ratio is nearly equal. Therefore, guidelines for the management of acute ICH given by the American Stroke Association suggest maintaining systolic blood pressure below 180 mmHg and maintaining arterial pressure below 130 mmHg [15]. About 75% or more of patients with acute stroke have elevated BP, which is associated with a poor outcome. High BP can result in cerebral edema or haemorrhagic transformation, and low BP can lead to increased cerebral infarction or perihematomal ischemia. [16]

STROKE SCALES

A single outcome measure cannot describe or predict all dimensions of recovery and disability after an acute stroke [17]. Changes in neurological deficits are useful outcome measures in acute stroke because they can measure inter-subject changes on the entire spectrum of scales starting at baseline [18]. The various scales that have proved reliability and validity in stroke trials are the National Institutes of Health Stroke Scale (NIHSS), the modified Rankin scale (MRS), the Barthel index (BI), the Glasgow outcome scale (GOS), and the stroke impact scale (SIS). The NIHSS is used for early prognostication and serial assessment, and the BI is used to plan rehabilitative strategies. The Modified Rankin Scale and GOS provide summary measures of outcome and are more relevant to clinicians and patients considering early interventions. The SIS was designed to measure patients' views on the effects of stroke [17].

AIM

To assess the quality of life and the management of hyponatremia and hypertension in stroke patients.

OBJECTIVE

- To assess the quality of life in stroke patients by using Barthel Index Scale.
- To analyse the management of hyponatremia in stroke patients.
- To analyse the management of hypertension in stroke patients.
- To assess the degree of disability by using Modified Rankin Scale.
- To assess the severity of stroke by using National Institute Health Stroke Scale.

METHODOLOGY

STUDY SETTINGS

The study has been conducted in the neurology department and at Lourdes Hospital, Kochi, which is a tertiary care teaching hospital. It is a 600-bed multi-speciality tertiary care referral teaching hospital with a wide range of amenities. The institution is equipped with seven super specialty departments and 22 other departments, with facilities comprising twelve operation theatres, ten intensive care units, and a computerised Lourdes Mediware System. Clinical laboratories are governed by ISO standards. It is one of the top hospitals in Kerala.

STUDY DURATION

This is a prospective, observational study done from the records of adult patients who have come to the Neurology Department from November 2019 to April 2020.

INCLUSION CRITERIA:

- Patients from Neurology Department.
- Stroke patients of both genders above 30 years.
- Consecutive CT or MRI proven stroke patients within 7 days of stroke.

EXCLUSION CRITERIA:

- Patients who are not willing to participate in the study.
- Pregnant and lactating women.
- Patients with pre-existing renal or hepatic failure.

STUDY DESIGN

A detailed history of the patient was collected using a pre-designed patient data collection form. Additionally, the time of onset of symptoms and treatment received were recorded. Pressure of the patient was recorded every 24 hours and examined for any spikes. Increased blood pressure was treated with antihypertensive agents as per stroke protocol. Serum electrolytes such as sodium and potassium were examined to find out if there were any variations. The reference range for serum sodium is 135–145 mEq/L. The recovery times of patients with mild, moderate, and severe strokes were studied. Patients in the study were followed up with one month, two months, and three months after discharge. Before beginning the study, informed written consent was obtained from the patient or bystanders. Ethical clearance was obtained

from the institutional ethical committee. Analysis of the data was conducted using SPSS software version 26.

SAMPLE SIZE

The sample size was calculated with the help of a statistician, and a total of 35 patients were included in the study.

DATA COLLECTION TOOL:

- Lourdes Mediware system
- Specially designed data collection form
- Barthel Index Scale
- Modified Rankin Scale
- National Institute Health Stroke Scale

DATA COLLECTION

Patient data were gathered prospectively, which comprised the demographics of the patient, chief complaints on admission, past medical and medication histories, lab parameters, and drug therapy during the hospital stay; the transition of care; and pertinent lab parameters, including blood pressure, that were extracted from the drug information centre, medical records department, and Mediware software (hospital data software).

STATISTICAL ANALYSIS

The collected data were compiled using Microsoft Excel and SPSS and presented using tables and graphs. Calculation of mean and SD were done by using statistical software and SPSS.

RESULT AND DISCUSSION

DEMOGRAPHIC DETAILS OF THE PATIENTS ENROLLED IN THE STUDY

AGE DISTRIBUTION OF PATIENTS

A total of 35 patients were included in the study. Their age distribution was as follows;

Age	Frequency	Percentage
40-50	6	17.1%
51-60	8	22.9%
61-70	10	28.6%
>70	11	31.4%
Total	35	100%

Table 1. Age wise distribution

The above table helps us understand the occurrence of stroke in different age groups. In our study, the occurrence of stroke was seen highest among the age group >70 years (31.4%), followed by 61-70 years (28.6%), and the least was found in the age group 40-50 years (17.1%).

Increased age is a known risk factor for stroke. In our study too, the occurrence of stoke increased with age.

GENDER WISE DISTRIBUTION OF THE PATIENTS

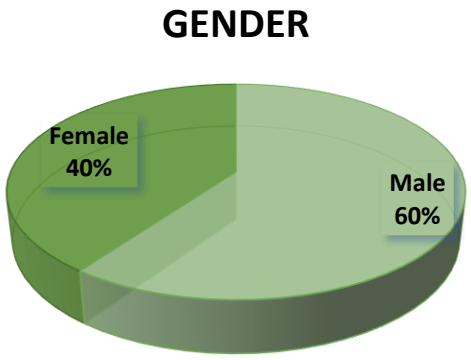


Figure 1. Gender wise distribution

Figure 1 shows that male patients are 60% more likely to have a stroke than female patients (40%). When we analysed our data, we observed that the majority of male patients consumed alcohol and were smokers. Smoking and excessive alcohol consumption are the main risk factors for stroke.

CHARACTERISTICS OF STROKE

Table 2 Characteristics of stroke

Type of Stroke		Hemisphere of Stroke	
Ischemic Stroke n=35	**Hemorrhagic Stroke n=35**	**Left Hemisphere n=35**	**Right Hemisphere n=35**
77.1%	22.9%	57.1%	42.9%

In our study, most of the patients were found to have ischemic stroke (77.1%) than hemorrhagic stroke (22.9%). Other than this most of the patients had a stroke on their left hemisphere (57.1%) than right hemisphere (42.9%).

SOCIAL HISTORY

Table 3. Social history of patients

Social History	Frequency	Percentage
Non-smokers/non alcoholic	15	42.85
Alcoholic	8	22.85
Smoking	14	40
Alcoholic and smoking	4	11.42

In our study, we found that stroke can occur even in non-smokers and alcoholic patients (42.8%). The sample population consists of 40% smokers, followed by 22.85% alcoholics, and 11.42% of both alcoholics and smokers.

TIME PERIOD IN WHICH TREATMENT RECEIVED AFTER ONSET OF SYMPTOMS

Table 4 Time of receiving treatment

Time of receiving treatment	Frequency	Percentage
Within 48 hrs.	22	62.9
After 48 hrs.	13	37.1
Total	35	100

In our study, 62.9% of the patients received treatment within 48 hours, and 37.1% received treatment after 48 hours. The patients who received treatment as early as possible had good improvements in their quality of life.

ASSESSMENT OF NIHSS SCALE

The NIHSS scale is used to measure the severity of stroke in patients. NIHSS was assessed during admission and on discharge in our study.

Table 5 Change in NIHSS between admission and discharge

NIHSS	Admission		Discharge	
	Freq.	%	Freq.	%
Minor stroke	3	8.6%	5	14.3%
Moderate stroke	19	54.3%	19	54.3%
Moderate to severe stroke	10	28.6%	8	22.9%
Severe stroke	3	8.6%	3	8.6%

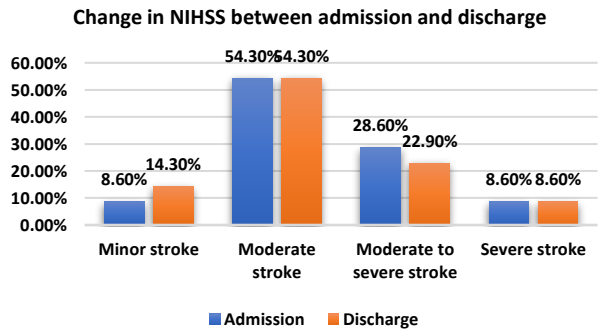


Figure 2: change in NIHSS between Admission and discharge

The percentage of patients who showed improvement in their stroke status from admission is 88.57%, and those without improvement are 11.43%.

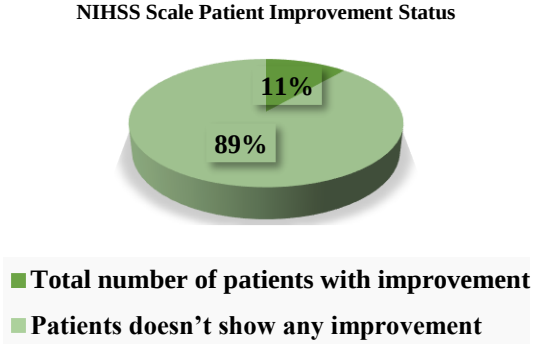


Figure 3: Status of patient improvement

Table 6: Mean, S.D. and t value to assess the improvement in NIHSS

Test	Mean	S.D.	n	Mean Improvement	T	df	Significance (*p*-value)
Admission	12.8	7.12	35	1.91	5.38	34	*p < 0.001**
Discharge	10.89	6.69					

The Mean column in the t test table displays the admissions (12.8) and discharge (10.89) mean NIHSS scores. The Standard Deviation column displays the standard deviation of the NIHSS scores. The mean improvement column is the difference between the means of follow-up 1 and the last follow-up of the study. Since the significance (p-value) is less than 0.001, we can conclude that the average improvement (1.91) in the NIHSS is significant. So, there is a highly significant impact of medication on the change in stroke level of the patients between admission and discharge.

MODIFIED RANKIN SCALE

The modified Rankin scale (MRS) is used to measure the disability of the patients. We measured the modified Rankin scale on admission, discharge, and after one month, two months, and three months.

Table 7: Patients follow up status

Category	During Admission	During Discharge
	Percentage	Percentage
Mild Disability	11.4	14.3
Moderate Disability	68.6	68.6
Severe Disability	20.0	17.1
Total	100	100

Patient Status	First Follow Up n=35	Second Follow Up n=31	Third Follow Up n=26
	Percentage	Percentage	Percentage
Patients With Improvement	34.29	25.81	19.23
Patients Without Improvement	65.71	74.19	80.77
Total	100	100	100

Table 8: Patients who showed improvement

Patient Status	Frequency	Percentage
Total patients with improvement	24	68.57
Total patients without improvement	11	31.43
Total	35	100

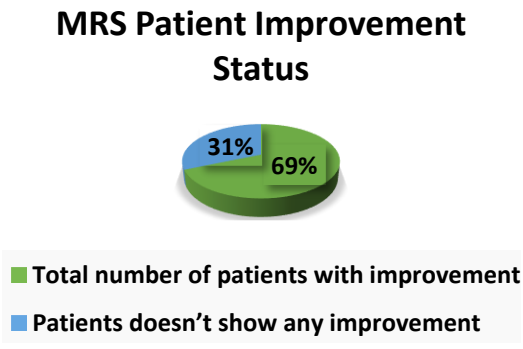


Figure 4: Patients who showed improvement

✧ **STATISTICAL ANALYSIS**

Change in Modified Rankin Scale between admission and last follow up

Table 9: Mean, S.D. and t value to assess the improvement in MRS

Test	Mean	S.D.	n	Mean betterment	T	Df	Significance (*p*-value)
Admission	3.49	1.09	35	1.08	7.52	34	$p < 0.001$*
Last follow up	2.40	1.33					

In the t test table, the Mean column displays the mean MRS scores of follow-up 1 and follow-up 2. The Standard Deviation column displays the standard deviation of the MRS scores. The mean improvement column is the difference between the means of follow-up 1 (3.49), and follow-up 2 (2.40) of the study.

Since the significance (p-value) is less than 0.001, we can conclude that the average improvement (1.08 in the MRS) is significant. So, there is a highly significant impact of medication on the change in stroke level of the patients between admission and the last follow-up.

BARTHEL INDEX SCALE

The Barthel index scale is used to measure the improvements in activities of daily life. We measured the Barthel index scale during admission, discharge, and after one month, two months, and three months.

Category	On Admission n=35	On Discharge n=35
	Percentage	Percentage
Independent in daily activities	8.6	11.4
Needs minimal help with ADL	31.4	40.0
Partially dependent	22.9	14.3
Very dependent	14.3	11.4
Totally dependent	22.9	22.9
Total	100	100

Category	First Follow Up n=35	Second Follow Up n=31	Third Follow Up n=26
	Percentage	Percentage	Percentage
Patients with improvement	51.43	45.16	61.54
Patients without improvement	48.57	54.84	38.46
Total	100	100	100

Table 10: Patients' follow-up status

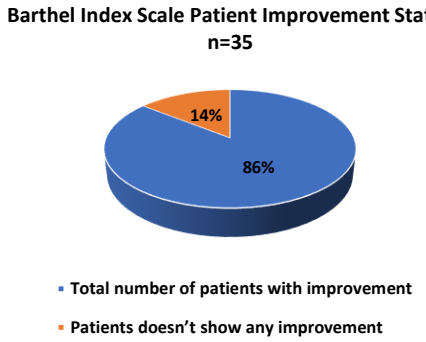


Figure 5: Patients who showed improvement

✧ STATISTICAL ANALYSIS

Change in Barthel Index Scale between follow up1 and follow-up 2

Table 11: Mean, S.D. and t value to assess the betterment in Barthel Index Scale

Test	Mean	S.D.	n	Mean betterment	T	df	Significance (*p*-value)
Follow-up 1	65.06	25.5	35	18.62	7.58	34	$p < 0.001$*
Follow-up 2	46.43	26.4					

- The Mean column in the t-test table displays the mean Barthel Index scores of follow-up 1 and follow-up 2. The Standard Deviation column displays the standard deviation of the Barthel Index scores. The mean improvement column is the difference between the means of follow-up 1 (65.06) and follow-up 2 (46.43) of the study.
- Since the significance (p-value) is less than 0.001, we can conclude that the average improvement (18.62) in the Barthel Index is significant. So, there is a highly significant impact of medication on the change in stroke level of the patients between follow-up 1 and follow-up 2.

HYPERTENSION

In our study, the majority of patients (69%) were hypertensive, with only a few (31%) being non-hypertensive.

Table 12: Patients with or without HTN

Patients	Percentage n=35
With HTN	69%
Without HTN	31%
Total	100%

Table 13. Patients taking and not taking treatment

Patients	Frequency	Percentage
Taking Medication	21	88%
Not Taking Medication	3	12%
Total	24	100%

In our study, most of them were undergoing treatment for HTN (88%), and few were not (12%).

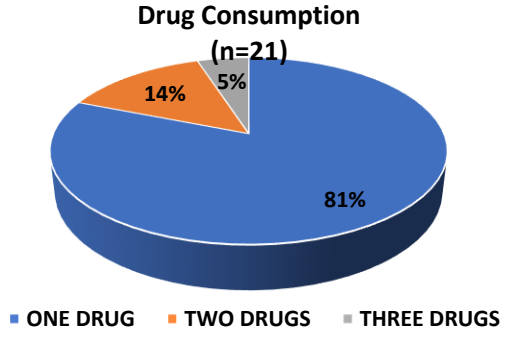


Figure 6: Drug consumption

In our study, most of the patients were taking a single drug (81%), whereas some were taking two drugs (14%), and a few were taking three drugs (5%).

✧ HYPERTENSION MANAGEMENT

In our study, the most commonly used drug for HTN was Telmisartan (62%), followed by Nifedipine (14%), Cilnidipine (14%), Amlodipine (10%), Clonidine (10%), Losartan (5%), and Cilnidipine + Telmisartan (5%).

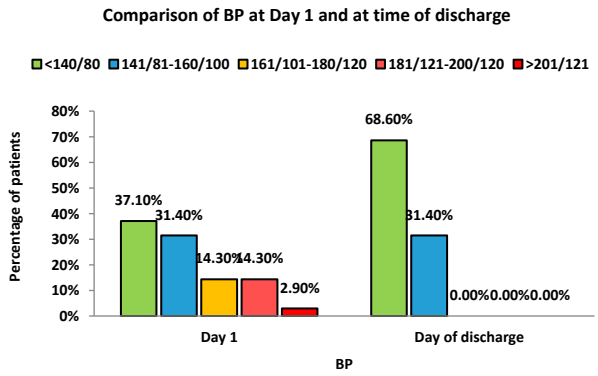
Table 14 Drugs used for the management of HTN

Drug	Frequency	Percentage
Telmisartan	13	62%
Nifedipine	3	14%
Cilnidipine	3	14%
Amlodipine	2	10%
Clonidine	2	10%
Losartan	1	5%
Cilnidipine+ Telmisartan	1	5%

✧ STATISTICAL ANALYSIS

Table 15: Blood Pressure Status

Blood Pressure	Day 1		Day of discharge	
	Frequency	Percentage	Frequency	Percentage
<140/80	13	37.1%	24	68.6%
141/81-160/100	11	31.4%	11	31.4%
161/101-180/120	5	14.3%	0	0.0%
181/121-200/120	5	14.3%	0	0.0%
>201/121	1	2.9%	0	0.0%
Total	**35**	**100 %**	**35**	**100 %**



Comparison of blood pressure on day 1 and day of discharge using Wilcoxon Signed Rank

Figure 7: Comparison of admission and discharge

Table 16: Blood pressure changes

N	+ve change	-ve change	No change	*Z-value*	*p-value*
35	19	2	14	3.635	*p < 0.01*

Positive changes are the number of patients with positive changes, i.e., the number of patients who have relief in BP. Since the majority of patients have positive changes (19), the Z-value is 3.635, which is significant with a p-value of 0.001. There is a significant reduction in blood pressure on the day of discharge.

HYPONATREMIA

Patients with hyponatremia (49%) and those without hyponatremia (51%), in our study, were found to be roughly equal.

Table 17 Patients with or without hyponatremia

Patients	Frequency	Percentage
With Hyponatremia	17	49%
Without Hyponatremia	18	51%
Total	35	100%

Most of the patients were on single-drug therapy (65%), some were on two-drug therapy (23%), and few were on triple-drug therapy (12%).

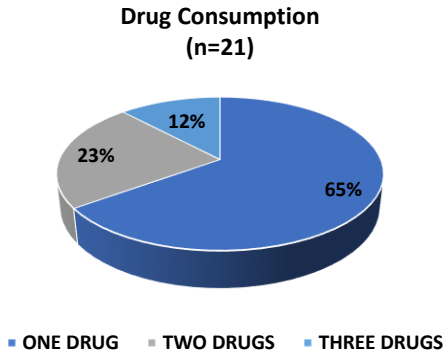


Figure 8: Drug consumption

In our study, normal saline was given to most of the patients (88%), then oral salt (23%), 3% hypertonic saline (23%), and tolvaptan (12%), respectively.

Table 18 Treatment of hyponatremia

Treatment	Frequency	Percentage
Normal Saline	15	88%
Oral Salt	4	23%
3% Hypertonic Saline	4	23%
Tolvaptan	2	12%

✧ STATISTICAL ANALYSIS

Changes in sodium level in follow-up 1 and follow-up 2

Table 19: Mean, S.D. and t value to assess the improvement in sodium levels

Test	Mean	S.D.	N	Mean betterment	t	df	Significance (*p*-value)
Follow-up 1	135.2	5.53	17	2.706	1.48	16	$p < 0.001$*
Follow-up 2	132.5	2.95					

The Mean column in the t-test table displays the mean sodium levels of follow-up 1 and follow-up 2. The Standard Deviation column displays the standard deviation of the sodium levels. The mean improvement column is the difference between the means of follow-up 1 (135.2) and follow-up 2 (132.5) of the study.

Since the significance (p-value) is less than 0.001, we can conclude that the average improvement (2.706) in sodium levels is significant. So, there is a highly significant impact of medication on the change in sodium levels of the patients between follow-up 1 and follow-up 2.

CONCLUSION

In our study, we could conclude that elderly people (>70 years) are more affected by stroke. We could see a pattern that, as age increases, the incidence of stroke also increases. The reason for increasing co-morbidities can be due to increasing age. Likewise, males are more susceptible to stroke than females. The reason might be that men consume larger amounts of alcohol and smoke than women in our country. Most of the patients reported ischemic strokes rather than haemorrhagic strokes. A left-hemisphere stroke is more common than a right-hemisphere stroke. In our sample population, most of the patients were smokers, and smoking as a risk factor for stroke was found to be statistically significant. Similarly, alcohol as a risk factor in stroke cases was also found to be highly significant statistically. A statistically significant association was found for both smoking and alcohol as risk factors in the causation of stroke.

There are many modifiable and non-modifiable risk factors for stroke. In our study, hypertension was identified in most of the patients. We can conclude that proper hypertension management can limit the occurrence of strokes to a certain extent. In our study, most of the patients showed improved BP on their follow-ups with its proper management. Most of the patients were treated with telmisartan 40 mg. Electrolyte imbalances are seen in most stroke patients. Hyponatremia was the most common among them. Most of the patients suffered from mild hyponatremia, and only a few suffered from severe hyponatremia. Most of the patients were managed with normal saline, and as the severity increased, oral salt, 3% hypertonic saline, and tolvaptan were added, respectively. As a result, medication has a significant impact on the change in sodium levels of the patients.

In our study, most of the patients showed improvement in each follow-up confirmed by the scales NIHSS, Barthel index and modified Rankin scale. The proper management of stroke and other related co-morbidities has an important role in the recovery of patients. From the measurement of scales, we can conclude that the proper and systematic management of stroke has a great impact on recovery from stroke. Our study proves that recovery from a stroke is a time-consuming process, highlighting the importance of creating awareness among patients about the importance of proper management of stroke and related co-morbidities.

LIMITATION OF STUDY

- The long-term improvement in stroke patients could not be assessed due to the study's short duration and small sample size.

- More studies need to be carried out to determine the role of other risk factors such as diabetes mellitus, physical activity, etc. in stroke.
- For the study, only one hospital was used.

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BIBLIOGRAPHY

1) Vaidya CV, Majmudar DK. A retrospective study of clinical profile of stroke patients from GMERS medical college and hospital, Gandhinagar, Gujarat. Int J Clin Trials. 2014 Jul;1(2):62-6.

2) Kimberly Holland the Healthline Editorial Team. Stroke: Symptoms, Causes, Treatment, Types & More [Internet]. Healthline. Healthline Media; 2019 [cited 2020May20]. Available from: https://www.healthline.com/health/stroke

3) Stroke, Diagnosis and Initial Treatment of Ischemic Stroke [Internet]. ICSI. [cited 2020May20]. Available from: https://www.icsi.org/guideline/stroke/

4) Mudaliar MR, Yiragamreddy SR, Tejashwani PP, Umapathi S, Sake N, Sharma S. Quality of Life in Stroke Patients Using SSQoL Scale and Barthel Index. Indian Journal of Pharmacy Practice. 2018 Jan;11(1):45.

5) Rayaz Jan, Rajiv Kumar Gupta, Parveen Singh, TajaliShora, Shahid Hussain, Risk Factors for Stroke: A Hospital Based Descriptive Study in North India, International Journal of Stroke Research, Vol. 3 No. 1, 2015, pp. 1-5

6) Vaidya CV, Majmudar DK. A study on the clinical profile of stroke in young and elderly in GMERS Medical College and Hospital, Gandhinagar, Gujarat. Int J Res Med Sci 2014;2:1446-52

7) Patne SV, Chintale KN. Study of clinical profile of stroke patients in the rural tertiary health care centre. Int J Adv Med 2016;3:666-70.

8) Kumar A, Reza TA, Agrawal PK, Sonal S, Chauhan S, Alam W, Kumar A, Dubey YK, Saif SB, Kumar V, Rahman MB, Bhargav K, Kaifee M, Alam MT. An Observation of Risk Factors Associated with Patients with Ischemic Stroke. Ann. Int. Med. Den. Res. 2016; 2(6): ME08-ME12.

9) Saleem S, Yousuf I, Gul A, Gupta S, Verma S. Hyponatremia in stroke. Ann Indian AcadNeurol 2014;17:55-7

10) Mittal M, Deepshikha, Khurana H. Profile of hyponatremia in a tertiary care centre in North India. Int J Adv Med 2016;3:1011-5.

11) Karunanandham S, Rajappa T, Selvaraju K. Hyponatremia in Patients Admitted with Stroke. Journal of Clinical & Diagnostic Research. 2018 Aug 1;12(8).

12) Dr. Shanmuga sundaram Rajamani, Dr. Binu Vazhapilly Pushpangadan MD, Dr. R Shankar. Clinico-etiological profile of Hyponatremia in the elderly. 2017; 3(7)

13) Kallol Bhattacharjee, Dwijen Das, Amit Kr. Kalwar, Bhaskar Debnath, GiridhariKar. "Relationship of Hyponatremia with Immediate Mortality in Acute Stroke". Journal of Evidence-based Medicine and Healthcare; Volume 2, Issue 38, September 21, 2015; Page: 6119-6124

14) R. S. Maniram, Lalji Patel, K. K. Kaware. "Hyponatremia in Stroke Patients and its Association with Early Mortality". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 54, July 06; Page: 9485-9491

15) Yeolekar ME, Kumbla DK, Menon PS. Hypertension in acute stroke. The Journal of the Association of Physicians of India. 1986 Feb;34(2):161.

16) Appleton JP, Sprigg N, Bath PM. Blood pressure management in acute stroke. Stroke and vascular neurology. 2016 Jun 1;1(2):72-82.

17) Lyden P. Using the national institutes of health stroke scale: a cautionary tale. Stroke. 2017 Feb;48(2):513-9.

18) Kasner SE. Clinical interpretation and use of stroke scales. The Lancet Neurology. 2006 Jul 1;5(7):603-12.

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