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Prescribing Patterns and Adherence to Medications Among Stroke Patients Visiting Neurology Clinic

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Abstract*—*Objectives: *A prospective observational study was employed to assess prevalence, clinical characteristics, comorbidities, prescribing patterns and medication adherence in stroke patients.* ***Materials and methods***: *A prospective observational study with convenience sampling used in this study. A total of 385 patients with stroke were recruited from Sri Sri neuro centre, hanamkonda, Telangana. We investigated the clinical and demographic aspects, prescribing patterns and medication adherence by using morisky medication adherence scale in stroke patients.* ***Results***: *Among 385 patients, 52% of the patients the majority affected age group with stroke was between 51-60 years of age. 52% of the stroke patients were from urban settings and (48%) rural. The prevalence of stroke was higher among males (62%). In this study stroke patients presented tingling sensation as major clinical presentation (16.02%). Most of the stroke patients in the present study were having SBP between 120-139mmHg and DBP between 62-79mmHg followed by DM (25.93%), axonal motor sensory neuropathy (7.47%) and seizures (4.57%). Most common form of stroke observed was Ischemic stroke 85(26.40%). Most prescribed drugs were analgesics (44.82%) Maximum number of stroke patients in our study were receiving Aspirin as major Anti-platelet agent. Majority of patients in the study were strongly adherent to the medications.* ***Conclusion***: *The present study carefully examined Socio-demographic information, clinical characteristics, prescribing patterns of medications, medication adherence of subjects. It was observed that stroke was more prevalent among males between 51 and 60 years and they all were found to be adherent to their medications*.

I. INTRODUCTION

Stroke is one of the main causes of death and functional inability worldwide (Lackland DT) Acute, focal neurological impairment that is clinically diagnosed as a stroke is caused by vascular injury (haemorrhage or infarction) to the central nervous system (Murphy SJ) Worldwide, stroke ranks as the second most common cause of co-morbidity. It kills over 5.5 million people a year and affects about 13.7 million people (Kuriakose D,) Clinical syndrome resulting from focal or generalized brain injury that has no other known cause and lasts more than 24 hours or causes death (Starostka-Tatar A) Stroke is a significant global health problem and a major cause of mortality and morbidity in developed countries and increasingly in low-middle income countries (LMICs) (Jones SP). In a population of one million, about 2400 people have strokes annually; of these, less than half recover to lead independent lives, and even those who do still experience significant impairments, restrictions, and behavioural and cognitive changes (Bártlová S,). A blocked artery in the brain is the cause of an ischemic stroke. A brain blood artery that bursts or leaks can result in a haemorrhagic stroke. A transient ischemic attack (TIA), which is a brief interruption of blood flow to the brain, may occur in certain individuals.(Minnesota et al.,2023) There are many risk factors and etiologies known to be linked with the occurrence of Ischemic stroke, however, there remains a significant percentage in the younger age group with undetermined causes(Aslam A,). The majority (90%) of strokes are supratentorial; as such, the public can be taught to recognize and act upon stroke using the acronym FAST, for facial droop, arm drop, speech disturbance and time. (Musuka TD,) Drug therapy is the most important component in the medical treatment of stroke (Smith SJ). Other types of medication used in patients with stroke includes antihypertensive agents, antiplatelet aggregation agents, and lipid-lowering agents, as well as other drugs needed for the treatment of coexisting diseases (ARNAN MK)

Prescription pattern analysis plays an key role in monitoring the rational use of medicines. Irrational prescribing is the most common cause of inappropriate use of medicines over the globe (Joshi, R et al., 2022) Irrational drug prescribing is considered one of the major challenges in worldwide for the healthcare sectors, leading to negative outcomes in patients includes various drug-related problems, such as polypharmacy, adverse drug events, more demands on drug monitoring, and unwanted increase in treatment cost (Al-Azayzih A et al.,2017).The prescribing pattern of drugs should be based on the condition and severity of stroke in order to provide optimal care. It is also suggest to select, a route, and dosage form of drugs to have optimal therapeutic effects to manage cerebrovascular accident. (Swetha K et al.,2018). Medication adherence is the first and most determinant for the treatment success. It is defined by the world health organization as “the degree to which the person’s behaviour corresponds to the agreed recommendations from a health care provider”. Non- adherence to medicine is an major public health problem that is termed as the "invisible epidemics” (Gudeta DB et al., 2023). Various categories of interventions, and characteristics of successful interventions within each category, were identified: patient education (eg, recurrent and personalized telephone counseling sessions with health educators); medication regimen management (using combination pills to reduce the number of pills patients take

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daily); clinical pharmacist consultation for chronic disease co-management (including education, increased frequency of disease monitoring via telephone or in-person follow-up visits, and refill reminders); cognitive behavioral therapies (such as motivational interviewing by trained counselors); medication-taking reminders (such as refill reminder calls or use of electronic drug monitors for real-time monitoring and reminding); and incentives to promote adherence (such as reducing co-payments and paying patients and clinicians for achieving disease management goals**)** (Kini V et al., 2018).Medication non-adherence (MNA) constitutes a complex health problem contributing to increased economic burden and poor health outcomes (Konstantinou P et al.,2020). Non adherence can also occur when the medication regimen is complex which could impact improper timing of drug administration, or administration of numerous medications at frequent or unusual times during the day. These patient behavioral components may or may not be perceived by the physician and results in decreased therapeutic outcome. Most deviations in taking medication occur as omission of doses (rather than additions) or delays in the timing of doses (Jimmy et al.,2011)

The Morisky Medication Adherence Scale (MMAS-8) remains one of the most widely used mechanisms to assess patient adherence (e Oliveira-Filho AD et al., 2011). The questions were framed to avoid "yes" bias. The first seven responses separated by two groups, "Yes" or "No" with 0 denoting “Yes” and 1 denoting "No"; items 5 and 8 are reverse scored. The answer to this item 8 used a five-point Likert response scale, which is further, divided into never, rarely, sometimes, often, and always, The score on the overall medication adherence questionnaire score ranges from 0 to 8. The higher the score range, the greater the medication adherence: <6 was considered as low adherence, 6-8 (excluding eight points) was contemplate as medium adherence, 8 points were considered as high adherence (Sui, et al.,2021)

II. METHODS

Sample and subjects

We conducted a Prospective observational study was employed to assess prevalence, clinical characteristics, co-morbidities, prescribing patterns and medication adherence in stroke patients. undertaken between October 2023 to April 13,2024 at Sri Sri neuro centre, hanamkonda, Telangana. The inclusion were as follows: Patients of either sex aged ≥ 18 years-90, Patients who were diagnosed as a stroke, Participants with co-morb patient condition, Patients with Recent ischemic stroke, Seizures at the beginning of episode. Total of 385 subjects who voluntarily participated and consented to the study protocol were selected based on eligibility criteria. The data was analysed using MS-Excel 2000.

Ethical Consideration

This study was carried out after ethical clearance and approval was obtained from Institutional Ethics Committee of the Department of Pharmacy Practice, Care College of Pharmacy, Hanamkonda, Telangana, India. The study participants were briefed about the objectives and procedures of the study. Thereafter, both verbal consents were obtained from those volunteers and such consentees were selected for the study. Confidentiality of information was maintained by excluding personal identifiers.

Clinical Evolution

We collected the following sociodemographic and clinical data: age, gender, clinical presentation, distribution of data according to residential location, distribution of patients depending on the type of stroke, distribution of patients depending upon area of stroke.

We also obtained a detailed clinical history and investigated medical records regarding the occurrence of hypertension, diabetesmellitus, axonal motor sensory neuropathy, seizure. prescribing patterns and medication adherence in stroke patients by morisky medication adherence scale.

III. RESULTS

1. Socio-demographic Characteristics of Study Participants (N=385)

Data collected from a total of 385 of stroke patients of age ranging between 20-100 years.

The data collected is presented in the following tables.

TABLE 1. Age wise distribution of data

Variable	Categories	Frequency	Percentage (%)
Age (years)	20 - 30	3	0.7%
	31 - 40	19	4.7%
	41 - 50	75	20%
	51 - 60	122	32%
	61 - 70	109	28.2%
	71 - 80	48	12.2%
	81 - 90	9	2%
	91 – 100	1	0.2%

Out of 385 patients most stroke cases were seen in the age group of 51-60 years and least patients were seen in the age group of 91-100

2. Distribution Data According to Gender

TABLE 2. Gender wise distribution of data

Variables Categories	Frequency	Percentage
Gender		
Male	239	62%
Female	146	38%

The study comprised 239 (62%) males and female 146 (38%) stroke patients. Males were affected mostly with stroke than females.

3. Distribution of Data According Residential Location

TABLE 3. Residential location wise distribution of data

Variables	Categories	Frequency	Percentage
Residence	Rural	182	48%
	Urban	203	52%

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203 (52%) of stroke patients belong to urban settings and 113 (16.02%) rural.

4. Clinical Presentations Of Stroke Patients (N=385)

Most common clinical presentation among stroke patient was presented tingling sensation, followed by dragging pain 106 (15.03%), general weakness 91(12.6%), giddiness 86 (12.1%), cervical pain 82 (11.6%), lumbar pain 54 (7.6%), headache 47 (6.6%), slurred speech 33 (4.6%), postural changes & numbness 27 (3.8%), true spinning 24 (3.4%), tremors 9 (1.2%), pricking sensation 6 (0.80%)

TABLE 4. Clinical presentation observed in stroke patients

Clinical presentations	Frequency	Percentage
Tingling sensation	113	16.02%
Dragging pain	106	15.03%
General weakness	91	12.6%
Giddiness	86	12.1%
Cervical pain	82	11.6%
Lumber pain	54	7.6%
Headache	47	6.6%
Slurred speech	33	4.6%
True spinning	24	3.4%
Postural changes	27	3.8%
Numbness	27	3.8%
Tremors	9	1.2%
Pricking sensation	6	0.8%

5. Co-morbidities associated in stroke patients

Table 5. Associated co-morbidities among stroke patients

Co-morbidities	Frequency	Percentage (n=486)
Hypertension	299	61.52%
Diabetes mellitus	139	28.61%
		5.35%
		4.52%
Axonal motor sensory	26	
neuropathy Seizures	22	

The comorbidities associated in stroke patients were HTN, DM, Axonal motor sensory neuropathy, seizures. Among the comorbidities associated HTN was mostly observed among stroke patients.

6. Distribution of Patients Depending Upon the Systolic Blood Pressure

TABLE 6. Systolic blood pressure

S.No.	Systolic BP	No. of patients
1.	<120mmHg	137
2.	120-139mmHg	144
3.	140-159mmHg	82
4.	160-179mmHg	18
5.	>180mmHg	4

Among 385 patients stroke, majority of patients reported systolic blood pressure between 120-139mmHg(144)

7. Distribution of patients depending upon the diastolic Blood pressure

TABLE 7. Diastolic blood pressure

S. No.	Diastolic BP	No. of patients
1.	<60mmHg	2
2.	60-79mmHg	152
3.	80-89mmHg	121
4.	90-99mmHg	81
5.	100-109mmHg	25
6.	110-120mmHg	4

Among 385 stroke patients, majority of patients reported with diastolic blood pressure between 60-79mmHg (152)

8. Distribution of Patient's Data Depending Upon the Type of Stroke

TABLE 8. Distribution of patients depending upon the type of stroke

S. No.	Type of stroke	Frequency	Percentage
1.	MCA territory	142	44.09%
	ischemic stroke		2.80%
	Hemorrhagic		5.28%
2.	Lacunar infarct	9	26.40%
3.	Ischemic stroke	17	4.35%
4.	TIA	85	10.25%
5.	Thalamic ischemic	14	
6.	stroke	33	
7.	Pontine ischemic stroke	22	6.83%

Among 385 patients the MCA is most commonly reported type of stroke 142 (44.09%), followed by ischemic stroke 85(26.40%), thalamic ischemic stroke 33(10.25%), pontine ischemic stroke 22 (6.83%), lacunar infarct 17 (5.28%), TIA 14(4.35%), least reported stroke is hemorrhagic 9 (2.80%).

9. Distribution of patients depending upon the area of stroke

TABLE 9. Area of stroke

S.No.	Area of stroke	Frequency	Percentage
1.	Left hemisphere of brain	14	11.47%
2.	Carotid artery	26	21.31%
3.	Ganglionic region	29	23.77%
4.	Medulla oblongata	4	3.28%
5.	Few lacunar infarcts	49	40.17%

The most commonly effected region of stroke among study patient was lacunar infarcts 49 (40.17%) and least affected area medulla oblongata 4 (3.28%)

10. Medications prescribed among stroke patients

TABLE 10. Medications prescribed among stroke patients

S.No.	Medications	Frequency	Percentage
1.	Anti-hypertensives	272	16.28%
2.	Antiplatelet	314	18.79%
3.	Anti-lipidemics	103	6.16%%
4.	Analgesics	749	44.82%
5.	Multivitamins	233	13.95%

Drugs category	Number(n=385)
1.Antihypertensive	
Olmesartan	
2.Antiplatelet	
Aspirin	
3.Anti-lipedemic	
Atorvastatin	210 (54.54%)
4.Analgesic	294 (76.36%)
(Neurokem nt	101 (26.23%)
(Neurokem nt, nacrol gel)	72 (18.70%)
(Neurokem nt, nacrol gel, tramadol)	82 (21.29%)
5.Multi-vitamin	157 (40.7%)
(Nuhenz)	200 (51.94)

In the present study, commonly prescribed drugs were oral analgesics (749) (tramadol) followed by antiplatelets (18.79%)

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– (aspirin) antihypertensives (16.28%)- (Olmesartan) multi-vitamins (13.95%) antilipidemic (6.16%) (atorvastatin).

11. Analysis of Medication Adherence in Stroke Patients (N=385)

Variables	Highly adherent (%)	Moderately adherent (%)	Low adherent (%)
Age group (years)			
20-40	12 (3.12%)	8 (2.08%)	2 (0.25%)
41-60	91 (23.64%)	50 (12.99%)	56 (14.54%)
61-80	73 (18.96%)	38 (9.87%)	45 (11.68%)
81-100	5 (1.30%	3 (0.78%)	2 (0.52%)
Gender			
Male	107 (27.79%)	64 (16.62%)	68 (17.66%)
Female	75 (19.49%)	35 (9.09%)	36 (9.35%)
Residence			
Urban	90 (23.40%)	52 (13.60%)	60 (15.68%)
Rural	90 (23.40%)	48 (12.48%)	44 (11.44%)
Co-morbidities (n=486)			
HTN	147(49.2%)	80(26.7%)	
DM	62(44.6%)	44(31.7%)	
Axonal motor	12(46.1%)	4(15.4%)	72(24.1%)
sensory neuropathy	12(54.5%)	6(27.3%)	33(23.7%) 10(38.5%)
Seizures			4(18.2%)

Medication adherence among the study participants was assessed participants and we observed that 40-60 years of age have shown higher adherence 91(23.64%), followed by 61- 80 years 73 (18.96%), 20-40 years of age group 12 (3.12%). Male participants were more adherence to medications 107 (27.79%) than female 75 (19.49%). The study showed that patients from both urban setting 90 (23.40%) and rural setting 90 (23.40%) were equal adherent in high adherence category, followed by moderate adherence in 52 (13.60%) population in urban & 48 (12.48%) in rural. Hypertensive patients were strongly adherence to the medication (49.2%) followed patient with diabetes mellitus (44.6%), Axonal motor sensory neuropathy (12 (46.1%)), seizures (54.5%)

12. Distribution of data according patients receiving physiotherapy

TABLE 11. Distribution of data according to physiotherapy

Variables (physiotherapy)	No. of patients	Percentage
Yes	240	62%
No	145	38%

Furthermore, In our study, 240 (62%) stroke patients affected, received physiotherapy 145 (38%) patients did not received physiotherapy.

IV. Discussion

Stroke is a neurological disorder characterized by functional disability and is one of the important cause of death worldwide. In this study stroke was mostly prevalent in the age group of between 51-60 years of age. While, in a study conducted by Kumar M et al.,2023 the higher incidence of stroke was observed among age group of >75 years.

In the present study majority of the stroke patients were from urban settings (52%) similar, results were found in study conducted by Sealy-Jefferson S et al., 2020

In our study, the prevalence of stroke was higher among males (62%) compared to females (38%), this can be due to the social habits like smoking cessation and alcohol intake or prevalence of comorbidities in males. Whereas, in a study conducted by P. Santalucia et al.,2013 higher stroke events were reported in women >80 years

16.02% of stroke patients in this study experienced tingling sensation most common clinical presentation were dragging pain (106 (15.03%)), general weakness (91(12.6%)), giddiness (86 (12.1%)), cervical pain 82 (11.6%), lumbar pain (54 (7.6%)), headache (47 (6.6%)), slurred speech (33 (4.6%)), postural changes & numbness (27 (3.8%)), true spinning (24 (3.4%)), tremors (9 (1.2%)), pricking sensation 6 (0.80%). In a study conducted by Stk et al.,2017 major clinical presentation was weakness in upper limbs (16%) followed by left and right hemiparesis (39%), facial palsy (7%), giddiness (5%) and ataxia (2%) of patients

In this study, highly prevalent pre-existing comorbidities among stroke patients was HTN (62.03%) followed by DM (25.93%), axonal motor sensory neuropathy (7.47%) and seizures (4.57%). Whereas, in a study conducted by Zhang et al.,2021 the pre-existing comorbidities was hypertension, CHD, diabetes. A large number of pre-existing comorbidities were associated with an increased risk of stroke and its subtypes.

The most common form of stroke observed was Ischemic stroke 85(26.40%) followed by thalamic ischemic stroke 33(10.25%), pontine ischemic stroke 22 (6.83%), lacunar infarct 17 (5.28%), TIA 14 (4.35%), least reported stroke is hemorrhagic 9 (2.80%). Whereas, similar results were found in study conducted by Namaganda et al.,2022 39(76.5%) had ischemic stroke and 12(23.5%) had hemorrhagic stroke. Ischemic strokes usually developed due to longterm diabetes and hypertension patients

In the present study, most prescribed drugs were oral analgesics (44.82%) –topical analgesics, tramadol, followed by antiplatelets (18.79% aspirin), antihypertensives (16.28% Olmesartan, multi-vitamins (13.95%)-, antilipidemics (6.16% atorvastatin). Whereas, in a study conducted by Naveed et al., 2014 most of the patients were prescribed anticoagulants, anti-platelets, dyslipidemics.

In our study, 240 (62%) patients received physiotherapy. Whereas, in a study conducted by Amanzonwé ER et al., 2023 amount of therapy time varied by stroke severity and did not progress over time. 66.7% received physiotherapy

It was noticed that an equal number of patients from urban and rural areas were strongly adherent to their medication and received best quality health care services that would result in better treatment success. In our study stroke patients with co-morbid conditions like HTN, DM were more adherent to prescribed medications. Stroke patients who were prescribed with Aspirin are strongly adherent as drug related adverse effects were not experienced by patients. Reasons for non-adherence presented by the patients in the current study include forgetfulness, complications from taking the

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medications such as, medication dislike, time of taking the medication being not suitable or easy to follow and taking large number of medications (polypharmacy)

V. CONCLUSION

The present study carefully examined Socio-demographic information, clinical characteristics, prescribing patterns of medications, medication adherence of subjects. The following conclusions can be drawn from the present study, Males were majorly affected than females among stroke patients, most of the stroke patients were >50 years of age, maximum number of stroke patients in our study were receiving Aspirin as major Anti-platelet agent, majority of patients were strongly adherent to the medications

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