

A Prospective Observational Study on Single Vs Dual Antiplatelet Drug Therapy in Patients with Ischemic Stroke in A Tertiary Care Hospital

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ABSTRACT

AIM

The main aim of the study is to assess the therapeutic outcomes of single vs. dual antiplatelet therapy by using the NIHSS Scale (National Institutes of Health Stroke Scale) among the inclusion criteria in patients with ischemic stroke in a tertiary care hospital.

OBJECTIVE

To estimate the therapeutic outcomes of single vs. dual antiplatelet drug therapy in patients with ischemic stroke based on the NIHSS scale in a tertiary care hospital.

METHOD

To determine demographic characters [gender, age], type of stroke occurrence, reoccurrence of stroke, factors causing [smoking, alcohol, hypertension, diabetes, drug non-compliance, and genetic history], the severity of the stroke, symptoms, rate of recovery, and outcomes of single vs. dual antiplatelet therapy, both comparatively

CONCLUSION

From the study, we conclude that patients aged 60–69 are prone to stroke, and the patients who are receiving DAPT have a higher rate of recovery with fewer major bleeding risks when compared with SAPT, but reoccurrence is seen more in SAPT.

Keywords: ischemic stroke , ANTIPLATELET THERAPY, Hypertension

1. INTRODUCTION:

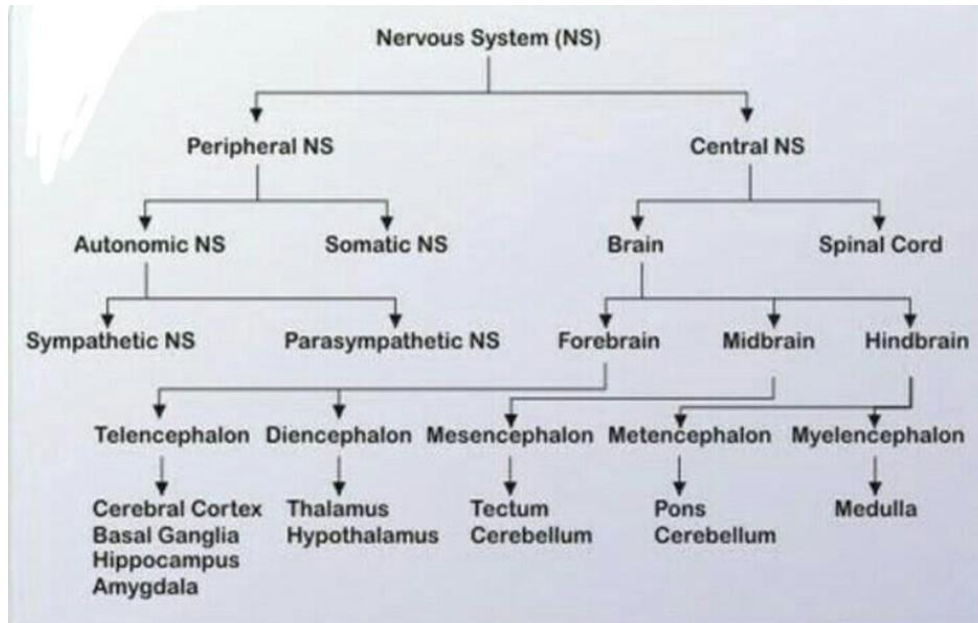
NEUROLOGY

The term neurology comes from the Greek words neuron (nerve) and logia (saying). Neurology is the branch of medicine that deals with the structure, function, and diseases of the nervous system.

NERVOUS SYSTEM

The nervous system deals with the coordination of voluntary and involuntary actions and responses by transmitting signals between different body parts. The nervous system is one of the smallest and yet the

most complex of the body's systems. The nervous system is an intricate, highly organised network of billions of neurons and even more neuroglia.



NEURONS:

Neurons are the fundamental units of the nervous system and are intended to transmit information from one part of the body to other parts. They receive and transmit signals to different parts of the body in both physical and electrical forms.

TYPES OF NEURONS AND FUNCTIONS OF NEURONS

The nervous system carries out a complex array of tasks. It allows us to sense various smells, produce speech, and remember past events. These diverse activities can be grouped into three basic functions.

There are three different types of neurons:

Sensory Neurons

Neurons are located near the receptor organs like the skin, eyes, ears, etc. Function: receive incoming stimuli from the environment.

Motor Neurons

Neurons located near the effectors, i.e., muscles and glands Function: carry impulses to effectors to initiate a response.

Interneurons

Neurons that reply to messages between other neurons, such as sensory and motor neurons, are often found in the brain and spinal cord.

CENTRAL NERVOUS SYSTEM

The central nervous system consists of the spinal cord and brain. The spinal cord is found in the vertebral column, and the brain is housed in the cranium (skull).

The spinal cord has 32 segments, and the brain consists of the brain stem, diencephalon, cerebellum, and cerebrum.

At the foramen magnum, the highest cervical segment of the spinal cord is continuous with the lowest level of the medulla of the brain stem.

The 12 cranial nerves attached to the brain form the upper part of the peripheral nervous system and record general sensations of pain, temperature, touch, and pressure. In addition, we now find the presence of special senses of smell, vision, hearing, balance, and taste.

The blood supply to the brain originates from the first major arterial branches from the heart, ensuring that over 20% of the entire supply of oxygenated blood flows directly into the brain.

BRAIN

The brain is one of the largest organs in the body and coordinates most body activities. It is the centre for thought, memory, judgement, and emotion. The brain is present in the skull, weighs 1300–1400 g, and is made up of a thousand billion neurons; each neuron is surrounded by 10 glial cells. The brain is covered by meninges: the outer dura mater, the middle arachnoid mater, and the inner pia mater. There are certain cavities of the brain called ventricles filled with CSF: ventricles 1 and 2, which are lateral ventricles, lie in two hemispheres of the brain; the third lies between the hypothalamus and thalamus; the fourth lies between the brain stem and cerebellum and is continuous with the spinal cord.

2. AIMS AND OBJECTIVES

AIM

The main aim of the study is to assess the therapeutic outcomes of single vs. dual antiplatelet therapy by using the NIHSS Scale (National Institutes of Health Stroke Scale) among the inclusion criteria in patients with ischemic stroke in a tertiary care hospital. Our secondary aim is to evaluate the risk factors that are leading to the occurrence of ischemic stroke.

OBJECTIVES

- Collection and study of patients' clinical profiles.
- Study of therapeutic outcome in ischemic stroke patients with single antiplatelet therapy vs. dual antiplatelet therapy using the NIHSS Scale To evaluate the risk factors for ischemic stroke.

3. METHODOLOGY

PLACE OF STUDY:

General Medicine Department, inpatient units of Government General Hospital, Kurnool, a 1000-bed teaching hospital

PERIOD OF STUDY:

The study was six months

STUDY POPULATION:

80 patients fit the inclusion and exclusion criteria from both female and male general medicine departments.

STUDY DESIGN:

A prospective cross-sectional observational study

SAMPLING:

The patients were selected based on inclusion and exclusion criteria. In the present study, the patients were admitted to the general medicine departments with the symptoms of a cerebrovascular attack with ischemia. All the patients with cerebrovascular attack cases were systematically evaluated by the general physician.

PATIENT ELIGIBILITY CRITERIA:

The present cross-sectional observation study with the patients involved is from the General Medicine Department with newly diagnosed patients and patients with a previous history of cerebrovascular attack with ischemic stroke. The subjects are selected based on the inclusion and exclusion criteria.

INCLUSION CRITERIA:

- Patients with cerebrovascular attacks with ischaemic stroke
- Age between 25 and 70 years.
- Patients who have a radiological confirmed diagnosis of CT or MRI are included in the study.

EXCLUSION CRITERIA:

- Patients with conditions other than ischemic stroke, such as hemorrhagic or transient ischemic attacks, are not eligible for the study.
- Paediatric patients with a cerebral vascular attack with ischemia stroke
- Patients without a confirmed diagnosis of CT or MRI are excluded.

4. RESULTS:

A total of 80 patients were enrolled in the study and presented to the outpatient department of general medicine during a 6-month period. Responses were collected using a patient proforma form, and the data collected from the patients was analyzed.

AGE AND GENDER DISTRIBUTION:

Among 80 patients who were presented to out patient department, the percentage distribution was found to be 50(62.5%) males and 30(37.5%) females were represented

Tab 4.1. GENDER DISTRIBUTION

GENDER	NO. PARTICIPANTS	PERCENTAGE (%)
MALES	50	62.5
FEMALES	30	37.5
TOTAL	80	100

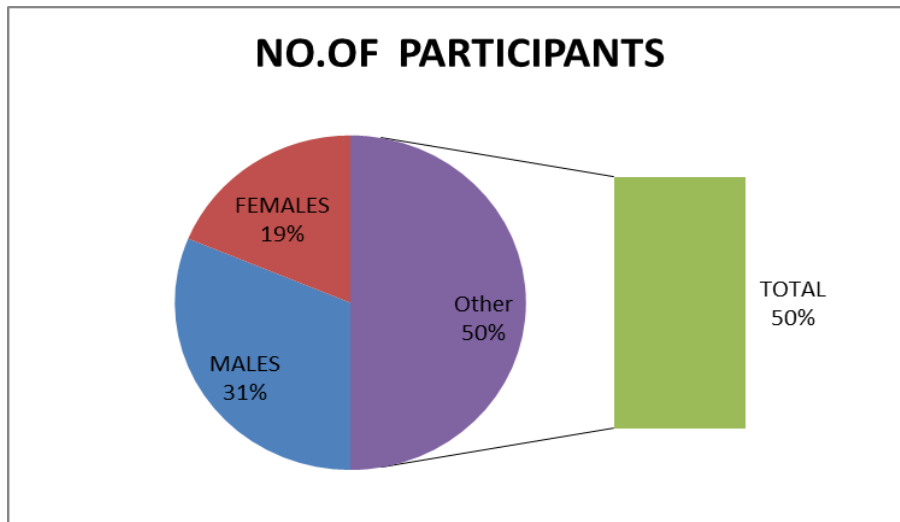


Fig 4.1. GENDER DISTRIBUTION

Tab 4.2. AGE DISTRIBUTION

AGE GROUP	NUMBER OF PARTICIPANTS	PERCENTAGE (%)
20-29	0	0
30-39	8	10
40-49	14	17.5
50-59	18	22.5
60-69	29	36.25
70-79	8	10
>80	3	3.75
Total	80	100

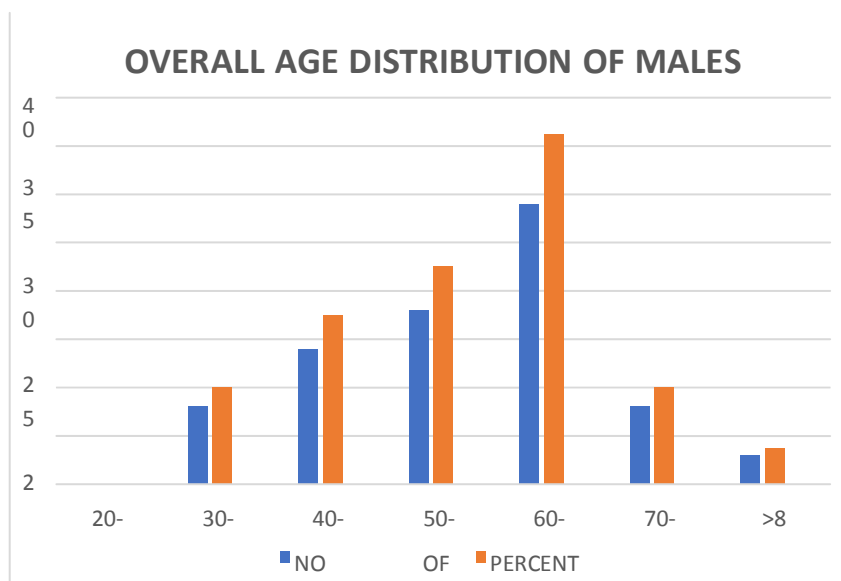


Fig 4.2 AGE DISTRIBUTION

Tab 4. 3 DISTRIBUTION OF AGE IN MALES IN SINGLE ANTIPLATELET THERAPY

AGE	NO. PARTICIPANTS	PERCENTAGE (%)
20-29	0	0
30-39	5	18.51
40-49	4	14.81
50-59	8	29.62
60-69	7	25.92
70-79	1	3.70
>80	2	7.40
TOTAL	27	100%

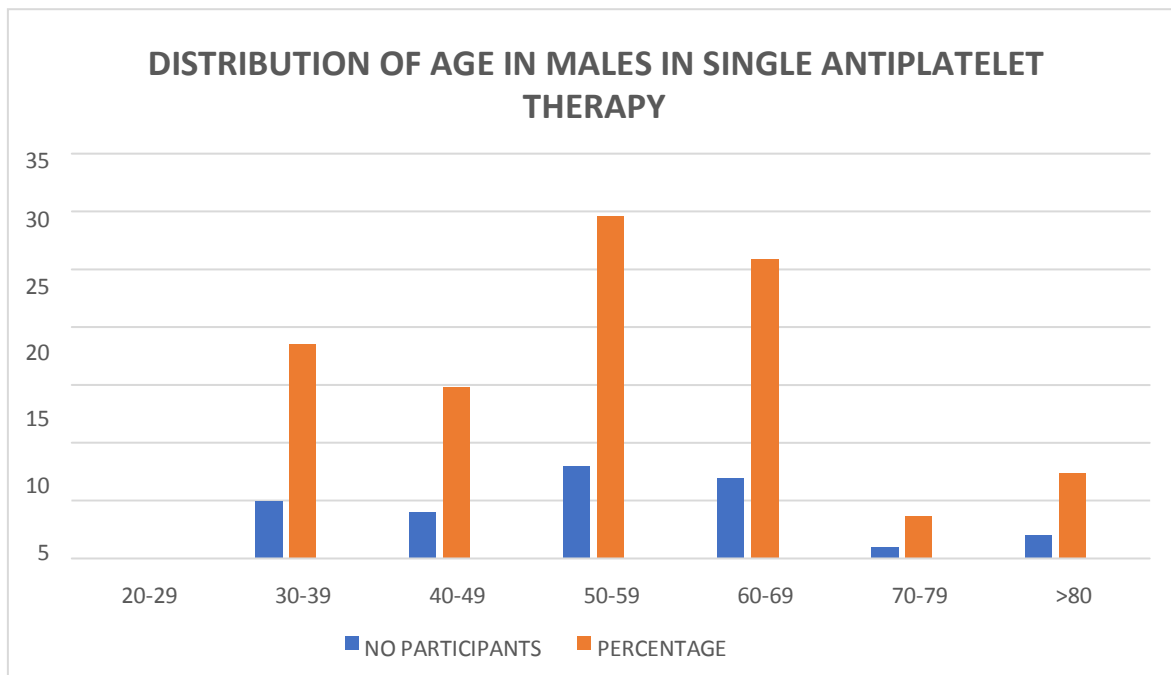


Fig 4.3 DISTRIBUTION OF AGE IN MALES IN SINGLE ANTIPLATELET THERAPY

Tab 4.4 DISTRIBUTION OF AGE IN MALES IN DUAL ANTIPLATELET THERAPY

AGE	NO.PARTICIPANTS	PERCENTAGE (%)
20-29	0	0
30-39	2	8.69
40-49	7	30.4

50-59	3	13.04
60-69	8	34.78
70-79	3	13.04
>80	0	0
TOTAL	23	100%

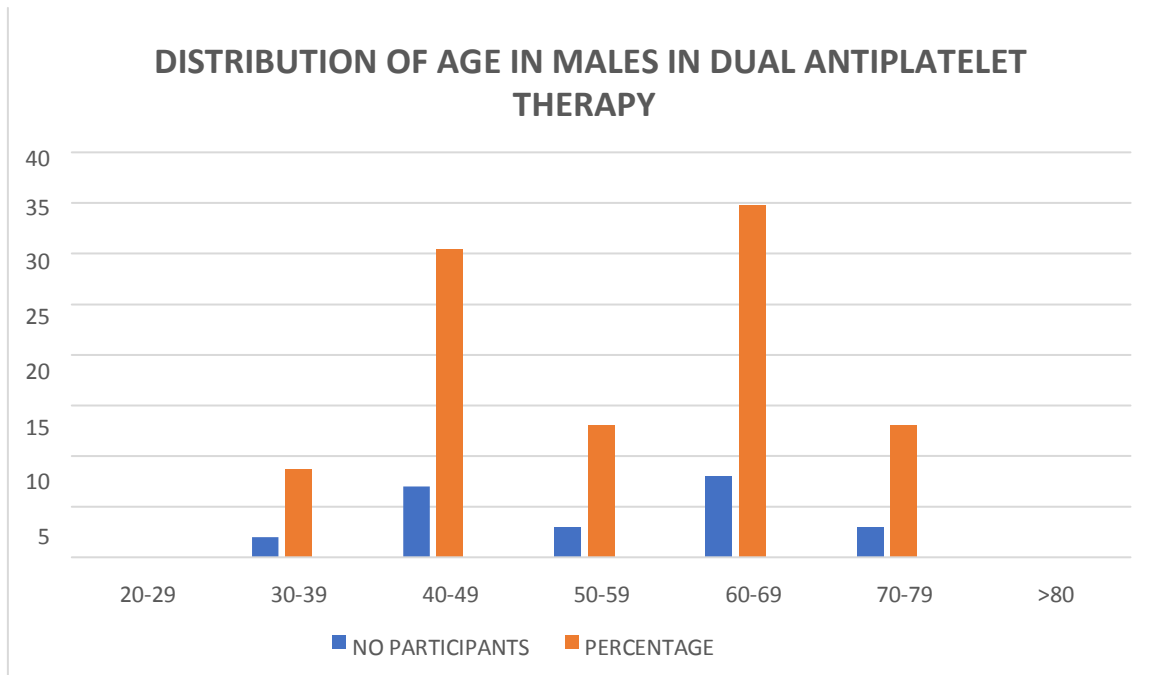


Fig 4.4 DISTRIBUTION OF AGE IN MALES IN DUAL ANTIPLATELET THERAPY

Tab 4.5 DISTRIBUTION OF AGE IN FEMALES FOR SINGLE ANTIPLATELET THERAPY

AGE	NO. PARTICIPANTS	PERCENTAGE (%)
20-29	0	0
30-39	0	0
40-49	1	6.6
50-59	2	13.3
60-69	8	53.3
70-79	3	20
>80	1	6.66
TOTAL	15	100

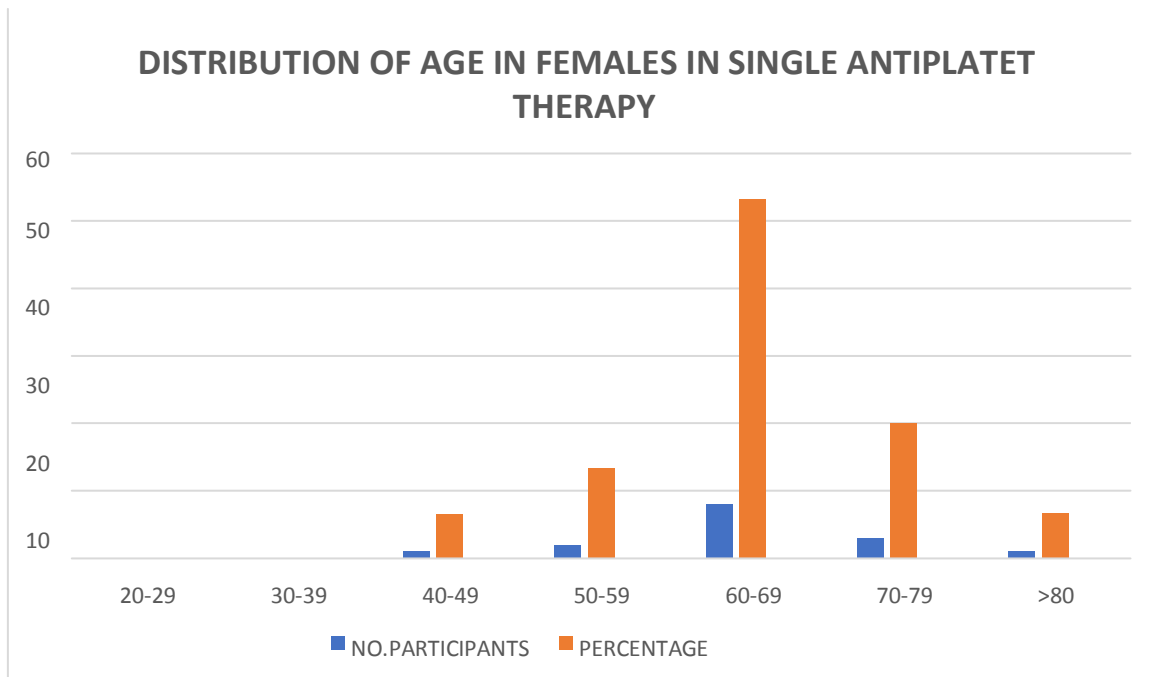


Figure 4.5 DISTRIBUTION OF AGE IN FEMALES IN SINGLE ANTIPLATELET THERAPY

Tab 4.6 DISTRIBUTION OF AGE IN FEMALES IN DUAL ANTI PLATELET THERAPY

AGE	NO. PARTICIPANTS	PERCENTAGE(%)
20-29	0	0
30-39	1	6.6
40-49	2	13.33
50-59	5	33.33
60-69	6	40
70-79	1	6.66
>80	0	0
TOTAL	15	100

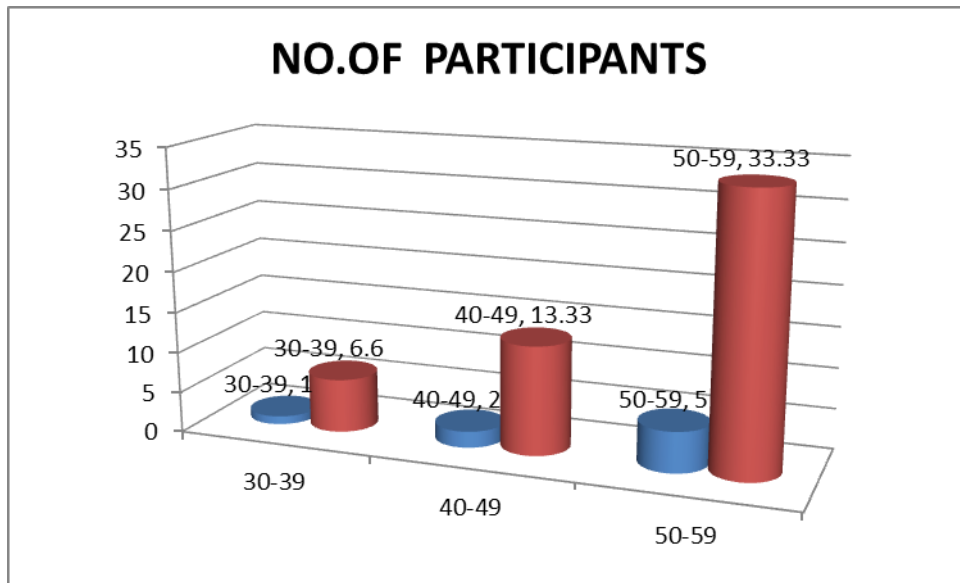


Fig 4.6 DISTRIBUTION OF AGE IN FEMLAES IN DUAL ANTIPLATELET THERAPY

Tab 4.7 DISTRIBUTION BASED ON SYMPTOMS

SYMPTOMS	NO.PARTICIPANTS	PERCENTAGE(%)
Weakness of Left UL&LL	31	18.4
Weakness of Right UL&LL	41	25
Loss of Consciousness	15	9.14
Slurred Speech	25	15.2
Vision	5	3.04
Deviation of Mouth	37	22.5
Others	10	6.09

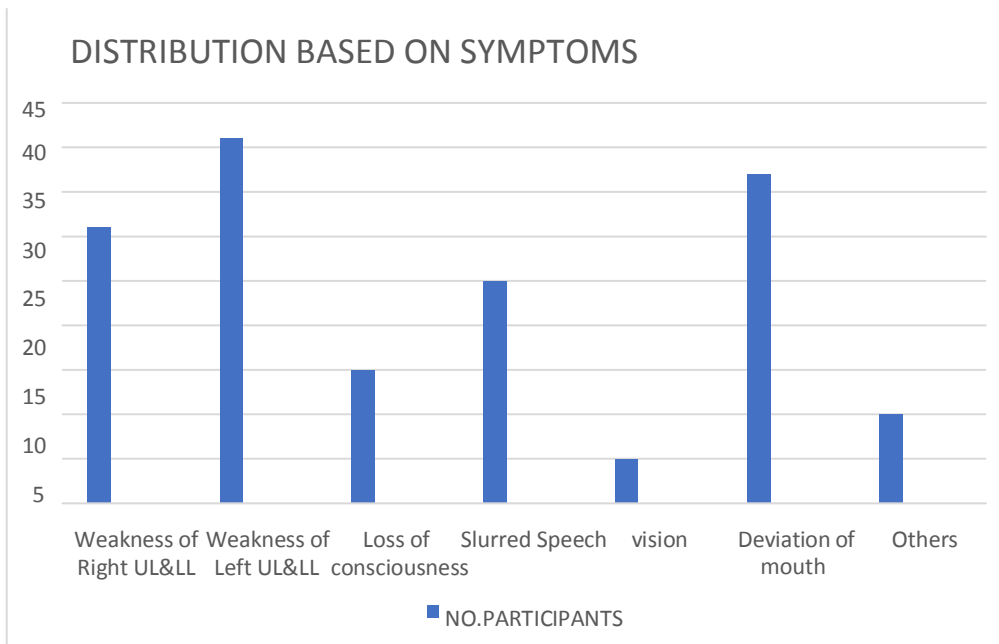


Fig 4.7 DISTRIBUTION BASED ON SYMPTOMS

Tab 4.8: RISK FACTORS IN TOTAL MALES

RISK FACTOR	NO. PARTICIPANTS	PERCENTAGE(%)
Hypertension	7	14
Diabetes	0	0
Hypertension + Diabetes	4	8
Alcoholic	3	6
Smokers	6	12
Alcoholic+ Smoker	18	36
Alcohol +Smoker +Hypertension	6	12
Alcohol +Smoker +Hypertension+ Diabetes	1	2
Others	5	10
Total	50	100

Tab 4.9 RISK FACTORS IN SINGLE ANTIPLATELET THERAPY INMALES

RISK FACTORS	NO.PARTICIPANTS	PERCENTAGE(%)
Hypertension	4	14.8
Diabetes	0	0
Hypertension + Diabetes	2	7.4
Alcoholic	0	0
Smokers	3	11.11
Alcoholic +Smoker	11	40.7
Alcohol +Smoker +Hypertension	3	11.11
Alcohol +Smoker+ Hypertension+ Di-abetes	1	3.7
Others	3	11.11
Total	27	100

Tab 4.10 RISK FACTORS IN DUAL ANTIPLATELET THERAPY IN MALES

RISK FACTORS	NO.PARTICIPANTS	PERCENTAGE(%)
Hypertension	3	13.04
Diabetes	0	0
Hypertension + Diabetes	2	8.69
Alcoholic	3	13.04
Smokers	3	13.04
Alcoholic+ smoker +hypertension	7	30.43
Alcoholic + smoker + hypertension + diabetes	3	13.04
Others	2	8.69
Total	23	100

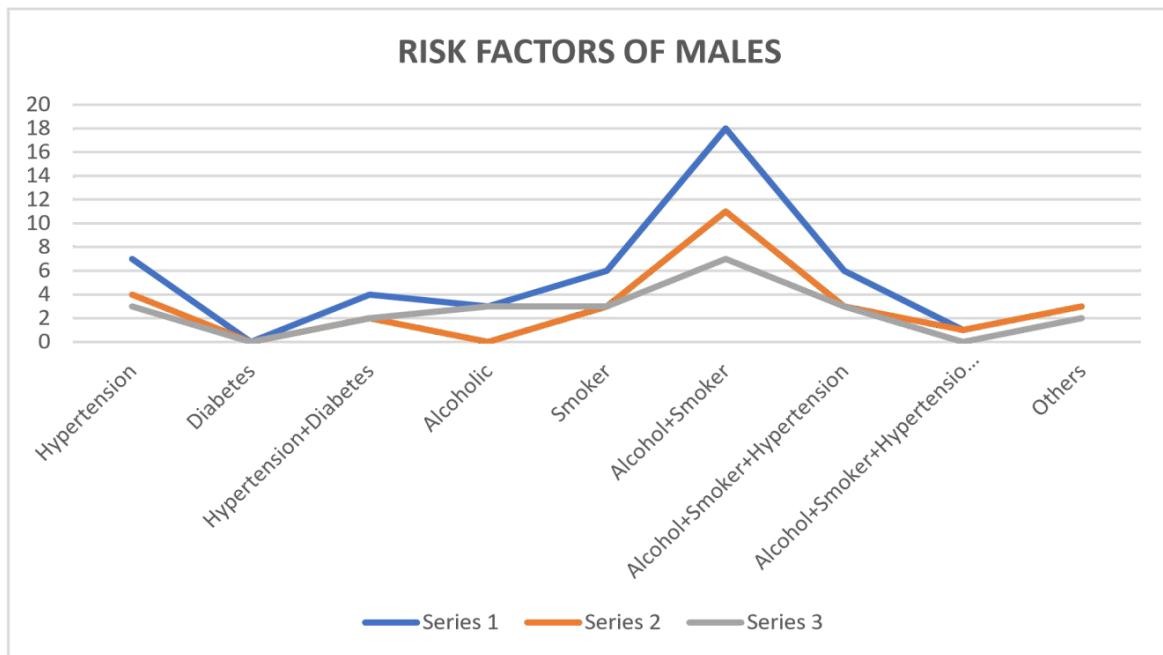


Fig 4.8 RISK FACTORS OF MALES

Tab 4.11 RISK FACTORS IN TOTAL FEMALES:

RISK FACTOR	NO.PARTICIPANTS	PERCENTAGE(%)
Hypertension	12	40
Diabetes	3	10
Hypertension + Diabetes	6	20
Others	8	26.66
Beetle nut chewer	1	3.33
Total	30	100

Tab 4.12 RISK FACTORS OF FEMALES IN SINGLE ANTIPLATELET THERAPY:

RISK FACTOR	NO.PARTICIPANTS	PERCENTAGE(%)
Hypertension	8	53.33
Diabetes	2	13.33
Hypertension + Diabetes	2	13.33
Others	2	13.33
Beetle nut chewer	1	6.66
Total	15	100

Tab 4.13 RISK FACTORS OF FEMALES IN DUAL ANTIPLATELET THERAPY

RISK FACTOR	NO.PARTICIPANTS	PERCENTAGE(%)
Hypertension	4	26.66
Diabetes	1	6.66
Hypertension + Diabetes	4	26.66
Others	6	40
Beetle nut chewer	0	0
Total	15	100

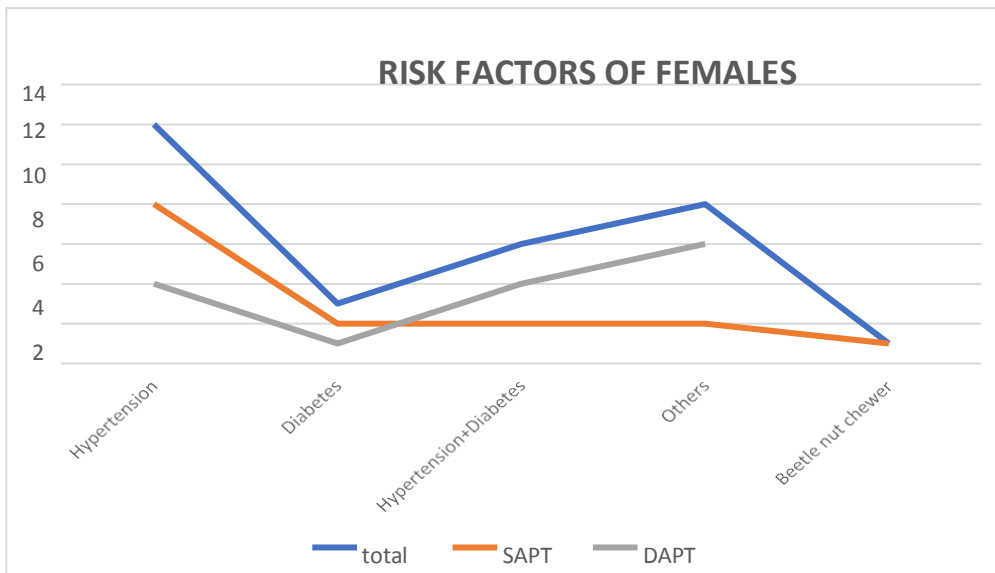


Fig 4.9 RISK FACTORS OF FEMALES

Tab 4.14 DISTRIBUTIONS BASED ON TREATMENT IN MALES:

TREATMENT	No. of participants	Percentage (%)
Single antiplatelet therapy	27	54
Dual antiplatelet therapy	23	46
Total	50	100

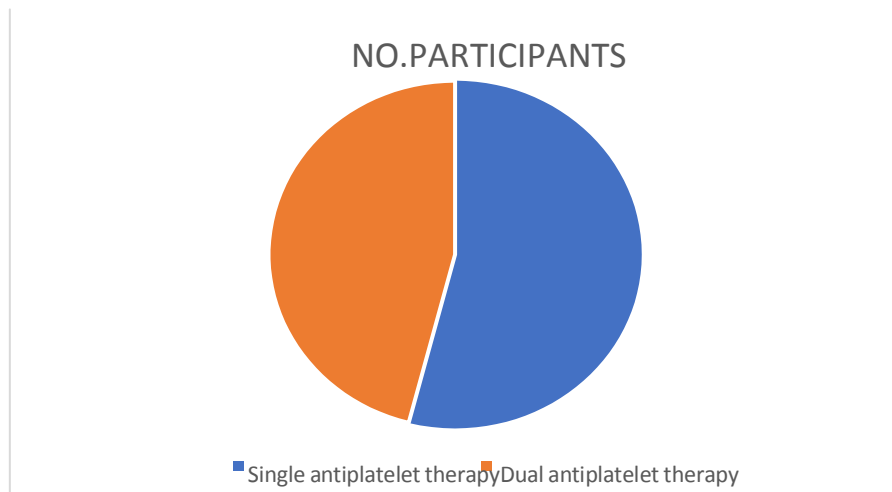


Fig 4.10 DISTRIBUTION BASED ON TREATMENT IN MALES

Tab 4.15 DISTRIBUTIONS BASED ON TREATMENT IN FEMALES:

TREATMENT	No. of participants	Percentage (%)
Single antiplatelet therapy	15	50
Dual antiplatelet therapy	15	50
Total	30	100

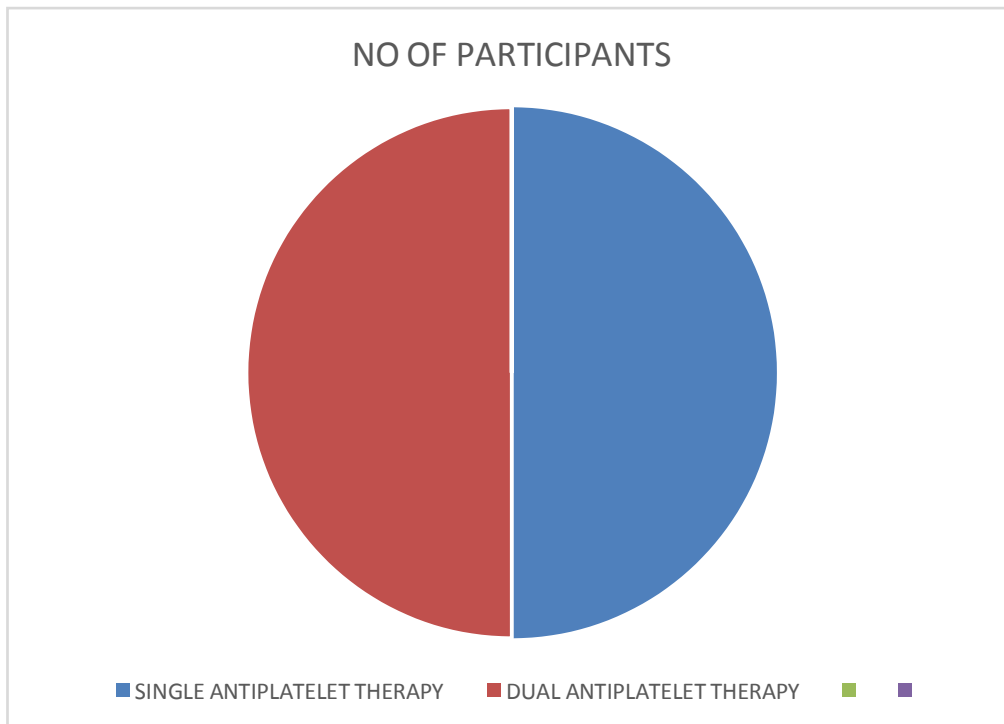


Fig 4.11 DISTRIBUTION BASED ON TREATMENT IN FEMALES

DISTRIBUTION BASED ON SEVERITY OF STROKE BY NIHSS SCALE

Tab 4.16 TOTAL SEVERITY IN MALES

Severity	No. participants	Percentage (%)
MINOR	15	30
MODERATE	28	56
MODERATE-SEVERE	6	12
SEVERE	1	2
TOTAL	50	100

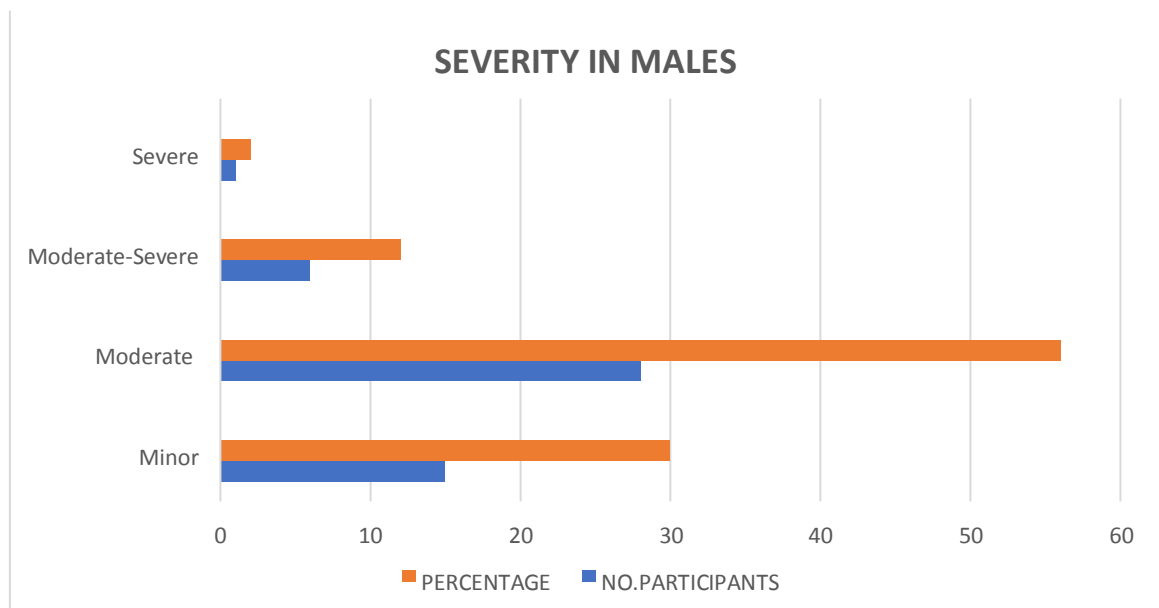


Fig 4.12 DISTRIBUTION BASED ON SEVERITY IN MALES

Tab 4.17 SINGLE ANTIPLATELET THERAPY SEVERITY IN MALES

SEVERITY	No. participants	Percentage (%)
Minor	13	48.14
Moderate	13	48.14
Moderate -severe	1	3.70
Severe	-	-
TOTAL	27	100

Tab 4.18 DUAL ANTIPLATELET THERAPY SEVERITY IN MALES

SEVERITY	No. participants	Percentage(%)
Minor	2	8.69
Moderate	15	65.21
Moderate-severe	5	21.73
Severe	1	4.34
Total	23	100

DISTRIBUTION OF STROKE SEVERITY IN FEMALES TOTAL

Tab 4.19 FEMALES SEVERITY

SEVERITY	No. participants	Percentage(%)
Minor	7	23.33
Moderate	13	43.33
Moderate-severe	3	10
Severe	7	23.33
Total	30	100

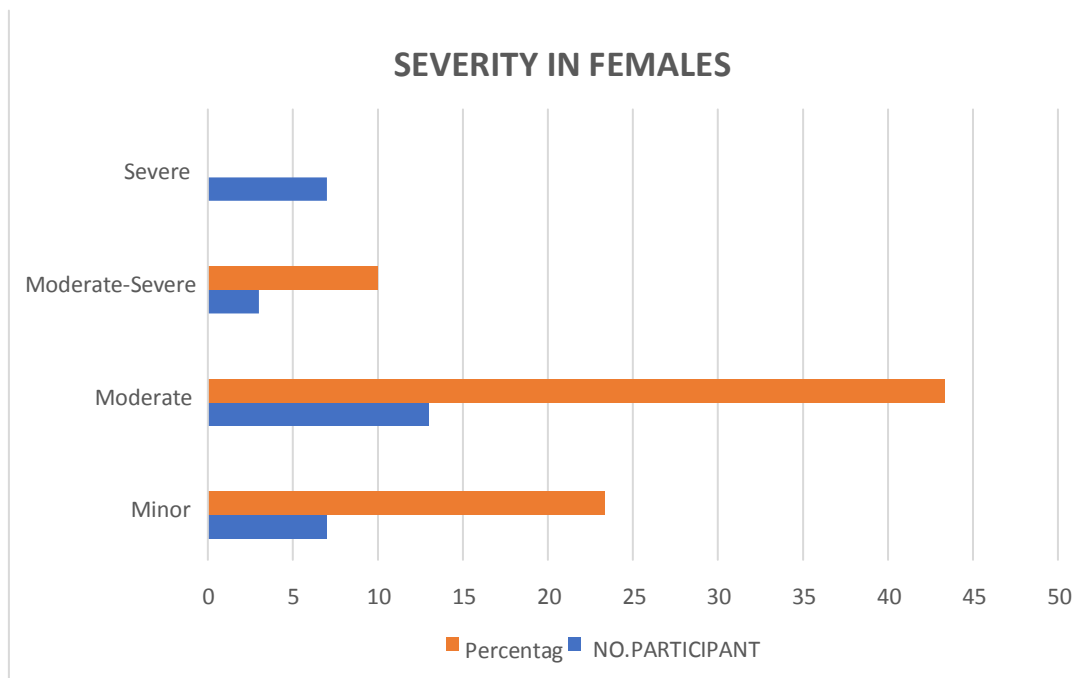


Fig 4.13 DISTRIBUTION BASED ON SEVERITY IN FEMALES

Tab 4.20 SINGLE ANTIPLATELET THERAPY STROKE SEVERITY INFEMALES

SEVERITY	No. participants	Percentage(%)
Minor	6	40
Moderate	6	40
Moderate-severe	-	-
Severe	3	20
Total	15	100

Tab 4.21 DUAL ANTIPLATELET THERAPY STROKE SEVERITY IN FEMALES

SEVERITY	No. participants	Percentage (%)
Minor	1	6.66
Moderate	7	46.66
Moderate-severe	3	20
Severe	4	26.66
Total	15	100

Tab 4.22 DISTRIBUTION BASED ON REOCCURANCE IN MALES

REOCCURANCE	NO.PARTICIPANTS	PERCENTAGE(%)
Single Antiplatelet Therapy	7	25.92
Dual Antiplatelet Therapy	1	4.37
Total	8	16

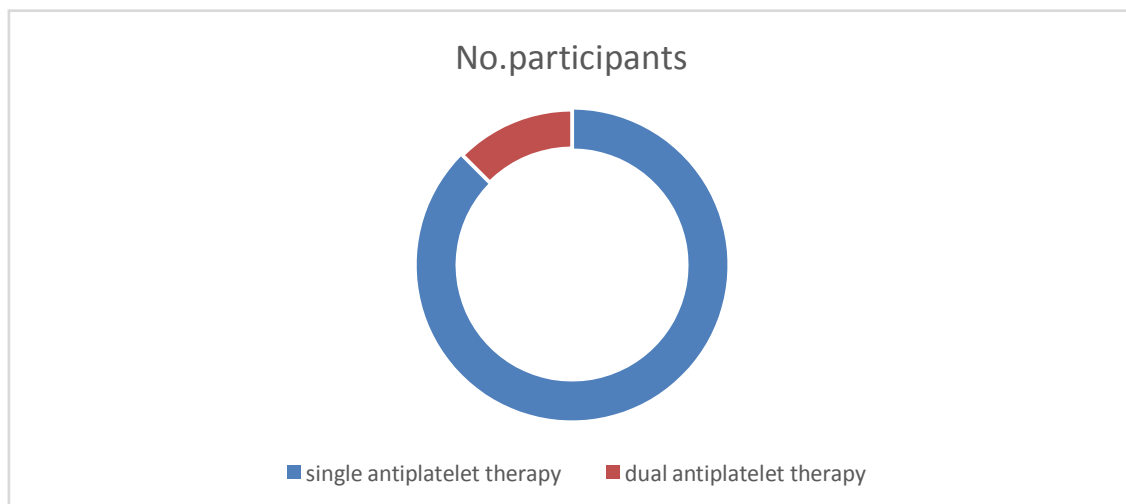


Fig 4.14 DISTRIBUTION BASED ON REOCCURANCE IN MALES

Tab 4.23 DISTRIBUTION BASED ON REOCCURANCE IN FEMALES

REOCCURANCE	NO.PARTICIPANTS	PERCENTAGE(%)
Single Antiplatelet Therapy	5	33.33
Dual Antiplatelet Therapy	1	6.66
Total	6	20

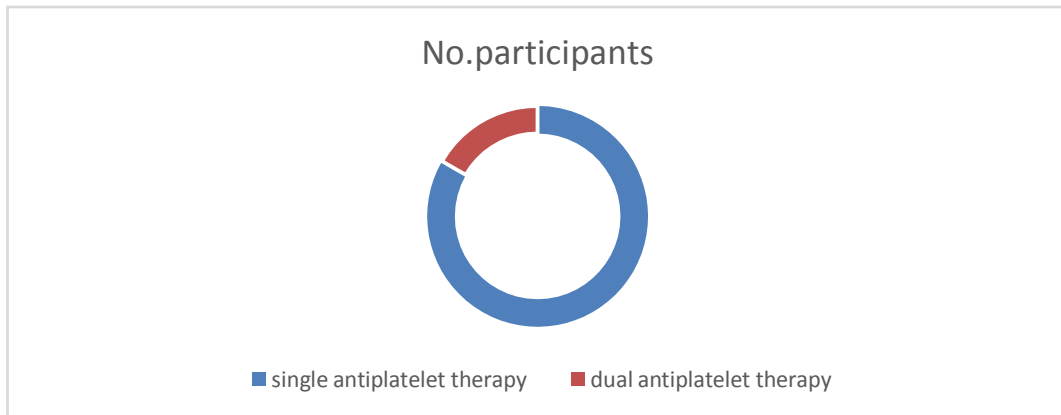


Fig 4.15 DISTRIBUTION BASED ON REOCCURANCE IN FEMALES

THERAPEUTIC OUTCOMES OF MALES

THERAPEUTIC OUT-COME	NO.OF PARTICIPANTS	PERCENTAGE
Severe-moderate to severe	6	12
Severe-moderate	1	32
Severe-minor	0	0
Moderate to severe-moderate	3	62
Moderate to severe-minor	1	2
Moderate-minor	1	28
Moderate	9	18
severe	1	2

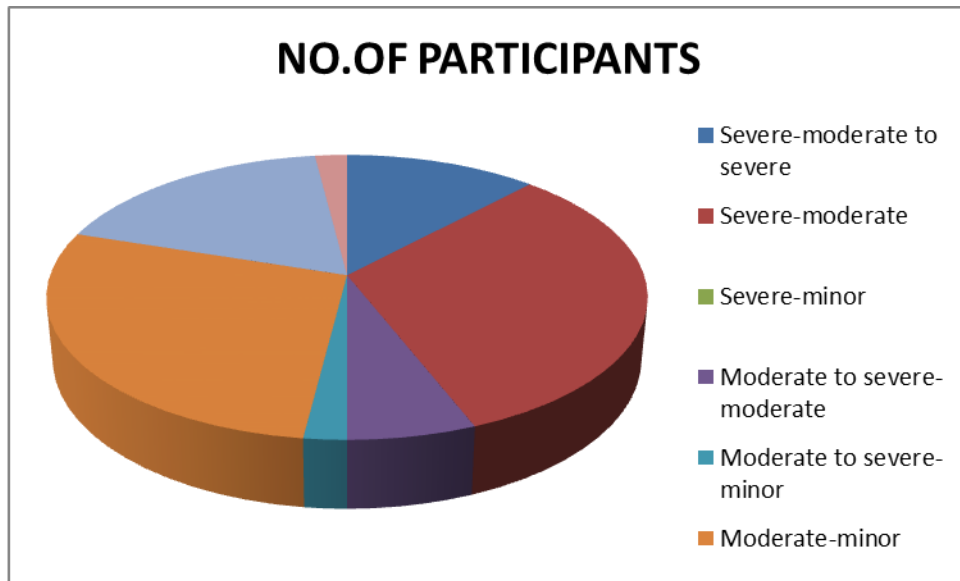


Fig 4.16 THERAPEUTIC OUTCOMES IN MALES

TAB 4.25 THERAPEUTIC OUTCOMES OF FEMALES

THERAPEUTIC OUT- COMES	NO.PARTICIPANTS	PERCENTAGE
Severe to moderate-severe	4	13.33
Severe to moderate	5	16.66
Severe to minor	1	3.33
Moderate to minor	3	10
Severe	7	23.3
Moderate-severe	2	6.66
Moderate	4	13.33
Minor	4	13.33

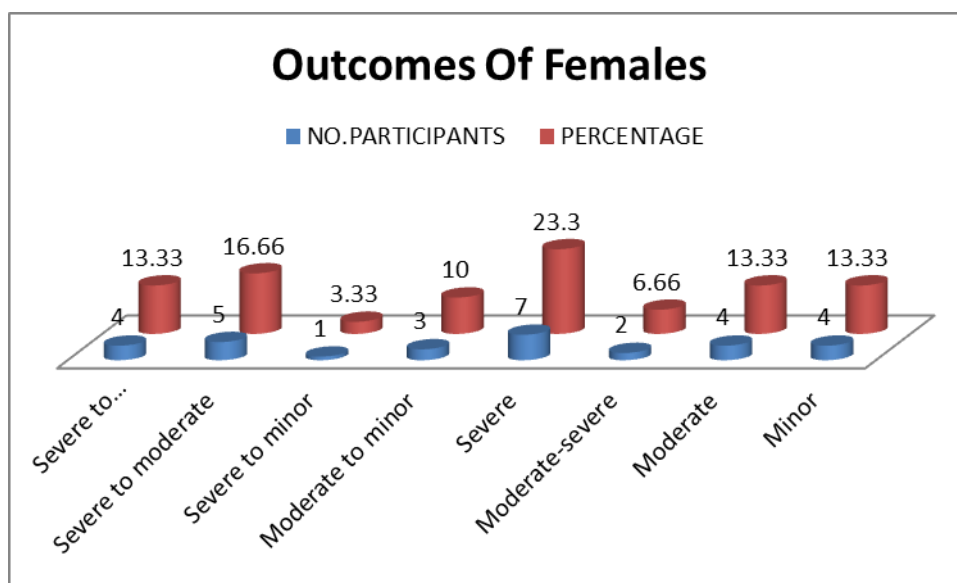


Fig 4.17 THERAPEUTIC OUTCOMES OF FEMALES

5.DISCUSSION

Ischemic stroke is an emergency condition, which has a persistently long term effect for patients, But it must always be managed as early as possible. In our prospective and observational study of about eighty cases of ischemic stroke in males and females, in particulars with single antiplatelet drug therapy(SAPT) vs dual antiplatelet drug therapy (DAPT) was carried out for about sixmonths duration in Dr. KVSP drug information centre in Kurnool, it was found to be more of men getting prone to ischemic stroke.

The study was conducted among 80 patients, of which males were 50 (62.5%) and females were 30 (37.5%). Where Males were further classified with single vs dual antiplatelet drug therapy, where 27 are males with SAPT and 23 males are with DAPT. And further of which Females were further classified with single vs dual antiplatelet drug therapy, where 15 are SAPT and 15 are DAPT.

Both males and female patients are taken into the project consideration and involved in this study based on age, gender, distribution of treatment given whether SAPT OR DAPT was prescribed both in males and females, symptoms , factors mostly effecting the patients, risk factors which may occur likely to the present conditions, severity of stroke by using NIHS s ,reoccurrence of stroke in both males and females.

Based on age the over all distribution of ischemic stroke in both males and females are from 20- 80 years and >80 years mostly the age group of 40-49 (17.5%), 50-59 (22.5%) and 60-69 (36.25%) . males and severity

Based on symptoms of ischemic stroke in both males and females are observed as weakness of left upper limb and lower limb – 13 (18.4%) , weakness of right upper limb and lower limb – 45 (25%) , loss of consciousness -15 (9.14%) , slurred speech -25 (15.2%) , vision – 5 (3.14%) , deviation of mouth -37 (22.5%) and others -10 (6.09%).

Most observed symptoms are to be weakness of right upper limb and lower limb, deviation of mouth, weakness of left upper limb and lower limb and slurred speech

Based on possible risk factors which lead to ischemic stroke in male patients are observed as Hypertension – 7 (14%), Hypertension + Diabetes – 4 (8%), Alcoholic 3- (6%) , Smoker –6 (12%), Alcoholic + Smoker – 18 (36%), Alcoholic + Smoker + Hypertension –6 (12%) , Alcoholic + Smoker + Hypertension+ Diabetes –1 (2%) and Others –5 (10%). In this observational study most possible risk factors are , Alcoholic +Smoker, Hypertension , Smoker and Alcoholic + Smoker +Hypertension, Risk factors in males which lead to ischemic stroke who are possibly treated with SAPT is observed to be , Hypertension –4 (14.8%) , Diabetes –0 (0%), Hypertension + Diabetes – 2 (7.4%) , Alcoholic –0 (0%), Smokers – 3 (11.11%), Alcoholic + Smoker – 11 (40.7%) , Alcohol +Smoker+ Hypertension – 3 (3.7%), Alcohol + Smoker + Hypertension +Diabetes – 1 (3.7%) and other – 3 (11.11%).

Risk factors in males which lead to ischemic stroke who are tend to treat with DAPT is observed as Hypertension – 3 (13.04%) , Diabetes – 0 (0%), Hypertension +Diabetes –2 (8.69%) , Alcoholic – 3 (13.04%) , Smokers -3 (13.04%), Alcoholic + Smoker + Hypertension – 7 (30.43%) , Alcoholic + Smoker + Hypertension + Diabetes –3 (13.04%) and others – 2 (8.69%).

Based on risk factors in females which affect them leading to ischemic stroke are observed as , Hypertension – 12 (40%), Diabetes –3 (10%), Hypertension + Diabetes– 6 (20%) , Others -8 (26.66%) and Beetle nut chewer – 1 (3.33%). Risk factors in females which lead to ischemic stroke and who are treated with SAPT are observed as Hypertension – 8 (53.33%), Diabetes – 2 (13.33%), Hypertension +Diabetes – 2 (13.33%), Others – 2 (13.33%) and Beetle nut chewer – 1 (6.66%).

Risk factors in females which lead to ischemic stroke and mostly to be treated with DAPT are observed to be , Hypertension –4 (26.66%) , Diabetes – 1 (6.66%) , Hypertension + Diabetes–4 (26.66%), Others – 6 (40%) and Beetle nut chewer 0 (0%)

By using NIHS score taken from the patients the severity of stroke was observed in both male and female patients, and looked into classifying stroke as Minor, Moderate, Moderate-Severe and severe.

Based on distribution of severity based on using NIHS scale total severity in males is most likely to be Minor – 15 (30%), Moderate – 28 (56%) , Moderate – Severe –6 (12%) and Severe – 1 (2%). In females by using NIHS scale the severity was found to be, Minor – 7(23.33%), Moderate – 13 (43.33%) , Moderate – Severe –3 (10%) and Severe –7 (23.33%).

Based on severity in SAPT males with ischemic stroke , it is observed as, Minor – 13 (48.14%), Moderate – 13 (48.14%), Moderate – Severe – 1 (3.70%) and Severe – 0 (0%).

Based on DAPT in males with ischemic stroke is observed as, Minor – 2(8.69%) , Moderate – 15 (65.21%) , Moderate – Severe – 5 (21.73%) and Severe –1 (4.34%).

Based on SAPT in females with ischemic stroke is observed as , Minor – 6(40%) , Moderate – 6 (40%) , Moderate – Severe – 0 (0%) and Severe – 3 (20%).

Based on DAPT in females with ischemic stroke is observed as, Minor – 1(6.66%), Moderate –7 (46.66%) , Moderate – Severe –3 (20%) and Severe–4 (26.66%).

Based on treatment total male patients given with Single antiplatelet drug therapy were observed as 27(54%) and total male patients given with Dual antiplatelet drug therapy were observed as 23 (46%). Based on treatment total female patients given with Dual antiplatelet drug therapy were given as observed Single antiplatelet therapy - 15(50%) and Dual antiplatelet drug therapy – 15 (50%).

6. CONCLUSION

From the above study, it was concluded that Ischemic stroke is occurring in both males and females. Among the study population male patients (62.5%) are high in number. Among them SAPT (27), DAPT (23). Ischemic stroke among adults was more common among patients with age group of 60-69(36.25%) and 50-59(22.5%) years of age Weakness of Right UL&LL(25%), Deviation of mouth(22.5%) were the most common presenting complaints. Smoker +Alcoholic (36%) in males, it is the major co-morbidity among the patients. Hypertension (40%) is the major risk factor among female patients. Single Antiplatelet therapy is received by 42 patients. Dual Antiplatelet therapy is received by 38 patients. Most of the females and males have Moderate severity of stroke by NIHSS Scale. Reoccurrence of stroke is seen in single antiplatelet therapy patients (males-25.92%) , (females-33.33%). Rate of recovery is seen in DAPT receiving patients with some Bleeding problems but Morbidity and Mortality is decreased.

7. BIBLIOGRAPHY

1. Sanes DH, Reh TA, Harris WA. Development of the nervous system. Academic press; 2011 Jan 25.
2. Ryan K, Lu Z, Meinertzhagen IA. The peripheral nervous system of the ascidian tadpole larva: Types of neurons and their synaptic networks. *Journal of Comparative Neurology*. 2018 Mar 1;526(4):583-608.
3. Arbib MA, editor. The handbook of brain theory and neural networks. MIT press; 2003.
4. Raichle ME, Mintun MA. Brain work and brain imaging. *Annu. Rev. Neurosci.*. 2006 Jul 21;29:449-76.
5. Riela AR, Roach ES. Topical review article: etiology of stroke in children. *Journal of child neurology*. 1993 Jul;8(3):201-20.
6. Toni D, Di Angelantonio E, Di Mascio MT, Vinisko R, Bath PM, PRoFESS Study Group. Types of stroke recurrence in patients with ischemic stroke: a substudy from the PRoFESS trial. *International journal of stroke*. 2014 Oct;9(7):873-8.
7. Pandian JD, Sudhan P. Stroke epidemiology and stroke care services in India. *Journal of stroke*. 2013 Sep;15(3):128.
8. Hilton-Jones D, Warlow CP. The causes of stroke in the young. *Journal of neurology*. 1985 Jul;232:137-43.
9. Elkind MS, Sacco RL. Stroke risk factors and stroke prevention. In *Seminars in neurology* 1998 (Vol. 18, No. 04, pp. 429-440). © 1998 by Thieme Medical Publishers, Inc..
10. Hilton-Jones D, Warlow CP. The causes of stroke in the young. *Journal of neurology*. 1985 Jul;232:137-43.
11. Rubattu S, Giliberti R, Volpe M. Etiology and pathophysiology of stroke as a complex trait. *American journal of hypertension*. 2000 Oct 1;13(10):1139-48.
12. Wardlaw JM, Farrall AJ. Diagnosis of stroke on neuroimaging. *BMJ*. 2004 Mar 18;328(7441):655-6.

13. Wang CX, Shuaib A. Neuroprotective effects of free radical scavengers in stroke. *Drugs & aging*. 2007 Jul;24:537-46.
14. Shuaib A, Hachinski VC. Mechanisms and management of stroke in the elderly. *CMAJ: Canadian Medical Association Journal*. 1991 Sep 9;145(5):433.
15. Lee M, Saver JL, Hong KS, Rao NM, Wu YL, Ovbiagele B. Risk–benefit profile of long-term dual-versus single-antiplatelet therapy among patients with ischemic stroke: a systematic review and meta-analysis. *Annals of internal medicine*. 2013