

“FUNCTIONAL INDEPENDENCE, MENTAL HEALTH AND QUALITY OF LIFE AMONG MIDDLE CEREBRAL ARTERY STROKE PATIENTS”

Dissertation submitted to The Tamil Nadu Dr. M.G.R. Medical University towards partial fulfilment of the requirements of **MASTER OF PHYSIOTHERAPY (Advanced PT in Neurology)** degree programme.



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CERTIFICATE

This is to certify that the dissertation entitled “**FUNCTIONAL INDEPENDENCE, MENTAL HEALTH AND QUALITY OF LIFE AMONG MIDDLE CEREBRAL STROKE PATIENTS**” is a bonafide work done by **SWATHI PRIYA .P. M** bearing the **Register No: 271720086**, KMCH College of Physiotherapy, towards partial fulfilment of the requirements of the **Master of Physiotherapy (Advanced PT in Neurology)** of the Tamil Nadu Dr. M. G. R. Medical university, Chennai – 32.

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ABSTRACT

ABSTRACT

Background – Assessment regarding functional independence, mental health and quality of life among Indian Middle Cerebral Artery stroke patients are scarce. Incidence of stroke was keep on increasing day by day, so this study would help the people to understand the recovery of stroke symptoms from admission till third month

Objective - The purpose of this study is to examine quality of life , anxiety, depression and Functional Independence of Middle Cerebral Artery stroke survivors and relationship of these variables with stroke characteristics

Methods- This was a prospective correlational study, patients were assessed at the time of admission, discharge and at third month after stroke. Short Form-36 Questionnaire was used to assess the quality of life, Anxiety and Depression measures was assessed using Hospital Anxiety and Depression scale, and Functional Independence was assessed using Functional Independence Measure, Fugl-Meyer Assessment, Functional Ambulation Category scale and stroke severity was assessed using National Institute of Health Stroke Scale and cognition level was assessed using Mini Mental Status Examination Scale. Comparative analysis were completed using Microsoft Excel and correlation was done using Karl Pearson's correlation

Results – 83 patients were screened, among them 26 patients who met the inclusion criteria were included, consent was obtained from the patient, and mean age was found to be 51 ± 6 years, 10 female and 16 male patients, among which 4 patients failed to come for follow up and 22 patients were taken for analysis. The correlation between short form 36 questionnaire and Fugl-Meyer assessment is 0.71, Fugl-Meyer assessment and Functional Independence Measure is 0.88, Hospital anxiety and depression scale and ShortForm-36 is– 0.66, Functional independence measure and ShortForm-36 is 0.76, Short Form-36 and Hospital Anxiety and Depression scale is – 0.37, Functional independence measure and National Institute of health stroke scale is – 0.55, age and depression is 0.64, Short Form-36 and Functional Independence measure is 0.59, age and Functional independence measure was – 0.44 and Short Form-36 and Functional Ambulation Category scale is 0.73.

Conclusion – There was a strong positive correlation with Functional Independence and Quality of Life and negative correlation with Mental Health and Quality of Life, compared at the time of admission, till the time of third month, the level of anxiety and depression was reduced, and the Functional Independence and Quality of Life was improved comparatively from admission till third month from the onset of stroke

Key words: quality of life, anxiety, depression, stroke

INTRODUCTION

1. INTRODUCTION

Stroke is becoming an important cause of disability in low income and middle income countries like India. As a result developing countries are exposed to double burden of both communicable and non-communicable diseases. Majority of stroke survivors continue to live with disabilities because some of them are not being able to afford the high cost for stroke care. According to Indian stroke fact sheet updated in 2010, the estimated age adjusted prevalence rate for stroke ranges between 84/100,000 and 262/100,000 in rural and between 334/100,000 and 424/100,000 in urban areas³.

Stroke affects all aspects of an individual's life and unlike other disabling conditions the onset of stroke is sudden leaving the individual and family ill prepared to deal with the sequel. Stroke causes sufficient decrease in quality of life even among those who have no post stroke disability. Depression and functional status have been repeatedly found to be factors that predict quality of life in stroke survivors. Stroke severity has also been identified as a factor affecting the quality of life of stroke survivors⁵. Traditionally epidemiological stroke studies focused on mortality and recurrence, but not on quality of life issues. Quality of life related to stroke and life satisfaction after stroke are important health care outcomes that have not received sufficient attention in literature. However, stroke patients have a broad range of impairments and a wide spectrum of symptom severity and sequel. A multidimensional approach is necessary to measure quality of life. The multi dimensional approach of perceived health status in stroke patients has received attention only in last few years. Consequences of stroke and health status affect even mild strokes.

Psychosocial well-being may be threatened following a stroke⁹. Depressive symptoms, anxiety, general psychological distress and social isolation are prevalent at the first months and years. Psychosocial difficulties may significantly impact long-term functioning and quality of life, reduces the effect of rehabilitation services and lead to higher mortality rates. The causes and risk factors of psychosocial problems are ambiguous and as special attention are to be paid to the associated disabilities towards initiation of their rehabilitation. A number of recent studies have focused on quality of life after stroke. It has been observed that underlying depression affects quality of life and the functional abilities of patients.

Another important factor that influences the stroke recovery is stroke pathogenesis. Cause of stroke can be broadly classified into intra cerebral hemorrhage or cerebral infarction. Stroke can affect the people physically, mentally and emotionally. So knowledge of long-term outcome after stroke rehabilitation is important for optimization of patient management but studies on long term outcomes are only few. Middle cerebral artery (MCA) stroke describes the sudden onset of focal neurologic deficit resulting from brain infarction or ischemia in the territory supplied by cerebrovascular middle cerebral artery is by far the largest cerebral artery and is the vessel most commonly affected by cerebrovascular accident. Functional disability and motor impairment are important concerns of post stroke, therefore improving functional and motor outcome is one of the main goals of stroke rehabilitation. Most of recovery is seen in the first few weeks after stroke, with a recovery slope reaching plateau between 3months and 6 months. It remains unclear whether early improvement can be sustained long term after stroke. There is only few information available relating to the patients status after the time of discharge from hospital¹³

Functional dependency caused by stroke has a massive impact on patient with social consequences and physical consequences of stroke being equally devastating. Stroke survivors are often greatly challenged by post stroke depression, which can lengthen rehabilitation and recovery time considerably. Post stroke depression also affects family and friends. Many stroke survivors experience feelings of hopelessness, helplessness, anxiety and dehumanization²¹. After a stroke quality of life is reported to decrease by more than 40% compared with pre-stroke quality of life.

Several studies have been performed in developed countries exploring the psychosocial problems and quality of life among post stroke survivors. However there are only few data available from India and other developing countries regarding these matters, despite stroke being one of the most common causes of disability and handicap in those communities. Stroke patients receive family support from care givers during their process of recovery. Therefore the psychosocial problems in Indian stroke patients could differ from those experienced by patients in other developed countries. So here comes the importance of the study, that is to find the relationship between sensory motor performance, functional recovery and quality of life. The objective of this study is to study the quality of life, functional dependence and depression

experienced by post stroke survivors and to study the relationship of these measures with various stroke characteristics.

1.1 OPERATIONAL DEFINITIONS

Middle Cerebral artery Stroke defined as sudden onset of focal neurologic deficit resulting from brain infarction or ischemia in the territory supplied by the Middle Cerebral Artery (American academy of physical medicine and rehabilitation, 2018).

Functional Independence is the ability to carry out activities of daily living safely and autonomously (Australian Institute of health and welfare, 2018).

Mental Health is defined as a state of well-being which every individual realizes his or her own potential, can cope with normal stresses of life, can work productively and fruitfully and is able to make a contribution to her or his community (WHO, 2014).

Quality of Life is defined as degree to which a person is able to function at a usual level of activity with out or with minimal, compromise of routine activities

(Dictionary of modern medicine, 2002).

1.2 NEED FOR THE STUDY

- In the present scenario, very few studies are available to understand the relationship between mental health, functional independence and quality of life among middle cerebral artery stroke patients that too at the time of admission, discharge and at third month from the onset of stroke.
- According to The International classification of functioning, disability and health, in their biopsychosocial approach, it considers five components and their interaction, they are Body functions, Body structures, Activity and participation, Environmental and Personal factors, and they too suggest patients centered care is important and based on that model in this study functional independence, mental health and quality of life was taken.
- The assessment of anxiety and depression from the time of admission to third month will help us to understand how far the patient is experiencing psychological issues and how it changes on progress of rehabilitation could also be noted and we can also know how it's been correlated with the quality of life of the patients.
- As only few studies are documented in Indian settings, hence the need arises to study the relationship between sensory motor performance, functional recovery and quality of life among middle cerebral artery stroke patients.

REVIEW OF LITERATURE

2.REVIEW OF LITERATURE

2.1 STUDY ON FACTORS AFFECTING QUALITY OF LIFE

- ❖ **Rinu Susan Raju et al., (2010)** conducted a study at Christian medical College, Punjab and the study was about psychosocial problems, quality of life and functional independence among Indian stroke survivors, it was a prospective hospital based study, patients interviewed after one month of post stroke, WHO QOL BREF, was used to assess the quality of life, anxiety and depression were assessed using hospital anxiety and depression and functional independence was measured by modified Rankin scale. Univariate and multi variate analysis were completed using spss statistics. 162 stroke patients were included and around two years follow up was taken and the study concluded that presence of anxiety, depression and functional dependence were associated with impaired quality of life. Older age and stroke severity resulted in increased functional dependence.
- ❖ **E. Varela et al., (2000)** conducted a study at Spain, a qualitative study, and it was a about quality of life among stroke survivors evaluated one year after stroke, a cross sectional and descriptive design, a cohort of 118 stroke survivors were included, patients completed a questionnaire that included socioeconomic variables. Hamilton rating scale for depression, sickness impact profile scale (SIP), Short Form-36, frenchay index, Rankin scale and Scandinavian stroke scale. Independent variables were age, sex, functional status, motor impairment and depression. They developed a ANOVA model for statistical analysis and the result concluded that functional status and depression Were concluded predictors of quality of life. Patients independent in their activities of daily living suffer from a deterioration of the psychosocial dimension of sickness impact profile

2.2STUDY ON QUALITY OF LIFE

- ❖ **Nuraydayapuglu et al., (2018)** conducted a study at Turkey on Quality of life in stroke patients, 70 patients with stroke seen in neurology clinic on a follow up visit at least a period of three months follow up were included, data were collected using SF-36

questionnaire, perceived social support from family scale and the results showed a low mean quality of life score in patients with stroke, there is a positive and significant correlation between scores on perceived social support from family scale and various aspects of quality of life.

- ❖ **Sonia shetty et al. (2016)**, conducted a study at Fr. Muller Medical College, Mangalore and the study was about quality of life in stroke patients, a qualitative
- ❖ study, 20 stroke patients were included and 3month follow up was taken. WHO QOL BREF scale was used to assess the quality of life and the result concluded that quality of life in stroke patients were hampered in majority of the patients.
- ❖ **Sehchi et al., (2014)**, conducted a study at Japan and the study was about the factors affecting the quality of life of home bound elderly hemiparetic stroke patients, 21 patients were included. The functional independence measure was used to assess the activities of daily living and SF-36 were used to assess the quality of life and the study concluded that quality of life was affected by their independence ADL and bedridden degree and care needed level.
- ❖ **Anthea j. Rhoda et al., (2014)**, conducted a study at university of Western Cape, South Africa and the season about health related quality of life of patients six months post stroke living in Western Cape, South Africa. It was a observational longitudinal study. The Rivermead motor assessment scale and the Barthel Index were used to assess functional outcome and the EQ-5D was used to assess the quality of life at two months and six months post stroke. 100 participants were included and 73 was analyzed out of 100 and the study concluded that functional ability and urinary incontinence were the factors affecting quality of life in their sample.
- ❖ **S. A. Abubakar et al., (2012)**, conducted a study at Nigeria and the study was about the health related quality of life of post stroke survivors, it's a cross sectional and descriptive correlational design, 62 stroke patients were included and interviewed 3 months post stroke in neurology out patient clinic, modified Rankin scale was used to assess the functional status, zung depression self rating scale was used to assess the presence of depression, stroke impact scale 16 was used to assess the health related quality of life and the study concluded that functional status and depression We're identified as independent factors affecting the quality of life in stroke patients.

- ❖ **Javier carod et al., (2000)** conducted a study at Spain on Quality of life among stroke survivors evaluated 1 year after stroke, 118 patients were included, a cross sectional, descriptive design was developed, patients completed a questionnaire that included socioeconomic variables, Hamilton depression rating scale, sickness impact profile, Short Form-36 questionnaire, Frenchay Index, Barthel index, Rankin scale and Scandinavian stroke scale, ANOVA was used for statistical analysis and they concluded that functional status and depression We're identified as predictors of quality of life, patients independent in their ADL suffered from a deterioration of the psychosocial dimension of Sickness Impact Profile.

2.3STUDY ON MOTOR OUTCOME

- ❖ **Fidel Lopez et al., (2017)** conducted a study at Spain on Functional status and disability in patients with acute stroke : a longitudinal study, they used Barthel index to evaluate basic activities of daily living and predictors of functional outcome at 6 months after stroke, is an observational longitudinal study, 175 stroke patients were included in the study, age was negatively associated with Barthel Index at the time of discharge and 6 months after stroke and the study concluded that functional status 6 months after stroke was influenced by age, sex, stroke severity, type of stroke, baseline status, mood and social risk.
- ❖ **Sarah meyer et al., (2015)** conducted a study at Europe and the study was about functional and motor outcome5 year after stroke is equivalent to outcome at two months, a prospective cohort study, 532 patients were included and the patients were assessed on admission, at 2 months and 6 months and 5 years after stroke. In this study, Rivermead motor assessment for gross function, barthel index, leg and trunk function, arm functions were assessed and the study concluded that 5 years follow up revealed deterioration in functional and motor outcome, with a return to a level measured at 2 months. Increasing age and increasing stroke severity negatively affected recovery upto 5 years after stroke.
- ❖ **Kyoung Bo Lee et al., (2015)**, conducted a study at Korea on six month functional recovery of stroke patients, a multi-time-point study, 20 consecutive stroke patients were

involved in this study, outcome measures were examined at the initial rehabilitation baseline, 1,2, and 4 weeks after rehabilitation and 3,4,5 and 6 months of stroke, tools used was trunk impairment scale, Fugl-Meyer motor and sensory assessments for upper and lower limb, mini mental status examination, functional ambulation category and modified barthel index, the recovery was relatively rapid during the first four weeks and this study confirms the importance of the period with in 3 months for recovery after stroke, during which most of the recovery occurred ranging from 48-91% and therefore intensive treatment targeting motor and sensory functions early after stroke may be beneficial for recovery of impairments and functional performance.

- ❖ **R. Bonita et al., (1988)**, conducted a study at New Zealand, a qualitative study and the study was about recovery of motor function after stroke, a community based study, 680 stroke patients were included, motor deficit category were used to assess motor recovery and the study concluded that recovery of motor function is confined to patients whose motor deficits at onset is either mild or moderate.
- ❖ **Derrick et al., (1985)**, conducted a study at UK and the study was about recovery after stroke at the first three months, 99 patients were included over first 13 weeks after the stroke, five functional areas were studied, urinary incontinence, Mobility, the ability to dress, feeding and the ability to transfer from bed to chair was used to assess the motor recovery, it was a prospective cohort study and multiple regression analysis using Wherry-Doolite method was used to assess the important independent prognostic factors and the study concluded that urinary incontinence was the first important adverse prognostic factor followed by age was the second most important factor. It is suggested that the rehabilitative therapy should concentrate less on physical function and more on cognitive ability.

2.4 STUDY ON ANXIETY AND DEPRESSION

- ❖ **Ho-yan Yvonne Chun et al., (2018)**, conducted a study at UK on Anxiety after stroke, it's a prospective cohort study, 175 patients were included who is within 3 months of stroke and outcome measures used was Fear questionnaire, modified rankin scale, Euro – QOL-5D5L, and Work and social adjustment scale and the study concluded that Anxiety after stroke is predominantly phobic and is associated with poorer patient outcomes.
- ❖ **Francesca Wright et al.,(2017)**, conducted a study at Factors associated with post stroke anxiety :A systematic review and meta-analysis, they systematically reviewed the literature and performed a meta analysis to identify the associations. They searched electronic databases from January 2014 to July 2015 to complement literature search, there were 24 studies recruiting 15448 patients, 13 studies with 2408 patients reported associations between post stroke anxiety and post stroke depression, as a result post stroke anxiety was associated with depression but there are limited data on other modifiable associations.
- ❖ **Yihong et al., (2017)**, conducted a study at South Africa on Reducing depressive or anxiety symptoms in post stroke patients : pilot trial of a constructive integrative psychosocial intervention 42 stroke patients were included, and HADS (Hospital anxiety and depression scale) was used at first, third and sixth month and the result concluded that constructive integrative psychosocial intervention appears to be of incremental value in treating depression as well as anxiety in subacute care.

2.5 STUDY ON FUGL MEYER SENSORIMOTOR ASSESSMENT

- ❖ **Nubia et al., (2018)** conducted a study at Sweden on Translation and cultural validation of clinical observational scales—The Fugl-Meyer assessment for post stroke sensory motor function in Colombian Spanish, procedure included forward and back ward translation, step wise reviewing by bilingual and professional experts to ensure conceptual and semantic equivalence and the study concluded that use of Fugl Meyer Assesment will allow unified description of stroke severity and motor recovery in Spanish speaking countries.

- ❖ **Jil see et al., (2013)** conducted a study at California on A standardized approach to the Fugl-Meyer assessment and its implications for clinical trials, among 66 chronic stroke patients were involved who received robotic therapy and the study concluded that training with current method improved accuracy, and reduced variance, of Fugl Meyer Sensorimotor Assessment scoring ; 20% Fugl Meyer Sensorimotor variance reduction with training would decrease sample size requirements from 137 to 88 in a theoretical trial aiming to detect a 7 point difference, the current training approach may be useful for assessing motor outcomes in restorative stroke trials.
- ❖ **Katherine J. Sullivan et al., (2010)** conducted a study at Los Angeles on Fuglmeyer assessment of sensory motor function after stroke, a standardized measurement method and rater training program were developed for randomized clinical trial 15 hemiparetic stroke patients were included, 17 trained physical therapists across 5 regional clinical sites and an expert rater participated in an inter rater reliability study and the study concluded that post stroke sensor motor impairment severity can be reliably assessed for clinical practice or rehabilitation research with these methods **Francine moulin et al., (2005)** conducted a study at Sweden University, on the topic evaluating motor recovery early after stroke, it was a correlational study and they took 32 stroke patients with mean age of 60 years, they compared Fugl-Meyer scale with motor assessment scale and at third month they administered both the scale and their results concluded that Fugl-Meyer scale can better discriminate the level of motor recovery than motor assessment scale
- ❖ **David j. Gladstone et al., (2002)** conducted a study at Australia on Fugl-Meyer assessment of motor recovery after stroke. The Fugl-Meyer scale was developed as the first quantitative evaluative instrument for measuring sensor motor recovery, it's a cross sectional study and 156 patients were included and the study concluded that Fugl-Meyer scale is well developed and designed, it's feasible and efficient and it has been tested widely in stroke patients. Excellent inter-rater and intra rater reliability and construct validity have been demonstrated and they recommend this tool for evaluating changes in motor impairment following stroke

2.6 STUDY ON SHORT FORM-36 QUESTIONNAIRE

- ❖ **Paula Costa Castro et al., (2014)** conducted a study at Brazil on Convergent validity between SF-36 and WHO QOL BREF in older adults, cross sectional study of 278 literate older adults were included, cornbachs alpha coefficient was used to estimate reliability and Pearson's correlation for comparison between two scales and the study concluded that both the scales are reliable instruments for clinical and research uses in older adults
- ❖ **Ann-Helen et al., (2009)** conducted a study at Sweden on Quality of life among Swedish patients after stroke :psychometric evaluation of Short Form-36, it was a cross sectional study, 118 acute stroke patients were included, data were collected by interviews during home visits 2-3 weeks after discharge, psychometric analysis were conducted and the internal consistency reliability Was >0.70 for all scales, the study findings support good divergent validity of Short Form-36 for discriminating health related quality of life of stroke groups and normal population
- ❖ **Unalan Demet et al., (2008)** conducted a study at Turkey on comparison of SF-36 and WHO- QOL – 100 in patients with stroke, 70 patients were included, they were six months post stroke, Pearson's correlation analysis were performed and Blant – Altman plots were used and the study concluded that both the scales are useful in practical evaluation of stroke patients
- ❖ **Kate. M. Scott et al., (1998)**, conducted a study at New Zealand on SF-36 health survey reliability, validity and norms for New Zealand, a cross sectional nationality representative survey of 7862 adults were included and the study concluded that satisfactory psychometric performance was demonstrated for SF-36 in New Zealand population, over all this questionnaire appeared to be a valid and reliable measure of health related quality of life for New Zealand population

2.7 STUDY ON HOSPITAL ANXIETY AND DEPRESSION SCALE

- ❖ **Edward et al., (2016)** conducted a study at Brazil on psychopathological evaluation and use of Hospital anxiety and depression scale in sample of Brazilian patients with post stroke depression, it's a cross sectional study, they included 60 stroke patients and they

also used NIHSS scale, functional independence measure, MMSE and the study concluded that hospital anxiety and depression scale has shown good performance in screening of depression and the depression presented sensitivity of 100% and specificity of 99.17%

- ❖ **Valdimira et al., (2012)** conducted a study at Croatia on Anxiety and depressive symptoms in acute ischemic stroke 40 patients were included who admitted in a period of one month and it was evaluated using Hospital anxiety and depression scale and statistics was performed by Sigma-stat software and the study concluded that attention should be paid to the anxiety and depression in stroke patients and try to relieve patients emotional stress, which could improve their neurological outcome
- ❖ **Ingvar Bjelland et al., (2002)** conducted a study at Norway on The validity of Hospital anxiety and depression scale, An updated literature review, A review of 747 identified papers that used Hospital Anxiety Depression Scale was taken, and the study concluded that Hospital Anxiety and Depression Scale was found to perform well in assessing the symptom severity and caseness of anxiety disorders and depression in both somatic, psychiatric and primary care patients and in the general population

2.8 STUDY ON FUNCTIONAL AMBULATION CATEGORY SCALE

- ❖ **Maijke van et al., (2012)**, conducted a study at Netherlands on Walking tests for stroke survivors : a systematic review of their measurement properties, COSMIN check list was applied for methodological quality assessment of included studies, 32 studies evaluating 23 walking tests which includes Functional Ambulation Category were taken,, the test assessed the walking using the outcome measures of walking speed, walking distance, functional ambulation and walking on different surfaces and the study concluded that many walking tests have been clinimetrically evaluated in stroke survivors, and FAC is also found to be reliable and valid tool
- ❖ **Jan mehrholz et al., (2007)**, conducted a study at Germany on predictive validity and responsiveness of Functional ambulation category in hemiparetic patients after stroke, it's a prospective cohort study, 55 non- ambulatory patients after first ever stroke, with duration of illness between 30 and 60 days were included and the outcome measures used

was Functional Ambulation Category, Rivermead mobility index, 6 minute walk test, walking velocity, step length were assessed at the beginning, after 2 and 4 weeks of rehabilitation and again 6months later and the study concluded that FAC has excellent reliability, good concurrent and predictive validity and good responsiveness in patients with hemiparesis after stroke

- ❖ **Enrique Viosca et al.,(2005)**,conducted a study at Spain on Proposal and validation of a New functional ambulation classification scale for clinical use, it's a validity study, 31 stroke patients were included, walking velocity was measured using manual chronometer, number of steps were measured using step counter and the study concluded that the proposed classification is reliable and valid for determining the different levels of walking abilities

2.9 STUDY ON FUNCTIONAL INDEPENDENCE MEASURE

- ❖ **Jean Francois et al (1999)**, conducted a study at France on Construct validity of Functional Independence measure: Questioning the unidimensionality of the scale and the value of FIM scores, it was assessed in 127 stroke patients and their findings demonstrate the multi dimensional nature of phenomenon assessed by the scale. This observation raises the question of relevant use of FIM total score, currently too widely applied without sufficient precautions and suggests that preferably subscores should be used
- ❖ **Syedmansoor et al., (2015)** conducted a study at Israel on Evaluation of complete functional status of patients with stroke they administered this tool at the time of admission, discharge and at sixth month, they included 108 patients and their study concluded that functional independence measure is a valid tool for evaluating activities of daily living among stroke patients and they concluded that patients with stroke make a significant improvement in their functional status over time

AIM AND OBJECTIVES

3. AIM AND OBJECTIVES

3.1 AIM

To find out the relationship between functional independence ,mental health and quality of life among middle cerebral artery stroke patients .

3.2 OBJECTIVES

- To find the sensory motor performance after the onset of stroke
- To find the quality of life of stroke patients at the time of admission, discharge and at third month
- To assess the functional abilities of stroke patients at the time of admission, discharge and at third month
- To assess the level of anxiety and depression of stroke patients at the time of admission, discharge and at third month
- To find the walking ability of the stroke patients at the time of admission, discharge and at third month
- To find the relationship between sensory motor performance and functional abilities
- To find the relationship between anxiety, depression, and quality of life
- To find the relationship between functional abilities and quality of life
- To find the relationship between quality of life and anxiety and depression
- To find the relationship between functional abilities and stroke severity
- To find the relationship between age and depression
- To find the relationship between quality of life and functional abilities
- To find the relationship between age and functional abilities
- To find the relationship between quality of life and walking ability

METHODOLOGY

4. MATERIALS AND METHODOLOGY

4.1 STUDY DESIGN

- Prospective correlational study

4.2 STUDY SETTING

- Physical Medicine and Rehabilitation Department and Out Patient Neurology Department, Kovai Medical Center and Hospital (KMCH), Coimbatore- 641 014

4.3 STUDY DURATION

- 6 months

4.4 STUDY POPULATION

- Middle Cerebral Artery stroke patients

4.5 SAMPLING TECHNIQUE

- Purposive sampling technique

4.6 SAMPLE SIZE

- 26 participants

4.7 SELECTION CRITERIA

4.7.1 INCLUSION CRITERIA:

- First ever stroke
- Clinically diagnosed middle cerebral artery stroke by MRI-scan or CT scan
- Age : 40 to 60 years of age
- Both genders (male and female)
- Medically stable patients

4.7.2 EXCLUSION CRITERIA:

- History of dementia
- Psychiatry Co – morbidity

- Refusal to consent
- Aphasia
- Patients with previous stroke
- Neurological impairment with permanent damage
- Stroke like symptoms attribute to tumor, trauma or encephalitis
- Other comorbidities like heart failure, peritoneal dialysis, pre existing musculoskeletal disease significantly limiting physical function, HIV or AIDS

4.8 HYPOTHESIS

4.8.1 NULL HYPOTHESIS

H0-There is no significant relationship between functional independence, mental health and quality of life among middle cerebral artery stroke patients

4.8.2 ALTERNATE HYPOTHESIS

H1- There is significant relationship between functional independence, mental health and quality of life among middle cerebral artery stroke patients

4.9 MEASUREMENT TOOLS

4.9.1 TOOLSTO ASSESS SENSORY MOTOR OUTCOME (APPENDIX – 5)

- **FUGL MEYER ASSESSMENT (Axel Fugl-Meyer etal., 1951)**

The motor and sensory Fugl-Meyer assessment are scored on a 3-point ordinal scale (0-2). The Fugl-Meyer motor is used to measure voluntary limb movement. It includes upper extremity Subscale (33 items; score range, 0-66) and the lower extremity Subscale (17 items; score range, 0-34) for a total Fugl-Meyer score of 100. The Fugl-Meyer sensory assessment is used to measure the limb sensation. Sensation is assessed as absent, impaired or normal for light touch (2 items each for Upper extremity and Lower extremity score range, 0-8) and proprioception (4 items each for Upper extremity and Lower extremity; score range, 0-16) for a total sensory Fugl meyer score of 24. It almost takes 20 to 25 minutes to complete the test

4.9.2 TOOLS TO ASSESS QUALITY OF LIFE

- **SF-36 QUESTIONNAIRE (Rand corporations, 1998) (APPENDIX –7)**

Short Form-36 health survey is a 36 item, patient reported survey of patient health. The Short Form-36 consists of eight scaled scores, which are the weighted sums of the questions in their section. Each scale is directly transformed into a 0-100 scale on the assumption that each question carries equal weight. The lower the score the more disability. The higher the score the less disability i.e., a score of zero is equivalent to maximum disability and a score of 100 is equivalent to no disability. The eight sections are physical functioning , role limitation due to physical function, role limitation due to emotional problems energy or fatigue, emotional well-being, social functioning pain and general health .It will take approximately 15 minutes for the patient to self report the given questionnaire

4.9.3 TOOLS TO ASSESS MENTAL HEALTH

- **HOSPITAL ANXIETY AND DEPRESSION SCALE(Zigmond et al., 1983) (APPENDIX – 6)**

The Hospital anxiety and depression scale (HADS) include 2subscals,1 for depression and the other for anxiety, each comprising 7 items relating to symptoms. Each item is scored (0-3) according to severity, with a maximum possible score of 21 for each sub scale. The original validation study suggest that a score of 0-7 would indicate no case, 8-10 would indicate borderline case and 11+ would indicate case (presence of anxiety and depression) it takes 2 to 5 minutes for the patient to complete the scoring

4.9.4 TOOLS TO ASSESS FUNCTIONAL INDEPENDENCE

- **FUNCTIONAL INDEPENDENCE MEASURE (Carl granger et al., 1983) (APPENDIX – 8)**

The Functional Independence Measure is an 18 item, 7 level ordinal scale. Functional independence measure has 2 dimensions motor and cognitive. The motor dimension prescribes physical function such as eating, toileting and transferring and the cognitive dimension describes

communication, social interactions and cognitive functioning. It contains response categories for each item ranging in value from 1 to 7 where 1 indicates complete dependence and 7 indicates complete independence. The total score ranges in value from 18 to 126. It takes 10-15 minutes to complete the assessment

- **FUNCTIONAL AMBULATION CATEGORY SCALE (Katie Marvin et al., 1988) (APPENDIX – 9)**

The Functional Ambulation category scale is used to assess the functional walking and ability of ambulation. This 6 point scale assess ambulation status by determining how much human support the patient requires when walking, regardless of whether or not they use a personal assisted device. The Functional Ambulation Category does not require endurance, as the patient is only required to walk 10 feet approximately. A score 0 indicates that the patient is a non functional ambulator and a score of 5 indicates independent ambulator who can walk freely in any surface. It takes 5 minutes approximately to record the values.

Modified Functional ambulation category scale has been updated, but still Functional ambulation category scale was used for this study as it is quick and easy to assess.

4.9.5 TOOLS TO ASSESS COGNITION LEVEL

- **MINI MENTAL STATUS EXAMINATION (M.F.Folstein et al., 1975) (APPENDIX –4)**

The Mini Mental Status Examination which includes eleven questions, requires only 5 to 10 minutes to administer and therefore practical to use serially and routinely. It mainly assess the cognitive level of patient, the total score is 30 where 0 to 17 indicates severe cognitive impairment, 18-23 indicates mild cognitive impairment and 24-30 indicates no cognitive impairment.

Modified Mini Mental Status Examination is been updated but still Mini Mental Status Examination was used in this study because of easy accessibility and time saving.

4.9.6 TOOLS TO ASSESS STROKE SEVERITY

- **NATIONAL INSTITUTE OF HEALTH STROKE SCALE (National Institute of health, 1989) (APPENDIX – 3)**

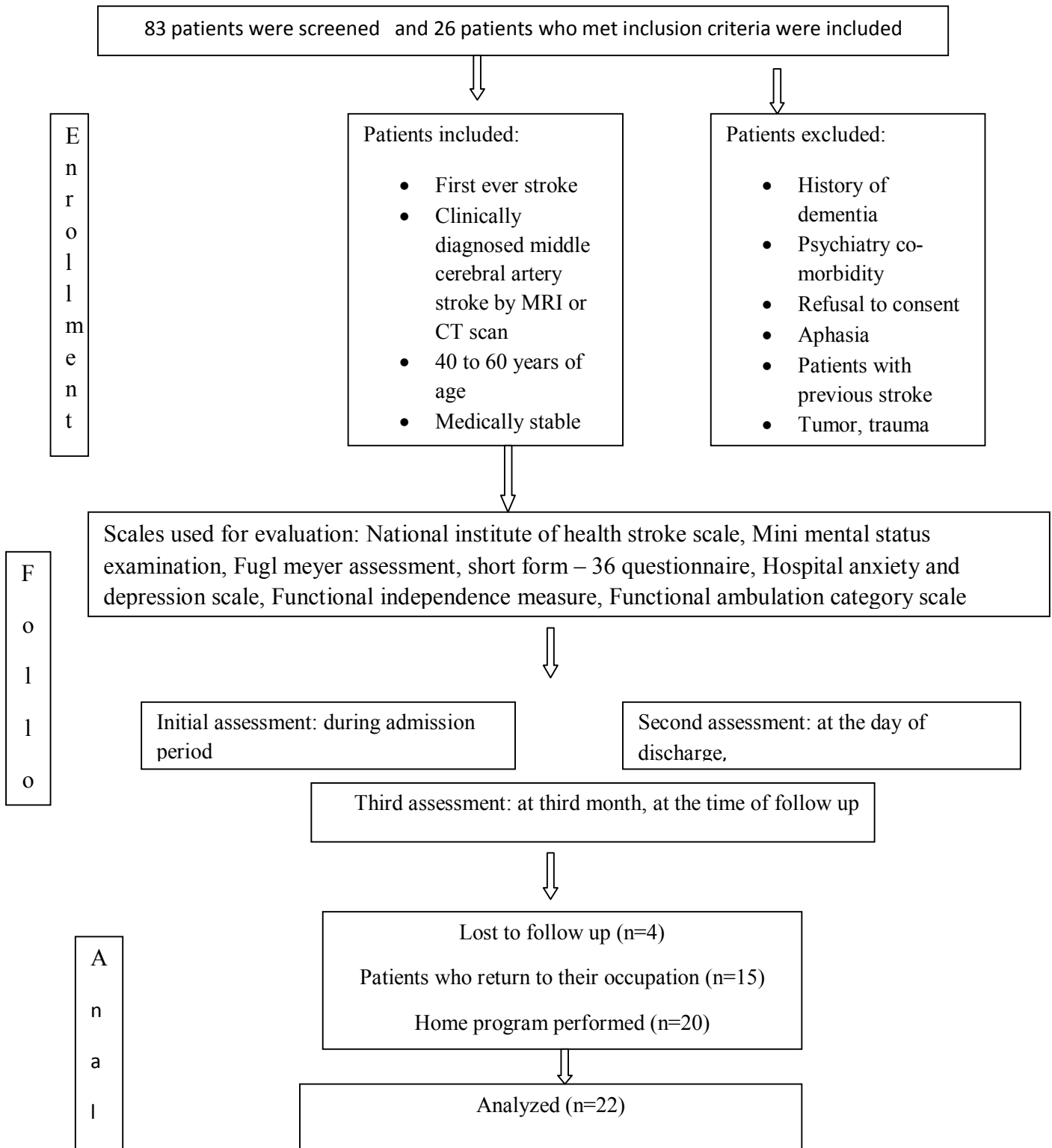
This scale is used to evaluate the severity of stroke. This scale contains 11 components which includes level of consciousness, eye movements, visual fields, motor component, sensory components, facial, limb ataxia, aphasia, dysarthria and neglect and the total score range between 0 to 42, where

1-5 indicates mild stroke, 5-14 indicates mild to moderately severe stroke, 15-24 indicates severe stroke and >25 indicates very severe

4.10 TREATMENT PROCEDURE

- 83 patients were screened and 26 patients who met the inclusion criteria were selected, procedure was explained to the patient and consent form was obtained, assessment were performed at three different times : at the time of admission , at hospital discharge and at third month after the onset of stroke.
- The following demographic variables were collected: age, sex, monthly income, and presence of arterial hypertension, diabetes mellitus and stroke severity noted according to NIHSS (National Institute of Health stroke scale).
- Sensorimotor recovery after the stroke event was assessed using Fugl-Meyer sensorimotor assessment, anxiety and depression after the onset of stroke was measured using hospital anxiety and depression scale, activities of daily living was measured using Functional Independence Measure, Quality of life was evaluated using ShortForm-36 questionnaire and walking ability was assessed using functional ambulation category scale, all the above mentioned scales are administered at the time of admission, at the time of discharge and at third month follow up.
- Patients who did not understand English language, for them Tamil version of Hospital Anxiety and Depression scale, Short Form -36 questionnaire were administered for better outcome. Patients were given adequate time to answer the questionnaires

4.10.1 FLOW DIAGRAM OF PATIENTS RECRUITED IN THE STUDY



4.10.2 PHOTOGRAPHIC ILLUSTRATION:

FUGL MEYER SENSORIMOTOR ASSESSMENT





FUNCTIONAL AMBULATION CATEGORY ASSESSMENT



4.11 STATISTICAL ANALYSIS

Statistical Tools

1. Percentage Analysis:

$$Total = \sum_{i=1}^n x_i$$

$$Average = \frac{\sum x_i}{n} ; i = 1,2,3, \dots n.$$

$$Percentage = \frac{x_i}{\sum x_n} * 100 ; i = 1,2,3, \dots n.$$

$$where \sum x_n = x_1 + x_2 + x_3 + \dots + x_n$$

2. Correlation

Karl Pearson's Coefficient of Correlation:

$$r = \frac{\sum xy}{N \sigma_x \sigma_y}$$

$$Where: x = (X - \bar{X}); y = (Y - \bar{Y})$$

$$r = \frac{\sum xy}{\sqrt{\sum x^2 * \sum y^2}}$$

$$Where: x = (X - \bar{X}); y = (Y - \bar{Y})$$

Range-

0 -0.3 – very less correlation

0.3- 0.7 – moderate correlation

0.7- 0.1 – strong correlation

3. Student's 't' Test

Test Statistic: (t calculated value)

$$t = \frac{\bar{X} - \mu}{S} * \sqrt{n}$$

DATA PRESENTATION

5. DATA PRESENTATION

5.1 TABULAR REPRESENTATION

TABLE 5.1.1 DEMOGRAPHIC DATA COLLECTION

Age	51± 6 years
Sex	10 females, 16 males
Income	>20000, 15 participants <20000, 11 participants
Education level	Highersecondary17, < higher secondary 9
Home program	20 patients did, 2patients didn't do, 4 didn't come for follow up
Area	With in Coimbatore 11, other districts, 15
Hypertension	14
Diabetes mellitus	11
Hyperlipidemia	16
Under medication	15
Type of stroke	Infarct – 26
Time of admission after stroke onset	<4hours – 17 >4 hours-9
Follow up	22 patients came 4 patients failed to come
Got back to the occupation	15 got back to their normal life

TABLE 5.1.2 PERCENTAGE ANALYSIS OF NATIONAL INSTITUTE OF HEALTH STROKE SCALE

MILD	MILD TO MODERATELY SEVERE	SEVERE
7.69%	84.62%	7.69%

TABLE 5.1.3. PERCENTAGE ANALYSIS OF MINI MENTAL STATUS EXAMINATION:

MINI MENTAL STATUS EXAMINATION	ADMISSION	DISCHARGE	AT THIRD MONTH
SEVERE COGNITIVE IMPAIRMENT	61.54%	0.00	0.00
MILD COGNITIVE IMPAIRMENT	38.46%	76.92%	0.00
NO COGNITIVE IMPAIRMENT	0.00	23.08%	100%

TABLE 5.1.4 MEAN VALUES OF FUGL MEYER SENSORIMOTOR ASSESSMENT:

UPPER LIMB AND LOWER LIMB

FUGL MEYER ASSESSMENT	ADMISSION	DISCHARGE	AT THIRD MONTH
UPPER LIMB	10.69	29.77	69.55
LOWER LIMB	11.04	20.65	41.32

TABLE 5.1.5 MEAN VALUES HOSPITAL ANXIETY AND DEPRESSION SCALE:

MEAN VALUES	ADMISSION	DISCHARGE	AT THIRD MONTH
ANXIETY	16.42	9.92	5.86
DEPRESSION	15.81	10.77	5.45

TABLE 5.1.6 MEAN VALUES OF SHORT FORM 36 QUESTIONNAIRE :

MEAN VALUE	ADMISSION	DISCHARGE	AT THIRD MONTH
PHYSICAL FUNCTIONING	12.77	34.12	87.77
ROLE LIMITATION DUE TO PHYSICAL HEALTH	9.63	32.31	81.00

ROLE LIMITATION DUE TO EMOTIONS	12.12	35.31	85.50
ENERGY OF FATIGUE	11.20	31.54	84.32
EMOTIONAL WELL BEING	13.14	37.04	91.09
PAIN	36.38	42.65	90.23
SOCIAL FUNCTIONING	24.90	41.04	87.18
GENERAL HEALTH	21.64	34.85	88.77

TABLE 5.1.7 MEAN VALUES OF FUNCTIONAL INDEPENDENCE MEASURE:

FUNCTIONAL INDEPENDENCE MEASURE	ADMISSION	DISCHARGE	AT THIRD MONTH
MEAN VALUE	29.96	63.27	105.45

TABLE 5.1.8 MEAN VALUES OF FUNCTIONAL AMBULATION CATEGORY:

FUNCTIONAL AMBULATION CATEGORY	ADMISSION	DISCHARGE	AT THIRD MONTH
MEAN VALUE	0.85	0.96	4.50
MEDIAN VALUE	0	0	4

TABLE 5.1.9 “t’ Test for Age:

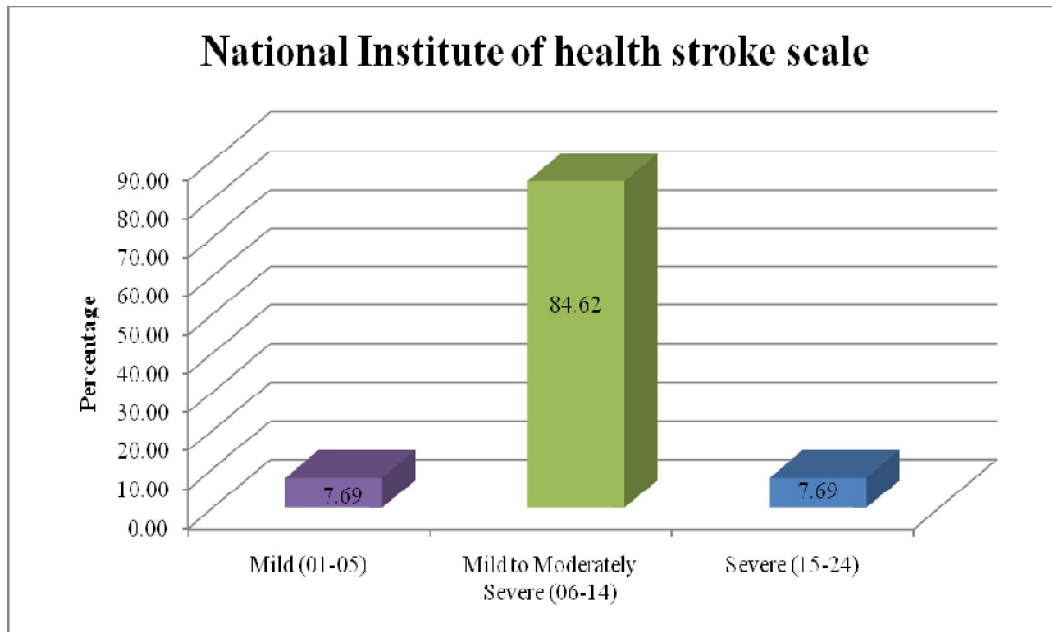
S	43.755
<i>t_{cal}</i>	0.809
<i>t_{exp}</i>	1.708

TABLE 5.1.10“t” Test for Quality of Life:

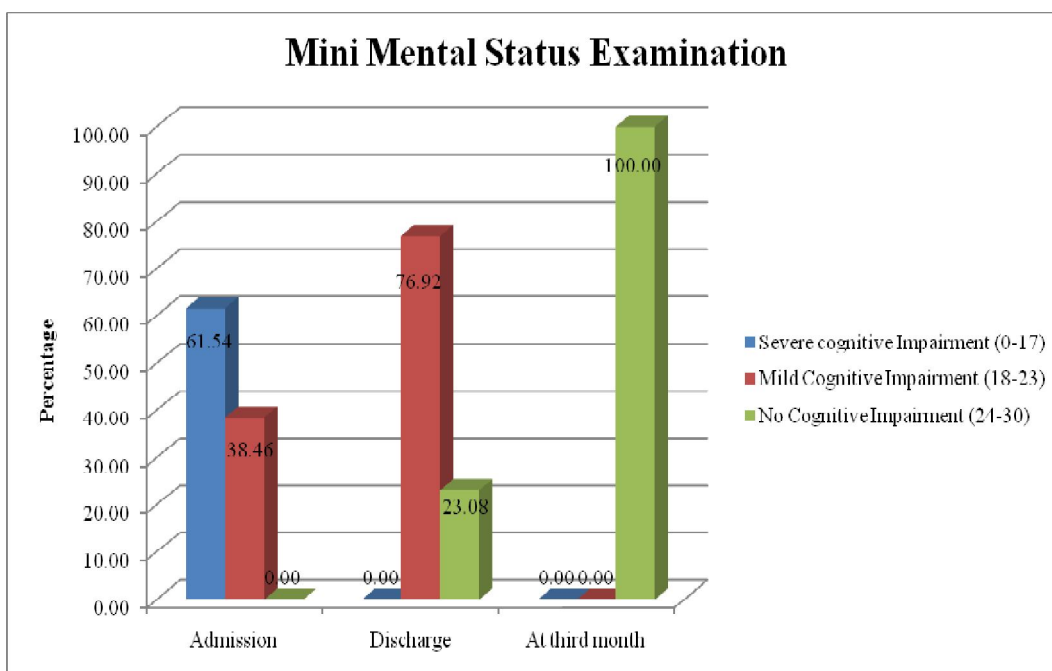
S	16.855
<i>t_{cal}</i>	9.979
<i>t_{exp}</i>	1.721

5.2 GRAPHICAL REPRESENTATION

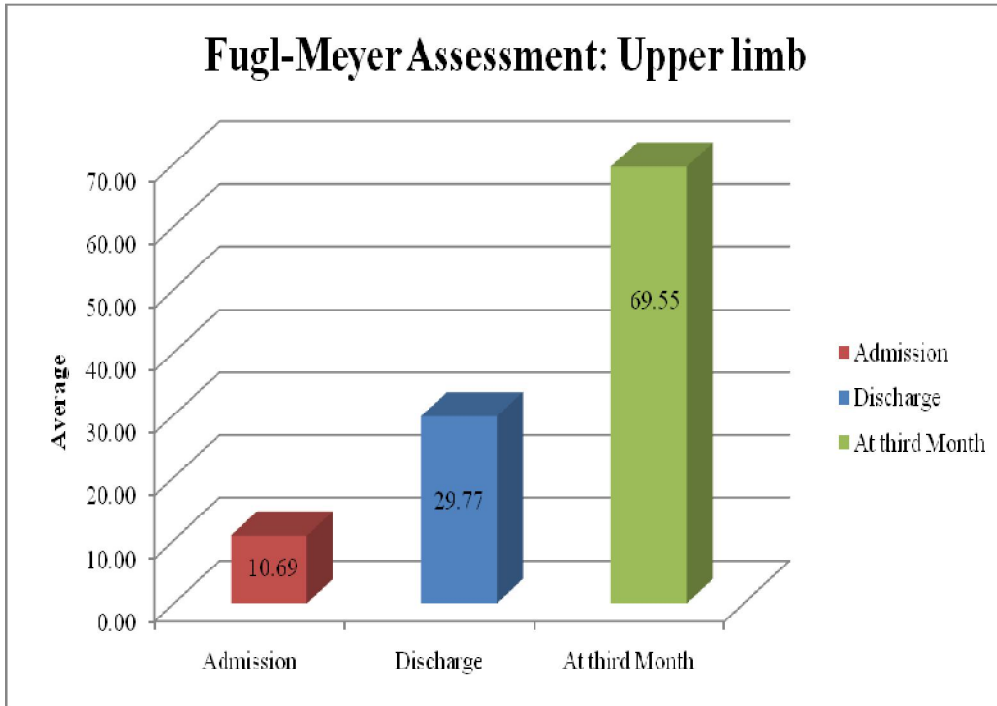
5.2.1 PERCENTAGE ANALYSIS OF NATIONAL INSTITUTE OF HEALTH STROKE SCALE



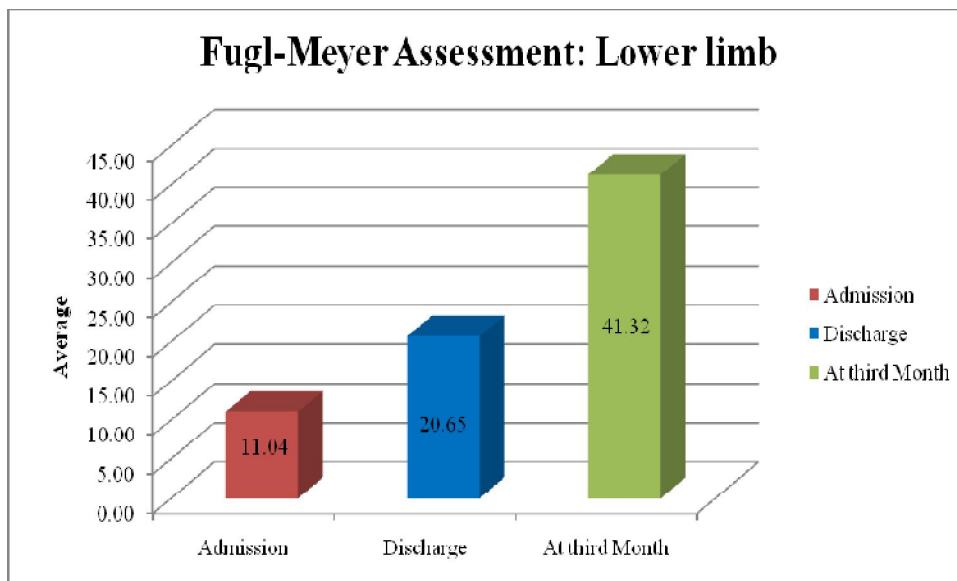
5.2.2. PERCENTAGE ANALYSIS OF MINI MENTAL STATUS EXAMINATION



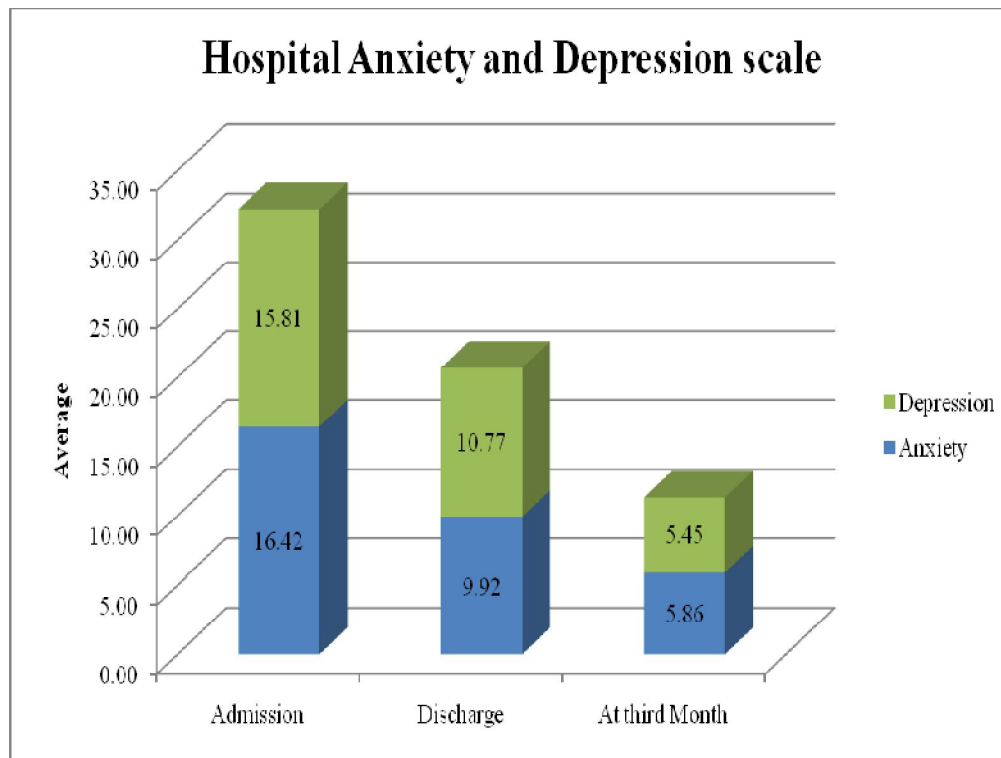
**5.2.3 MEAN ANALYSIS OF FUGL MEYER SENSORIMOTOR
ASSESSMENT: UPPER LIMB**



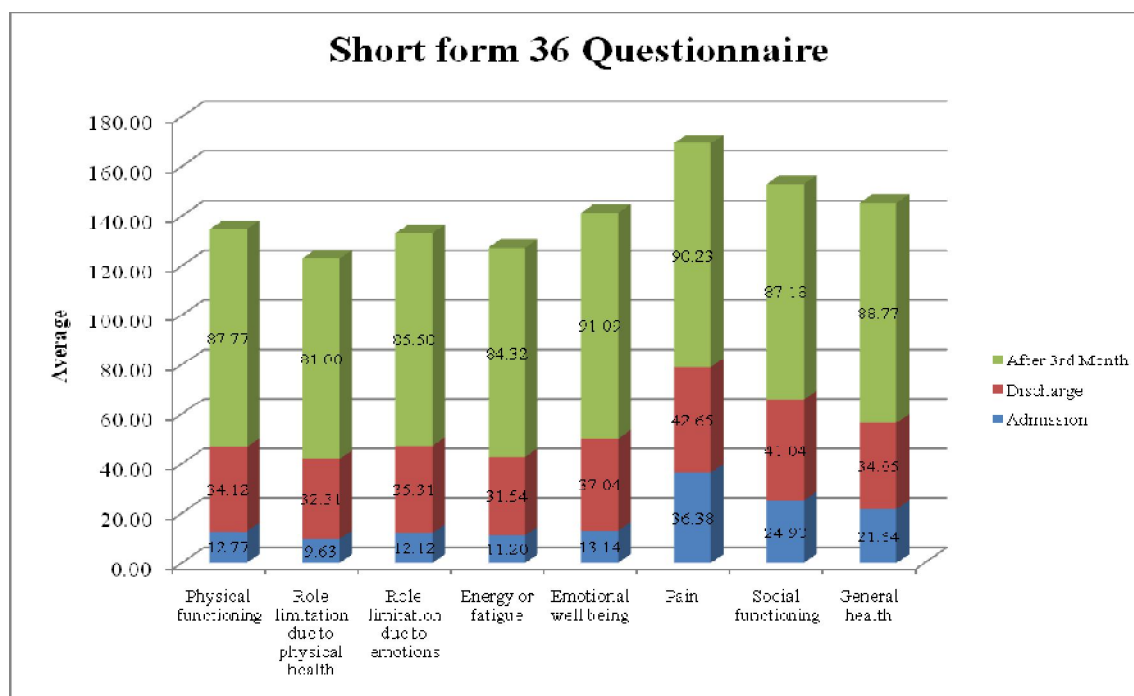
LOWER LIMB



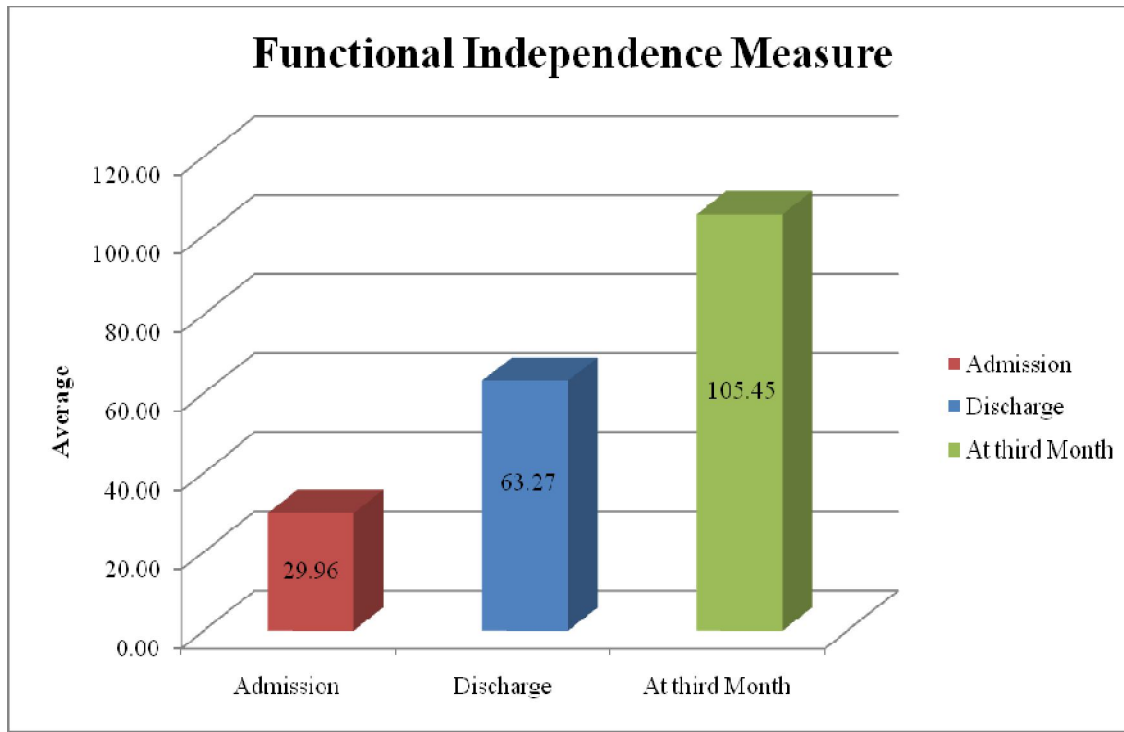
5.2.5 MEAN ANALYSIS OF HOSPITAL ANXIETY AND DEPRESSION SCALE



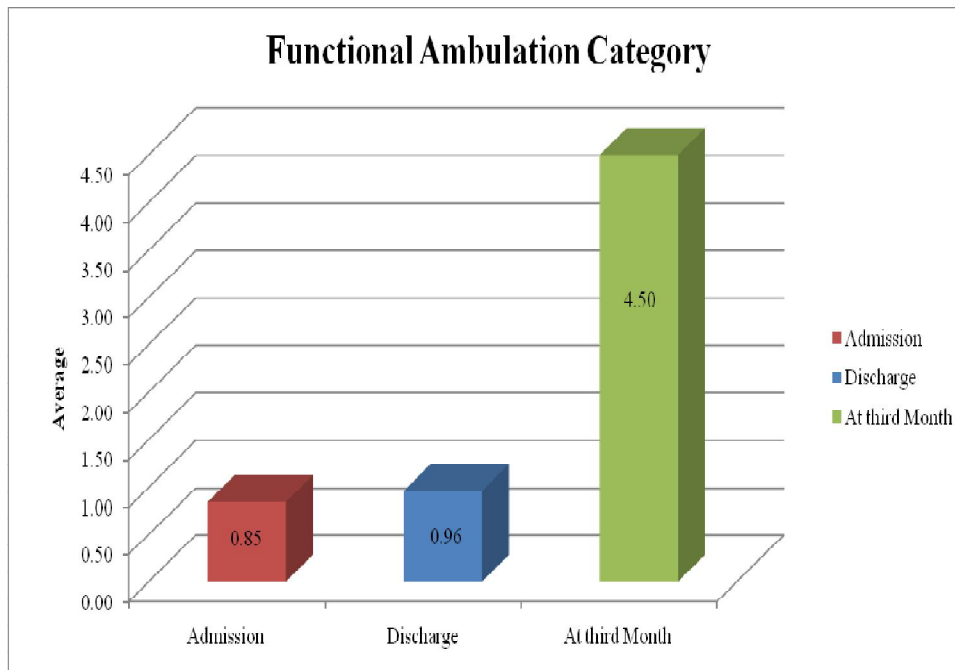
5.2.6. MEAN ANALYSIS OF SHORT FORM 36 QUESTIONNAIRE



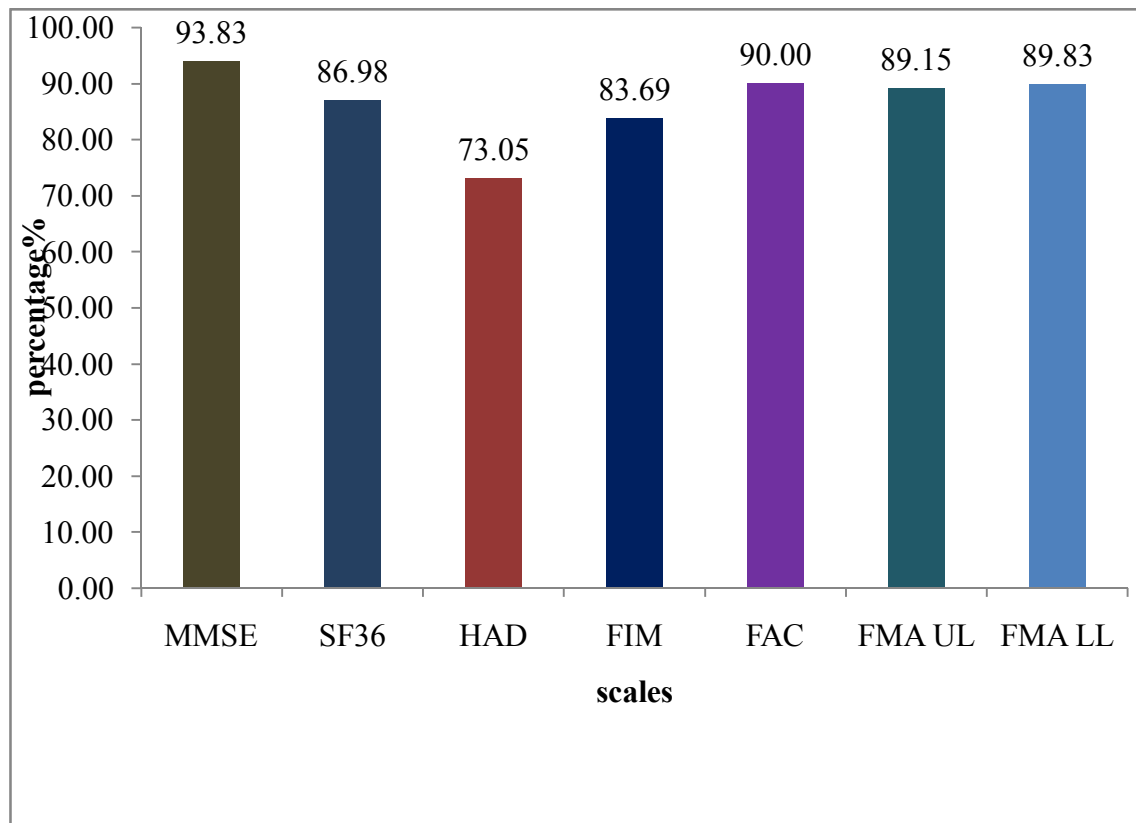
5.2.7. MEAN ANALYSIS OF FUNCTIONAL INDEPENDENCE MEASURE



5.2.8. MEAN ANALYSIS OF FUNCTIONAL AMBULATION CATEGORY



5.2.9 PERCENTAGE ANALYSIS OF SCALES USED



- MMSE- Mini Mental Status Examination
- SF 36- Short Form 36 questionnaire
- HAD- Hospital Anxiety Depression
- FIM- Functional independence measure
- FAC- Functional Ambulation Category
- FMA- Fugl Meyer Sensorimotor Assessment
- UL- Upper Extremity
- LL- Lower Extremity

DATA ANALYSIS AND RESULTS

6. DATA ANALYSIS AND RESULTS

- **FUGL MEYER ASSESSMENT**

All domains of quality of life had a strong positive correlation with Fugl meyer assessment (upper extremity and lower extremity) with a value of 0.71, ie patients who had better physical outcome were more likely to have a better quality of life

Fugl meyer assessment of both upper extremity and lower extremity had strong positive correlation with functional independence measure with a value of 0.88 ie patient who had better sensory motor performance were more likely to have a better functional outcome

- **SHORT FORM-36 QUESTIONNAIRE:**

Anxiety and depression was negatively correlated with physical, social and environmental domains of Short Form-36 (quality of life) with a value of -0.33 ie patients with anxiety and depression are more likely to have impaired quality of life

Functional independence measure score was positively correlated with quality of life in all domains with a value of 0.76, ie patients who were functionally dependent were more likely to have impaired quality of life

- **HOSPITAL ANXIETY AND DEPRESSION SCALE**

Quality of life in all the domains had a negative correlation with and depression with a value of -0.66 ie patients with low scores in various domains of quality of life were more likely to have anxiety and depression

Functional Independence Measure scores and National Institute of health stroke scale scores were negatively correlated with depression with a value of $-$

0.55 ie patients with low Functional Independence measure score and higher national institute of health stroke scale score were more likely to be anxious and depressed.

Age had a moderate positive correlation with depression with a value of 0.64 ie older stroke were more likely to have depression

- **FUNCTIONAL INDEPENDENCE MEASURE**

All domains of quality of life had a moderate positive correlation with Functional independence measure Score with a value of 0.59 ie patients with impaired quality of life were more likely to be functionally dependent

Age had a negative correlation with functional independence measure scores with a value of – 0.44 ie older stroke patients were more likely to be functionally dependent

- **FUNCTIONAL AMBULATION CATEGORY SCALE**

Quality of life had a positive correlation with functional ambulation category scores with a value of 0.73 i.e. patients with better quality of life Were more likely to have better functional ambulation

- **“ t “Test significance**

Age group : $t_{cal} (0.809) < t_{exp} (1.708)$ we suppose to accept the null hypothesis at 5% level of significance, so there is no relationship between sample mean of age group and population mean of age group

Quality of life : $t_{cal} (9.979) > t_{exp} (1.121)$ we suppose to reject the null hypothesis at 5% level of significance, so there is relationship between sample mean of quality of life and population mean of quality of life

DISCUSSION

7. DISCUSSION

This study assessed the quality of life, functional dependency, anxiety and depression experienced by Middle Cerebral Artery stroke patients and the relationship of these measures with various stroke characteristics. Quality of Life was influenced by the presence of anxiety and depression and functional independence. Middle Cerebral Artery stroke patients were found to have low scores on most of the domains of quality of life, even mild to moderate stroke can affect all the dimensions of quality of life despite a patient achieving full independence in activities of daily living. But interestingly the study showed that mental health was fairly good in majority of patient which goes against study done by Francesca Wright et al, which were like anxiety, depression and mood shift was major problem in post stroke patients. Through this study, believed that it is necessary to study the quality of life and patient centered outcomes in longitudinal studies in patients after with normal and standardized instruments that are accepted as standard in all stroke units. If health planning is to be effective, information about the rate of recovery after stroke is essential, this information is also important for designing, studies that attempt to evaluate the effectiveness of the therapy. Maximum functional recovery is likely to have been achieved within 3 months of time from onset of stroke

The quality of life of the patients included in this study has shown significant improvement from the time of admission till third month the domains had a mean value of 88.5 ± 6.5 at third month, whereas in the study done by Ann-Helene Almborg, they mentioned that their mean values for stroke patients at third month shown a score of 78 ± 9.8 , which means that, for the patients included in this study the quality of life was improved significantly at third month in all domains.

In developed countries, depression seems to represent a considerable problem in early post stroke period, persisting in one quarter of patients beyond 2 years following stroke. Anxiety affected approximately one third of patients in first few weeks following stroke and after 5 years approximately one fifth remained anxious¹³. The presence of anxiety and depression in these patients was low compared with that in studies conducted in developed countries. This is likely because most of these patients had moderate strokes and therefore good outcome. Another crucial point is that unlike in developed countries most of the patients went back home rather than to nursing homes or other institutions. In the study⁵, there was 48% of anxiety and 62% of depression seen in their patients at third month from the onset of stroke. In this study the patients had anxiety and depression at the time of admission, which was reduced significantly at the time of discharge.

The gait seemed to be recovered well at third month to the patients included in this study, it may be because mainly moderate type of stroke were included. At the time of admission most of the patients were not able to walk at all, but at third month almost everyone was independent in walking. In the study done by Enrique Viosca et al., they have mentioned that almost 89% the stroke patients they included in their study gained a score of 4 (ambulatory independent –level surface only) at third month from onset of stroke, in this study, most of the patients had a score of 4 (ambulatory independent – level only) which says that patients is independent enough walk without support

The study used Functional independence measure because it has the advantage of providing detailed assessment of various functional abilities of the patient and also includes measures of communication, cognition, important components of post stroke functioning. . The Functional independence Measure was positively correlated with quality of life .In the study done by Jean Francois et al.,, their mean value was 6 (modified independence) out of 7 (complete independence) for all the components been assessed in functional independence

measure and in this study also the mean value was almost similar, which shows that the patient is independent enough to carry out their activities of daily living at around third month from the onset of stroke. The outcome was better in the study population, this outcome may be related to technological advances and specialized care provided by highly trained professionals in the stroke unit.

On comparing the various scales used in this study, the better change was found to be in Mini Mental Status Examination, following that functional ambulation category followed by Fugl Meyer Sensorimotor Assessment, Quality of Life, functional independence measure and followed by Hospital anxiety and depression scale at third month after the onset of stroke.

SUMMARY AND CONCLUSION

8. SUMMARY AND CONCLUSION

8.1 SUMMARY

On comparing the mean values of the outcome measures from the time of admission till third month after the onset of stroke, it shows that there is improvement in quality of life, functional independence and mental health at third month when compared to the admission time and discharge. This study assessed, compared and correlated several parameters of stroke recovery during the period from admission till third month after stroke, covering both acute as well as sub acute phases.

8.1 CONCLUSION

The study conclude that there was a significant improvement in functional independence, mental health and quality of life among middle cerebral artery stroke patients from the time of admission till third month from the onset of stroke and it was found that Quality of Life is having strong positive correlation with functional abilities and negative correlation with mental health.

LIMITATIONS AND SUGGESTIONS

9. LIMITATIONS AND SUGGESTIONS

9.1 LIMITATIONS

- Most of the patients had mild to moderate stroke and hence the sample was biased towards outcome.
- Purposive sampling technique and prospective correlational study resulted in non-standard follow up of patients, this could have contributed to low Prevalence of anxiety and depression.
- This study is not able to provide information for individual prediction for every patient, as it needs a further validation to assess.

9.2 SUGGESTIONS

- This study focused only on ischemic stroke of middle cerebral artery, but to generalize the outcome among stroke patients, all other forms of stroke must be included.
- Only small sample size is included, so future studies could concentrate in all types of stroke population, to know the recovery pattern of various stroke characteristics
- This study has mainly concentrated on functional outcome, mental health and quality of life, but in future studies they can also include other stroke characteristics (gait speed, trunk balance, caregiver assessment) hence those variables can also be assessed.
- This study the age group taken was between 40 and 60, but in future studies they can also include more younger or older stroke into consideration. As the study comprises of few sample size, the prognosis difference between gender was not able to found, so in future studies large sample without gender bias can be suggested.

- This study follow up was done only till third month, so follow up time period can be extended to know the long term progress of the patients recovery, stroke recovery could even extend up to two years
- Interventions could also be added along with the scales used in this study.

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APPENDICES

APPENDICES

APPENDIX-1

CONSENT FORM

I Voluntarily consent to participate in the research study, “**FUNCTIONAL INDEPENDENCE, MENTAL HEALTH AND QUALITY OF LIFE AMONG MIDDLE CEREBARL ARTERY STROKE PATIENTS**”. The researcher has explained me the treatment approach in brief, risk of participation and has answered the question related to the research to my satisfaction.

Participant signature :

Signature of witness :

SSignature of researcher:

APPENDIX -2
ASSESSMENT PERFORMA

DATA PERFORMA

Name:

Age:

Sex:

Ip no:

Op no:

Marital status:

Contact number:

Address :

Occupation:

Income:

Date of admission:

Date of assessment:

Chief Complaints:

Associated conditions:

Present medical history:

Surgical history:

Past medical history:

Family history:

Investigation:

Impression:

Medical Diagnosis:

Physiotherapy diagnosis:

Home programme:

Date of assessment:

Date of reassessment:

Vitals:

During discharge: During follow-up :

Temperature:

Blood pressure:

Heart rate:

Respiratory rate:

NIHSS score:

SCALES	ADMISSION	DISCHARGE	THIRD MONTH
Hospital anxiety and depression scale			
SF-36			
Fugl-Meyer assessment UL & LL	Motor: Sensory:	Motor: Sensory:	Motor: Sensory :
Functional independence measure			
Functional ambulation category scale			
MMSE			

APPENDIX - 3

NIH Stroke Scale		
Instructions	Scale Definition	Score
<p>1a. Level of consciousness: The investigator must choose a response, even if a full evaluation is prevented by such obstacles as an endotracheal tube, language barrier, orotracheal trauma/bandages. A "3" is scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation.</p>	<p>0 = Alert; keenly responsive 1 = Not alert, but arousable by minor stimulation to obey, answer, or respond 2 = Not alert, requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements (not stereotyped) 3 = Responds only with reflex motor or autonomic effects or totally unresponsive, flaccid, areflexic</p>	_____
<p>1b. LOC Questions: The patient is asked the month and his/her age. The answer must be correct - there is no partial credit for being close. Aphasic and stuporous patients who do not comprehend the questions will score "2." Patients unable to speak because of endotracheal intubation, orotracheal trauma, severe dysarthria from any cause, language barrier or any other problem not secondary to aphasia are given a "1." It is important that only the initial answer be graded and that the examiner not "help" the patient with verbal or non-verbal cues.</p>	<p>0 = Answers both questions correctly 1 = Answers one question correctly 2 = Answers neither question correctly</p>	_____
<p>1c. LOC Commands: The patient is asked to open and close the eyes and then to grip and release the non-paretic hand. Substitute another one-step command if the hands cannot be used. Credit is given if an unequivocal attempt is made but not completed due to weakness. If the patient does not respond to commands, the task should be demonstrated to them (pantomime) and score the result (i.e., follows none, one or two commands). Patients with trauma, amputation, or other physical impediments should be given suitable one-step commands. Only the first attempt is scored.</p>	<p>0 = Performs both tasks correctly 1 = Performs one task correctly 2 = Performs neither task correctly</p>	_____
<p>2. Best Gaze: Only horizontal eye movements will be tested. Voluntary or reflexive (oculocephalic) eye movements will be scored but calorice testing is not done. If the patient has a conjugate deviation of the eyes that can be overcome by voluntary or reflexive activity, the score will be "1." If a patient has an isolated peripheral nerve paresis (CN, III, IV or VI) score a "1." Gaze is testable in all aphasic patients. Patients with ocular trauma, bandages, pre-existing blindness or other disorder of visual acuity or fields should be tested with reflexive movements and a choice made by the investigator. Establishing eyes contact and then moving about the patient from side to side will occasionally clarify the presence of a partial gaze palsy.</p>	<p>0 = Normal 1 = Partial gaze palsy. This score is given when gaze is abnormal in one or both eyes, but where forced deviation or total gaze paresis are not present 2 = Forced deviation, or total gaze paresis not overcome by the oculocephalic maneuver</p>	_____
<p>3. Visual: Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting or visual threat as appropriate. Patient must be encouraged, but if they look at the side of the moving fingers appropriately, this can be scored as normal. If there is unilateral blindness or enucleation, visual fields in the remaining eye are scored. Score 1 only if a clear-cut asymmetry, including quadrant anopia is found. If patient is blind from any cause, score "3." Double simultaneous stimulation is performed at this point. If there is extinction, patient receives a "1" and the results are used to answer question #11.</p>	<p>0 = No visual loss 1 = Partial hemianopia 2 = Complete hemianopia 3 = Bilateral hemianopia (blind, including cortical blindness)</p>	_____

(Continued)

<p>4. Facial Palsy: Ask, or use pantomime to encourage the patient to show teeth or raise eyebrows and close eyes. Score symmetry of grimace in response to noxious stimuli in the poorly responsive or non-comprehending patient. If facial trauma/bandages, orotracheal tube, tape or other physical barrier obscures the face, these should be removed to the extent possible.</p>	<p>0 = Normal symmetrical movement 1 = Minor paralysis (flattened nasolabial fold, asymmetry on smiling) 2 = Partial paralysis (total or near total paralysis of lower face) 3 = Complete paralysis of one or both sides (absence of facial movement in the upper and lower face)</p>	<p>_____</p>
<p>5 & 6. Motor Arm and Leg: The limb is placed in the appropriate position: extend the arms (palms down) 90 degrees (if sitting) or 45 degrees (if supine) and the leg 30 degrees (always tested supine). Drift is scored if the arm falls before 10 seconds or the leg before 5 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime but not noxious stimulation. Each limb is tested in turn, beginning with the non-paretic arm. Only in the case of amputation or joint fusion at the shoulder or hip may the score be "9" and the examiner must clearly write the explanation for scoring as a "9".</p>	<p>0 = No drift, limb holds 90 (or 45) degrees for full 10 seconds 1 = Drift, Limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; does not hit bed or other support 2 = Some effort against gravity, limb cannot get to or maintain (if cued) 90 (or 45) degrees, drifts down to bed, but has some effort against gravity 3 = No effort against gravity, limb falls 4 = No movement 9 = Amputation, joint fusion explain: _____</p> <p>5a. Left Arm..... _____ 5b. Right Arm..... _____</p>	<p>_____</p> <p>_____</p>
	<p>0 = No drift, leg holds 30 degrees position for full 5 seconds. 1 = Drift, leg falls by the end of the 5 second period but does not hit bed. 2 = Some effort against gravity; leg falls to bed by 5 seconds, but has some effort against gravity. 3 = No effort against gravity, leg falls to bed immediately. 4 = No movement 9 = Amputation, joint fusion explain: _____</p> <p>6a. Left Leg..... _____ 6b. Right Leg..... _____</p>	<p>_____</p> <p>_____</p>
<p>7. Limb Ataxia: This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. In case of visual defect, insure testing is done in intact visual field. The finger-nose-finger and heel-shin tests are performed on both sides, and ataxia is scored only if present out of proportion to weakness. Ataxia is absent in the patient who cannot understand or is paralyzed. Only in the case of amputation or joint fusion may the item be scored "9", and the examiner must clearly write the explanation for not scoring. In case of blindness test by touching nose from extended arm position.</p>	<p>0 = Absent 1 = Present in one limb 2 = Present in two limbs</p>	<p>_____</p>
<p>8. Sensory: Sensation or grimace to pin prick when tested, or withdrawal from noxious stimulus in the obtunded or aphasic patient. Only sensory loss attributed to stroke is scored as abnormal and the examiner should test as many body areas [arms (not hands), legs, trunk, face] as needed to accurately check for hemisensory loss. A score of 2, "severe or total," should only be given when a severe or total loss of sensation can be clearly demonstrated. Stuporous and aphasic patients will therefore probably score 1 or 0. The patient with brain stem stroke who has bilateral loss of sensation is scored 2. If the patient does not respond and is quadriplegic score 2. Patients in coma (item 1a=3) are arbitrarily given a 2 on this item.</p>	<p>0 = Normal; no sensory loss 1 = Mild to moderate sensory loss; patient feels pinprick is less sharp or is dull on the affected side; or there is a loss of superficial pain with pinprick but patient is aware he/she is being touched 2 = Severe to total sensory loss; patient is not aware of being touched in the face, arm and leg</p>	<p>_____</p>

(Continued)

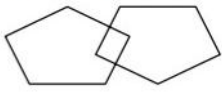
<p>9. Best Language: A great deal of information about comprehension will be obtained during the preceding sections of the examination. The patient is asked to describe what is happening in the attached picture, to name the items on the attached naming sheet, and to read from the attached list of sentences. Comprehension is judged from responses here as well as to all of the commands in the preceding general neurological exam. If visual loss interferes with the tests, ask the patient to identify objects placed in the hand, repeat, and produce speech. The intubated patient should be asked to write. The patient in coma (question 1a=3) will arbitrarily score 3 on this item. The examiner must choose a score in the patient with stupor or limited cooperation but a score of 3 should be used only if the patient is mute and follows no one step commands.</p>	<p>0 = No aphasia, normal 1 = Mild to moderate aphasia; some obvious loss of fluency or facility of comprehension, without significant limitation on ideas expressed or form of expression. Reduction of speech and/or comprehension, however, makes conversation about provided material difficult or impossible. For example in conversation about provided materials examiner can identify picture or naming card from patient's response. 2 = Severe aphasia; all communication is through fragmentary expression; great need for inference, questioning and guessing by the listener. Range of information that can be exchanged is limited; listener carries burden of communication. Examiner cannot identify materials provided from patient response. 3 = Mute, global aphasia; no usable speech or auditory comprehension</p>	<p>_____</p>
<p>10. Dysarthria: If patient is thought to be normal an adequate sample of speech must be obtained by asking patient to read or repeat words from the attached list. If the patient has severe aphasia, the clarity of articulation of spontaneous speech can be rated. Only if the patient is intubated or has other physical barrier to producing speech, may the item be scored "9", and the examiner must clearly write an explanation for not scoring. Do not tell the patient why he/she is being tested.</p>	<p>0 = Normal 1 = Mild to moderate; patient slurs at least some words and, at worst, can be understood with some difficulty 2 = Severe; patient's speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or is mute/anarthric 9 = Intubated or other physical barrier, explain</p>	<p>_____</p>
<p>11. Extinction and Inattention (formerly Neglect): Sufficient information to identify neglect may be obtained during the prior testing. If the patient has a severe visual loss preventing visual double simultaneous stimulation, and the cutaneous stimuli are normal, the score is normal. If the patient has aphasia but does appear to attend to both sides, the score is normal. The presence of visual spatial neglect or anosagnosia may also be taken as evidence of abnormality. Since the abnormality is scored only if present, the item is never untestable.</p>	<p>0 = No abnormality 1 = Visual, tactile, auditory, spatial, or personal inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities 2 = Profound hemi-inattention or hemi-inattention to more than one modality. Does not recognize own hand or orients to only one side of space.</p>	<p>_____</p>
Total NIHSS Score:		
<p>Time of NIHSS Assessment: _____</p>		
<p>Date of NIHSS Assessment: _____</p>		
<p>Physician/NIHSS Certified Individual Signature: _____</p>		

APPENDIX-4

Mini-Mental State Examination (MMSE)

Patient's Name: _____ Date: _____

Instructions: Ask the questions in the order listed. Score one point for each correct response within each question or activity.

Maximum Score	Patient's Score	Questions
5		"What is the year? Season? Date? Day of the week? Month?"
5		"Where are we now: State? County? Town/city? Hospital? Floor?"
3		The examiner names three unrelated objects clearly and slowly, then asks the patient to name all three of them. The patient's response is used for scoring. The examiner repeats them until patient learns all of them, if possible. Number of trials: _____
5		"I would like you to count backward from 100 by sevens." (93, 86, 79, 72, 65, ...) Stop after five answers. Alternative: "Spell WORLD backwards." (D-L-R-O-W)
3		"Earlier I told you the names of three things. Can you tell me what those were?"
2		Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them.
1		"Repeat the phrase: 'No ifs, ands, or buts.'"
3		"Take the paper in your right hand, fold it in half, and put it on the floor." (The examiner gives the patient a piece of blank paper.)
1		"Please read this and do what it says." (Written instruction is "Close your eyes.")
1		"Make up and write a sentence about anything." (This sentence must contain a noun and a verb.)
1		"Please copy this picture." (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.) <div style="text-align: center;">  </div>
30		TOTAL

(Adapted from Rovner & Folstein, 1987)

APPENDIX -5

FUGELMEYER ASSESSMENT: UPPER EXTREMITY

Scoring: 0 = subject could not perform task at all 1 = subject could only perform task in part 2 = subject performed task faultlessly

Test 1 Reflex activity (can reflexes be elicited or not?):	Affected	Unaffected
1. flexors	0 2	0 2
2. extensors	0 2	0 2
Test 2 Dynamic flexor synergy in the shoulder:		
3. retraction	0 1 2	0 1 2
4. elevation	0 1 2	0 1 2
5. abduction	0 1 2	0 1 2
6. outward rotation	0 1 2	0 1 2
Dynamic flexor synergy in the elbow and forearm:		
7. flexion	0 1 2	0 1 2
8. supination	0 1 2	0 1 2
Dynamic extensor synergy in the shoulder:		
9. adduction and inward rotation	0 1 2	0 1 2
Dynamic extensor synergy in the elbow and forearm:		
10. extension	0 1 2	0 1 2
11. pronation	0 1 2	0 1 2
Test 3 Motions with a mixture of the dynamic flexor and extensor synergies:		
12. hand to lumbar spine	0 1 2	0 1 2
13. flexion of the shoulder from 0 to 90°	0 1 2	0 1 2
14. pronation and supination of the forearm with the elbow actively flexed to about 90°	0 1 2	0 1 2

Test 4 Volitional movements performed with little or no synergy dependence:						
15. shoulder abduction from 0-90°	0	1	2	0	1	2
16. shoulder forward flexion from 90-180°	0	1	2	0	1	2
17. pronation and supination of forearm with elbow straight (shoulder slightly flexed)	0	1	2	0	1	2
Test 5 Normal reflex activity:						
18. scored as being hyperactive or not	0	2		0	2	
Test 6 Three different functions of the wrist:						
19. wrist stability (shoulder 0°; elbow 90°)	0	1	2	0	1	2
20. wrist flexion/extension (shoulder 0°; elbow 90°)	0	1	2	0	1	2
21. wrist stability (shoulder 30°; elbow 0°)	0	1	2	0	1	2
22. wrist flexion/extension (shoulder 30°; elbow 0°)	0	1	2	0	1	2
23. circumduction of the wrist	0	1	2	0	1	2
Test 7 Seven details of function of the hand:						
24. mass flexion of the fingers	0	1	2	0	1	2
25. mass extension of the fingers	0	1	2	0	1	2
26. grasp with extended metacarpophalangeal joints of digits 2-5 and flexion of the proximal and distal interphalangeal joints	0	1	2	0	1	2
27. grasp with pure thumb adduction (scrap of paper interposed between thumb and the 2nd metacarpal)	0	1	2	0	1	2
28. grasp with opposition of thumb pulpa against the pulpa of the second finger (a pencil is interposed)	0	1	2	0	1	2
29. grasp a cylinder-shaped object	0	1	2	0	1	2
30. a spherical grasp (tennis ball)	0	1	2	0	1	2
Test 8 Co-ordination and speed: A finger-to-nose test is applied five times in succession, as rapidly as possible.						

31. tremor	0 1 2	0 1 2
32. dysmetria	0 1 2	0 1 2
33. speed	0 1 2	0 1 2
TOTAL	—	—

FUGEL MEYER ASSESSMENT : LOWER EXTREMITY

Scoring: 0 = no motion 1 = partial motion 2 = full motion

	<i>Affected</i>	<i>Unaffected</i>
Test 1 Reflex activity (can reflexes be elicited or not?): supine		
1. patellar 0=no reflex activity	0 2	0 2
2. Achilles 2=reflex activity elicited	0 2	0 2
Test 2 Dynamic movement within flexor synergy: supine		
3. hip flexion	0 1 2	0 1 2
4. knee flexion	0 1 2	0 1 2
5. ankle dorsiflexion	0 1 2	0 1 2
Dynamic movement within extensor synergy: sidelying		
6. hip extension	0 1 2	0 1 2
7. hip abduction	0 1 2	0 1 2
8. knee extension	0 1 2	0 1 2
9. ankle plantarflexion	0 1 2	0 1 2
Test 3 Active movement while sitting:		
10. flex knee to and past 90°	0 1 2	0 1 2
11. ankle dorsiflexion	0 1 2	0 1 2
actively flexed to about 90°		
Test 4 Active movement while standing:		
12. flex knee to 90° with hip at 0	0 1 2	0 1 2
13. dorsiflex ankle	0 1 2	0 1 2
Test 5 Normal reflex activity: seated		

14. scored as being hyperactive or not	0 1 2	0 1 2
Testing at knee flexors, patellar, and Achilles		
Test 6 Coordination/speed: supine		
15. tremor	0 1 2	0 1 2
16. dysmetria	0 1 2	0 1 2
17. speed	0 1 2	0 1 2
TOTAL	_____	_____

APPENDIX-6

Hospital Anxiety and Depression Scale (HADS)

Tick the box beside the reply that is closest to how you have been feeling in the past week.
Don't take too long over you replies: your immediate is best.

D	A		D	A	
		I feel tense or 'wound up':			I feel as if I am slowed down:
	3	Most of the time	3		Nearly all the time
	2	A lot of the time	2		Very often
	1	From time to time, occasionally	1		Sometimes
	0	Not at all	0		Not at all
		I still enjoy the things I used to enjoy:			I get a sort of frightened feeling like 'butterflies' in the stomach:
0		Definitely as much	0		Not at all
1		Not quite so much	1		Occasionally
2		Only a little	2		Quite Often
3		Hardly at all	3		Very Often
		I get a sort of frightened feeling as if something awful is about to happen:			I have lost interest in my appearance:
	3	Very definitely and quite badly	3		Definitely
	2	Yes, but not too badly	2		I don't take as much care as I should
	1	A little, but it doesn't worry me	1		I may not take quite as much care
	0	Not at all	0		I take just as much care as ever
		I can laugh and see the funny side of things:			I feel restless as I have to be on the move:
0		As much as I always could	3		Very much indeed
1		Not quite so much now	2		Quite a lot
2		Definitely not so much now	1		Not very much
3		Not at all	0		Not at all
		Worrying thoughts go through my mind:			I look forward with enjoyment to things:
	3	A great deal of the time	0		As much as I ever did
	2	A lot of the time	1		Rather less than I used to
	1	From time to time, but not too often	2		Definitely less than I used to
	0	Only occasionally	3		Hardly at all
		I feel cheerful:			I get sudden feelings of panic:
3		Not at all	3		Very often indeed
2		Not often	2		Quite often
1		Sometimes	1		Not very often
0		Most of the time	0		Not at all
		I can sit at ease and feel relaxed:			I can enjoy a good book or radio or TV program:
	0	Definitely	0		Often
	1	Usually	1		Sometimes
	2	Not Often	2		Not often
	3	Not at all	3		Very seldom

Please check you have answered all the questions

Scoring:

Total score: Depression (D) _____ Anxiety (A) _____

0-7 = Normal

8-10 = Borderline abnormal (borderline case)

11-21 = Abnormal (case)

APPENDIX -7

SF-36 QUESTIONNAIRE

Name: _____

Ref. Dr: _____

Date: _____

ID#: _____

Age: _____

Gender: M / F

Please answer the 36 questions of the **Health Survey** completely, honestly, and without interruptions.

GENERAL HEALTH:

In general, would you say your health is:

- Excellent Very Good Good Fair Poor

Compared to one year ago, how would you rate your health in general now?

- Much better now than one year ago
 Somewhat better now than one year ago
 About the same
 Somewhat worse now than one year ago
 Much worse than one year ago

LIMITATIONS OF ACTIVITIES:

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports.

- Yes, Limited a lot Yes, Limited a Little No, Not Limited at all

Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf

- Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Lifting or carrying groceries

- Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Climbing several flights of stairs

- Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Climbing one flight of stairs

- Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Bending, kneeling, or stooping

- Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Walking more than a mile

- Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Walking several blocks

- Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Walking one block

- Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Bathing or dressing yourself

Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

PHYSICAL HEALTH PROBLEMS:

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

Cut down the amount of time you spent on work or other activities

Yes No

Accomplished less than you would like

Yes No

Were limited in the kind of work or other activities

Yes No

Had difficulty performing the work or other activities (for example, it took extra effort)

Yes No

EMOTIONAL HEALTH PROBLEMS:

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

Cut down the amount of time you spent on work or other activities

Yes No

Accomplished less than you would like

Yes No

Didn't do work or other activities as carefully as usual

Yes No

SOCIAL ACTIVITIES:

Emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

Not at all Slightly Moderately Severe Very Severe

PAIN:

How much bodily pain have you had during the past 4 weeks?

None Very Mild Mild Moderate Severe Very Severe

During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all A little bit Moderately Quite a bit Extremely

ENERGY AND EMOTIONS:

These questions are about how you feel and how things have been with you during the last 4 weeks. For each question, please give the answer that comes closest to the way you have been feeling.

Did you feel full of pep?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Have you been a very nervous person?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Have you felt so down in the dumps that nothing could cheer you up?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Have you felt calm and peaceful?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Did you have a lot of energy?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Have you felt downhearted and blue?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Did you feel worn out?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Have you been a happy person?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Did you feel tired?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

SOCIAL ACTIVITIES:

During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

- All of the time
- Most of the time
- Some of the time
- A little bit of the time
- None of the Time

GENERAL HEALTH:

How true or false is each of the following statements for you?

I seem to get sick a little easier than other people

- Definitely true Mostly true Don't know Mostly false Definitely false

I am as healthy as anybody I know

- Definitely true Mostly true Don't know Mostly false Definitely false

I expect my health to get worse

- Definitely true Mostly true Don't know Mostly false Definitely false

My health is excellent

- Definitely true Mostly true Don't know Mostly false Definitely false

APPENDIX-8

Functional Independence Measure (FIM) Instrument

	ADMISSION	DISCHARGE	FOLLOW-UP
Self-Care			
A. Eating			
B. Grooming			
C. Bathing			
D. Dressing - Upper Body			
E. Dressing - Lower Body			
F. Toileting			
Sphincter Control			
G. Bladder Management			
H. Bowel Management			
Transfers			
I. Bed, Chair, Wheelchair			
J. Toilet			
K. Tub, Shower			
Locomotion			
L. Walk/Wheelchair			
M. Stairs			
<i>Motor Subtotal Score</i>			
Communication			
N. Comprehension			
O. Expression			
Social Cognition			
P. Social Interaction			
Q. Problem Solving			
R. Memory			
<i>Cognitive Subtotal Score</i>			
TOTAL FIM Score			

APPENDIX-9

Functional Ambulation Classification

Category	Definition
0 Nonfunctional Ambulation	Patient cannot ambulate, ambulates in parallel bars only, or requires supervision or physical assistance from more than one person to ambulate safely outside of parallel bars.
1 Ambulator-Dependent for Physical Assistance— Level II	Patient requires manual contacts of no more than one person during ambulation on level surfaces to prevent falling. Manual contacts are continuous and necessary to support body weight as well as maintain balance and/or assist coordination.
2 Ambulatory-Dependent for Physical Assistance— Level I	Patient requires manual contact of no more than one person during ambulation on level surfaces to prevent falling. Manual contact consists of continuous or intermittent light touch to assist balance or coordination.
3 Ambulator-Dependent for Supervision	Patient can physically ambulate on level surfaces without manual contact of another person but for safety requires standby guarding of no more than one person because of poor judgment, questionable cardiac status, or the need for verbal cuing to complete the task.
4 Ambulator-Independent Level Surfaces Only	Patient can ambulate independently on level surfaces but requires supervision or physical assistance to negotiate any of the following: stairs, inclines, or nonlevel surfaces.
5 Ambulator-Independent	Patient can ambulate independently on nonlevel and level surfaces, stairs, and inclines.