

Evolution in Hemiplegic Management: A Review

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ABSTRACT

Hemiplegia/ hemiparesis is the paralysis of either right or left side of the body with loss of functions. The main cause of hemiplegia is cerebrovascular attack (CVA) or stroke. Stroke is the third main cause of the death & disability in India. There are two major categories of brain damage in stroke i.e. ischemia & haemorrhage. The aim of rehabilitation in subjects with hemiplegia is to promote recovery of lost function, independence, and early reintegration into social and domestic life. Many stroke patients have a number of serious disorders such as hemiplegia, motor disturbance, sensory disability, and cognitive impairment. Stroke rehabilitation is the process by which those with disabling strokes undergo treatment to help them return to normal life as much as possible by regaining and relearning the skills of everyday living. Physiotherapy treatment includes conventional therapies & neurophysiological approaches. Conventional therapies (Therapeutic Exercises, Traditional Functional Retraining) comprises of: Range Of Motion (ROM) Exercises i.e. passive followed by active assisted, active then active resisted exercises, Muscle Strengthening Exercises to reduce flaccidity, Stretching techniques to reduce spasticity, Mobilization techniques, Fitness training & Compensatory Techniques. Neurophysiological Approaches: 1. Muscle Re-education Approach. 2. Neurodevelopmental Approaches: – Sensorimotor Approach (Rood, 1940S), Movement Therapy Approach (Brunnstrom, 1950S), NDT Approach (Bobath, 1960-70S), PNF Approach (Knot and Voss, 1960-70S). 3. Motor Relearning Program for Stroke (1980S). 4. Contemporary Task Oriented Approach (1990S). We conclude that above all the techniques, Bobath, NDT, PNF, Roods approach, speech therapy, robotic devices, balance training and kinesiotapping are effective in the improvement of patient's condition.

Key words: Hemiplegia, stroke, assessment, positioning, physiotherapy management.

INTRODUCTION

Hemiplegia/ hemiparesis is the paralysis of either right or left side of the body with loss of functions. The main cause of hemiplegia is cerebrovascular attack (CVA) or stroke. Stroke is the third main cause of the death & disability in India. [4] According to world health organization; from the total world's population, nearly 18.6 had severe disability and 79.7 million had moderate long term disability. [5] From all the disabilities, hemiplegia is one of the crippling disorders in our society. [2] The

estimated adjusted prevalence rate of stroke in India is 84-262/100,00 in rural area & 334-424/100,00 in urban areas. The incidence rate is 119-145/100,00 based on recent population based studies. There is wide variation in fatality rates with the highest being 42% in Kolkata. The incidence of stroke/hemiplegia is about 1.25 times greater in males than females. [6] Stroke incidence is approximately one million per year in the European Union and survivors can suffer several neurological deficits or impairments, such as

hemiparesis, communication disorders, cognitive deficits or disorders in visuo-spatial perception.^[1,6] There are two major categories of brain damage in stroke i.e. ischemia & haemorrhage.^[4] Other causes of hemiplegia are hypersensitive encephalopathy, vascular disorders, infective disorders of brain tissue, tumours or abscess, trauma, internal artery occlusion. Problems and difficulties related to hemiplegia are sensorimotor deficit (numbness, tingling, anosognosia, apraxia, loss of proprioception and stereognosis, loss of strength and power), unilateral neglect, activities of daily living, mental barriers (dementia, depression, anxiety), speech difficulties (aphasia, dysarthria), abnormal tone (spasticity/ flaccidity), inability of social participation, cognitive difficulties (attention, learning, planning), difficulties in mobility, cardiopulmonary dysfunction, loss of independency, visual neglect, loss of vision or diplopia, incoordination that results in ataxia, gait difficulties, balance difficulties, abnormal reflexes, postural difficulties, swallowing problems (dysphagia), emotional deficit (irritability, frustration), bladder and bowel difficulties. The frequency of aphasia resulting from CVA has been reported in the literature to vary between 21-38%. People with hemiplegia are limited physically in their daily activities. This limitation affects their social well-being & thus can lead to depression.^[2] The aim of this article is to find out the possible rehabilitation strategies & recovery from hemiplegia. Recovery from stroke occurs in three phases: two weeks concerned with survival; eight to twelve weeks of effort to restore activity & independence in walking, standing & self-care; two years – the time that may elapse before the full capacity of the patient to participate in normal social activities.^[1] Two main points that may need special emphasis are initial assessment should be directed for the rehabilitation and intervention strategies, and the process of recovery is spontaneous and slow.^[1]

Moreover, after completing standard rehabilitation, approximately 50%-60% of stroke patients still experience some degree of motor impairment, and approximately 50% are at least partly dependent in activities-of-daily-living (ADL).^[2] Recovery is partial in 85 percent of stroke survivors, about 35 percent of whom are left with a major disability. The aim of rehabilitation in subjects with hemiplegia is to promote recovery of lost function, independence, and early reintegration into social and domestic life.^[2]

METHODOLOGY

Systematic search was done on September 2017 in Google Scholar search engine using scientific terms. Scientific term include hemiplegia AND assessment, AND management. This search yielded more than 550 articles. We screened first 100 titles, then used filter (exclude case studies). This resulted 252 hits and we screened first 100 titles. Then again we used filter (exclude surgical and medical treatment) which yielded 75 hits and we screened first 50 titles. Thus total of 31 titles were screened. Inclusion criteria includes article should be in English, availability of full text and articles that deal with physiotherapy treatment of hemiplegia. The articles that did not meet inclusion criteria are excluded. After inclusion and exclusion criteria, we found 22 articles for final analysis.

Assessment

Many stroke patients have a number of serious disorders such as hemiplegia, motor disturbance, sensory disability, and cognitive impairment.

1. Firstly Analyze affected and non-affected sides of stroke/ hemiparalytic patients.

A bioelectrical impedance analysis (BIA), which is non-invasive, can easily measure the components of biological tissue and a biopsy specimen. Whole-body BIA measurements have been increasingly applied within the medical field. They have been utilized to diagnose diseases as well as assess the hydration status and nutritional

condition of bodies. Among impedance data, the indicators for determining bodily condition are prediction marker (PM), resistance (R), reactance (Xc), and phase angle (PA). The prediction marker (PM) is an indicator of body cell health, the resistance (R) is inversely related to fluid volume, the reactance (Xc) is a measure of cell membrane integrity and function, and the phase angle (PA) is a global indicator of health and nutritional status. [7]

2. Levels of Consciousness

Altered level of consciousness (coma, decreased arousal levels) may occur with extensive brain damage. The Glasgow Coma Scale developed by Teasdale and Jennett, is the gold standard used to document level of coma. Three areas of function are examined: eye opening, best motor response, and verbal responses. The therapist should document levels of consciousness using standard descriptive terms: normal, lethargy, obtundation, stupor, and coma. Total score is of 15. Score of 8 or lower resulted in unconscious. [11]

3. Cranial nerves

1st (olfactory) nerve is tested by Test smell in each nostril separately e.g. coffee.

2nd (optic) nerve is tested by AFRO – acuity, fields, reflexes, ophthalmoscopy.

3rd (oculomotor) nerve, 4th (trochlear) nerve and 6th (abducens) nerve are tested by Extraocular movements and pupillary reflexes (motor). 5th (trigeminal) nerve is tested by Corneal reflex (sensory), touch, pin, clench teeth, open mouth and jaw jerk. 7th (facial) nerve is tested by Corneal reflex (motor), inspect face at rest, wrinkle forehead, close eyes, blow out cheeks, show teeth (taste: sweet, sour, salt, bitter). 8th (vestibulocochlear) nerve is tested by Otoscopy, whispered speech, Rinné, Weber and vestibular tests e.g. Hallpike manoeuvre. 9th (glossopharyngeal) nerve is tested by Gag reflex (sensory), (taste) – with Cranial nerve X.

10th (vagus) nerve is tested by Say “Ah” – uvula moves towards normal side, gag reflex (motor), phonation/cough, swallow. 11th (accessory) nerve is tested by

Turn head against resistance, shrug shoulders. 12th (hypoglossal) nerve is tested by Look at tongue at rest, poke out tongue and move side-to-side. [12]

4. Motor functions

Perform passive movements, active assisted and active movements. Abnormal movements- Tremor, Chorea and Other uncontrolled movement. Muscle Power and strength can be assessed by manual muscle testing. Deep tendon reflexes can be examined by using a hammer to assess affected myotome & dermatome.

5. Examination of muscle bulk

The symmetry of muscle bulk is observed during spontaneous movements of the patient. Any asymmetry of muscle bulk may be assessed by measuring the diameter of the legs, thighs and arms at sites with standard distances from the joints (7, 14, 21 cm). When assessing muscle bulk, it is very important to take into account the subcutaneous tissue mass. Excessive subcutaneous fat may impede the evaluation of muscle bulk, or on the contrary, localized loss of subcutaneous tissue may mimic muscle atrophy.

6. Examination of muscle tone

Muscle tone is examined by the passive movement of the patient's limbs after asking the patient to relax the limbs as much as possible. Decreased or increased muscle tone is based on the resistance of the muscles examined as felt by the examiner. Assess increased tone (spasticity) by clasp knife phenomena (High resistance that suddenly releases) & (Rigidity); lead pipe rigidity (Increased resistance throughout movement) and cog wheel (Jerky resistance). Standard scale for testing rigidity is modified Ashworth scale. Decreased tone (flaccidity) can be assessed by reduced resistance to passive movement. [11,12]

7. Unilateral neglect

Current guidelines recommend that suspected neglect can be confirmed using the Behavioural Inattention Test (BIT). The BIT contains six pen-and-paper and nine behavioural assessments and is highly

reliable and sensitive. Pen-and-paper assessments include star cancellation, letter cancellation, line crossing, line bisection, free drawing and shape copying tasks. Patients are presented with an array of target symbols that they are required to mark. Patients with neglect are likely to miss targets toward the contralesional side and often begin to search from the ipsilesional side. One scale that does attempt to capture how neglect affects activities of daily living is the Catherine Bergego Scale (CBS). The CBS consists of 10 items related to everyday functioning, including grooming, dressing, eating and navigation. Each item is assessed on a four point scale, where a score of 0 is indicative of no neglect and a score of 3 indicates severe neglect. One form is completed by the therapist and another by the patient to help assess his/her anosognosia. [8]

8. Test speech and language

Listen to history, Expression, reception and phonation; assess repetition, articulation, Nominal dysphasia and “Global” aphasia.

9. Gait

The joint kinematics of hemiplegic patients exhibit differences from normal participants in both the stance and swing phases of gait and they also exhibit large inter individual variability. Patient with hemiplegia have been reported to exhibit reduced stride/step lengths relative to normal, increased step lengths on the affected lower extremity, a moderately wider base of support and slightly greater toe-out angles. The temporal aspects of hemiplegic gait are characterized by increased stride times, reduced walking velocity, and reduced cadence. Altered stance phase and swing phase periods have been observed in hemiplegic patients with increased stance periods being observed on both lower limbs relative to normal participants. On the affected lower extremity, less time is spent in stance and more time is spent in swing phase. Hemiplegic walking has been found to require between 50% to 67% more metabolic energy expenditure than that of

normal participants at the same walking velocity. [9]

10. Posture

11. Balance

Use standard test Romberg test, berg balance test if possible. Also assess static and dynamic balance.

12. Coordination

Finger-nose test test, repetitive alternating movements, Rebound Test

Heel-shin test, Tapping toes test.

13. Activities of daily living (ADLs)

ADLs can be assessed by The Functional Independence Measure, FIM™, The Instrumental Activity Measure, IAM and The ADL taxonomy. The FIM™ instrument is a generic, internationally used instrument. It was devised by the American Congress for Rehabilitation Medicine and the American Academy of Physical Medicine and Rehabilitation to be used as an assessment tool in the Uniform Data System for Medical Rehabilitation. It consists of items assessing self-care, sphincter management, transfer, locomotion, communication, social interaction and cognition. The measurement procedure uses a seven-step scale anchored by the extreme ratings of total dependence as “category 1” and complete independence as “category 7”.

IAM was introduced in 1996 as a supplement to the items of the FIM™. It consists of locomotion outdoors, simple meal, cooking, public transportation, small scale Shopping, large-scale shopping, cleaning and washing. The ADL taxonomy was introduced in 1994 as a classification system of activities of daily living. The ADL taxonomy contains 12 common activities in self-care, home maintenance and communication. The taxonomy comprises 12 activities: eating/drinking, mobility, going to the toilet, dressing, personal hygiene, grooming communication, cooking, transportation, shopping, cleaning and washing. [10]

14. Higher mental function – cognition

The “Mini mental state examination” is used to assess mental status. It consists of 11 major questions that test five areas of

cognitive functions, i.e. orientation, registration, attention, calculation, recall and language. Maximum score is 30. Score of 23 and lower shows cognitive impairment.

Rehabilitation

Stroke rehabilitation is the process by which those with disabling strokes undergo treatment to help them return to normal life as much as possible by regaining and relearning the skills of everyday living. It also aims to help the survivor understand and adapt to difficulties, prevent secondary complications and educate family members to play a supporting role.

When an acute stroke is suspected by history and physical examination, the goal of early assessment is to determine the cause. Treatment varies according to the underlying cause of the stroke, thromboembolic (ischemic) or hemorrhagic. Good nursing care is fundamental in maintaining skin care, feeding, hydration, positioning and monitoring vital signs such as temperature, pulse, and blood pressure.

Physiotherapy in the acute stage:

Treatment should be based on assessment by the relevant health professionals, including physiotherapists, Physicians and occupational therapists. Muscles with severe motor impairment including weakness need these therapists to assist them with specific exercises. The Physiotherapist as a treatment team member in the stroke unit aims the followings in this stage:

- Maintenance of anti -spastic/ anti-synergistic posture.
- Maintenance of Range of motion.
- Maintenance of airways and facilitation of breathing.
- Maintenance of muscle properties and strength.
- Stimulation of upper limb, lower limb and oro- facial function.
- Facilitation of bed mobility such as lying to sitting.
- Facilitation of early sitting.

Physiotherapy comprises of:

– Conventional therapies.

– Neurophysiological therapies.

Conventional therapies (Therapeutic Exercises, Traditional Functional Retraining)

- Range of Motion (ROM) Exercises i.e. passive followed by active assisted, active then active resisted exercises.
- Muscle Strengthening Exercises to reduce flaccidity.
- Stretching techniques to reduce spasticity.
- Mobilization activities
- Fitness training
- Compensatory Techniques

Neurophysiological Approaches:

1. Muscle Re-education Approach.
2. Neurodevelopmental Approaches:
 - Sensorimotor Approach (Rood, 1940S)
 - Movement Therapy Approach (Brunnstrom, 1950S)
 - NDT Approach (Bobath, 1960-70S)
 - PNF Approach (Knot and Voss, 1960-70S)
3. Motor Relearning Program for Stroke (1980S)
4. Contemporary Task Oriented Approach (1990S) ^[13]

Rehabilitation after stroke

The primary goals of people with stroke include being able to walk independently and to manage to perform daily activities. The aim of all physical therapies is to improve ADL's, functional ambulation and independence. Specifically designed preparatory exercises, physical therapist's observation and direct manipulation of the lower limbs position during gait over a regular surface, followed by assisted walking practice over ground.

Bobath is the most widely accepted treatment concept in Europe. It hypothesizes a relationship between spasticity and movement, considering muscle weakness due to the opposition of spastic antagonists. This method consists on trying to inhibit increased muscle tone (spasticity) by passive mobilization associated with tactile and proprioceptive stimuli. Accordingly, during exercise, pathologic synergies or reflex activities are not stimulated.

The **Brunstrom** method is also well known but its practice is less common. Contrary to the Bobath strategy, this approach enhances pathologic synergies in order to obtain a normal movement pattern and encourages return of voluntary movement through reflex facilitation and sensory stimulation.

Proprioceptive neuromuscular facilitation (PNF) is widely recognized and used but it is rarely applied for stroke rehabilitation. It is based on spiral and diagonal patterns of movements through the application of a variety of stimuli (visual, auditory, proprioceptive...) to achieve normalized movements increasing recruitments of additional motor units maximising the motor response required. The **Vojta method** has been mainly developed to treat children with birth related brain damage.

The principle is to stimulate nerves endings at specific body key points to promote the development of physiological movement patterns. This approach is based on the activation of “innate, stored movement patterns” that are then “exported” as coordinated movements to trunk and extremities muscles. Vojta method meets well central pattern generator theories for postural and gait control and it is also applied in adult stroke.

The **Rood technique** focuses on the developmental sequence of recovery (from basic to complex) and the use of sensory stimulation to facilitate movement and postural responses in the same automatic way as they normally occur.

The **Johnstone method** assumes that damaged reflex mechanisms responsible for spasticity are the leading cause of posture and movement impairment. These pathological reflexes can be controlled through positioning and splinting to inhibit abnormal patterns and controlling tone in order to restore central control. In this gross motor performances are trained and only skilled movements are addressed. [14]

Motor learning techniques

Motor learning approach stresses active patient involvement. Thus patient collaboration is a prerequisite and neuropsychological evaluation is required. In this, the use of practice of context-specific motor tasks and related feedbacks are implemented. These exercises would promote learning motor strategies and thus support recovery. Task-specific and context-specific training are well-accepted principles in motor learning framework.

Additionally, training should be given in the patient’s own environment. [14]

Robotic devices.

Robotic devices are increasingly used in rehabilitation of physical impairments in both the upper and lower limbs. These devices provide safe, intensive and task-oriented rehabilitation to people with mild to severe motor impairments after neurologic injury.

Robotic training could increase the intensity of therapy with advantages such as:

- i. precisely controllable assistance or resistance during movements
- ii. good repeatability
- iii. objective and quantifiable measures of subject performance
- iv. increased motivation through the use of interactive (bio)feedback.

In addition, this approach reduces the amount of physical assistance required to walk. [15]

Functional Electrical Stimulation

Functional Electrical Stimulation (FES) is a useful technique for the rehabilitation after stroke. FES consists on delivering an electric current through electrodes to the muscles. The current elicits action potentials in the peripheral nerves of axonal branches and thus generates muscle contractions. FES has been used in rehabilitation of chronic hemiplegia since the 1960s.

The first applications of FES in stroke recovery were focused on foot - drop correction, to stimulate the muscles for dorsiflexion of the foot. [14]

Balance training

The SMART Balance Master (NeuroCom International, Inc., Clackamas, OR, USA) was used for both balance function assessment and training. It provides objective measurement of the basic components of balance control including the COG, posture alignment, limits of stability (LOS), and rhythmic weight shifts.

Training protocol

Visual feedback balance training with the Smart Balance Master is used in the patients. They are encouraged to maintain their posture steadily and symmetric weight bearing while adapting to different static sensory conditions through verbal or tactile cues. For dynamic function training, the patients are instructed to practice controlling their weight shifts by tracing the moving targets on the screen in every main direction. [16]

Speech therapy

Butfield and Zangwill suggested that there was marked improvement in the patients who had received speech therapy six months or more after the onset of the aphasia and other speech difficulties. Speech therapists have an essential part to play in the management of some aphasic patients. Requirements for the treatment of aphasic patients:

- (1) Visual contact with people and with objects.
- (2) Sound location-evident when the patient turns his head in response to sound
- (3) Hand eye co-ordination-that is, willingness to reach for objects.
- (4) Ability to imitate the mouthing of words.
- (5) Response to simple mime.
- (6) Response to repetitive speech to indicate: (a) if the palate is working, (b) the extent of articulation possible, (c) whether the normal voice is available, (d) whether language is complicated by jargon.
- (7) Penmanship and ability to sign name.
- (8) A capacity to respond to pictures and written words.

Approaches to aphasia treatment

- Traditional modality specific stimulus-response treatment

- Language oriented therapy (LOT)
- Group therapy
- Functional communication therapy
- Programmed instrumental approaches
- Computerized approaches
- Visual action therapy (VAT)
- Melodic intonation therapy
- Auditory comprehension training.

Rehabilitation of Anosognosia

Few practical guidelines that involved in the rehabilitation

1. To respond to the patients statement at face value with natural interest and curiosity.
2. To discreetly suggest and add correct background information to their stories, when possible.
3. To pace the conversation with the patient.
4. To explore the memories, beliefs and current facts, by taken into account both patient's emotions and emotions of others and their need for shared reality. [17,18]

Effect of kinesio taping (KT)

Taping provides immediate sensor motor feedback regarding functional abilities. Sensory feedback and proprioception have a chief role in the development of proper motor schemas.

Specially, KT was effective and promising in improvement of hand function in hemiplegic patients in rehabilitation program. KT application are based on certain variables which include the amount of pre-stretch applied to the tape, position of the area to be taped, treatment goals (improved muscle function, pain reduction, improvement of subcutaneous blood flow). [19]

Pelvic exercises and gait in hemiplegia

There is marked overall improvement in gait patterns after manually resisted pelvic anterior-elevation and posterior-depression movements on the involved side. [20,22]

Treatment of Glenohumeral subluxation Positioning

Treating GHS with the limb positioned while patients lie in bed or with supportive devices while the patients are in the sitting

position. Usually, for patients in bed, the arm is supported by a pillow.

Slings

Sling that significantly corrected vertical asymmetry is the single-strap hemisling while total asymmetry is corrected mostly by the Rolyan sling.

Dennison sling, Dumbbell sling, Harris hemisling, Hook hemiharness and Zimmer Fashion arm sling are effective in reducing GHS.

Strapping

Shoulder strapping is useful in the first period after stroke. Morin and Bravo found strapping to be more effective when it is combined with a conventional sling. [21]

Treatment for depression

Social support, especially from spouses, is one of the main factor the aids the patient in coping with their illness and disability.

- Psychosocial therapy
- Counselling

Activities of Daily Living/Instrumental ADL

• Bathing/showering

Use a soap-on-a-rope to hang around neck, or put soap in a pocket washcloth. Use bath/shower bench to help him/her get into shower or bath, to sit on, and to help him/her get out again.

Use grab rails, long-handled brush to wash back and feet. Place nonslip mat in tub or shower.

• Dressing

Putting the garment on the affected arm first and pulling sleeve past elbow. Then put unaffected arm in other sleeve, pull over his/her head, pulldown bottom of garment, and adjust. To remove upper garments, have person gather garment from back of neck and pull it over his/her head, pulling out unaffected arm and finally removing garment from affected arm.

- **Eating:** Client may use cutlery with built-up handles for easier grasp. A rocker knife, plateguard, buttering board, and nonslip mat under plate can be helpful.
- **Grooming/hygiene**

Use electric razor, suction nail brush or file, or a nail clipper.

• Tooth brushing

To open toothpaste tube, client may wedge tube between knees or teeth or against a solid object, and unscrew top with uninvolved hand.

Sensorimotor

- Active and active-assistive range-of-motion exercises.
- Bilateral use: Encourage use of both hands at the same time to help the person improve awareness of the involved side.
- Constraint-induced movement therapy.
- Graded activities: Start with easy activities, such as eating. Use more difficult activities as the person improves.
- Guided movement.
- Meaning and purpose: Choose activities that have meaning and purpose to the person to encourage participation.
- Modification: Modify the *activity* to elicit better movement. [3]
- Positioning: Affected upper extremity should be positioned in shoulder protraction, while arm is brought forward, spine aligned, and finger extended.
- Robotic therapy.
- Skills: Use activities appropriate to the person's skill level.

Hemiplegia in Ayurveda

Treatment is focused on improving sensations, motor abilities, allowing the patients to better manage their activities of Daily Living. In the treatment of hemiplegia, most common used therapy is Panchakarma therapy. In this therapy, purification of the body by eliminating morbid is done. In this, sudation and pouring of oil on the head are the line of treatment for hemiplegia. Proper treatment is given at appropriate time with logical use of internal and external medicines. Good results are obtained and patient remains self-

dependent from this therapy. Other rehabilitation therapy besides Ayurveda and physiotherapy, as occupational therapy, vocational therapy etc. should also be incorporated for the complete management. [4]

CONCLUSION

After this study, we conclude that there are many intervention techniques possible in the rehabilitation of hemiplegia. Above all the techniques, Bobath, NDT, PNF, Roods approach, speech therapy, robotic devices, balance training and kinesiotapping are effective in the improvement of patient's condition.

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