

Stroke Rehabilitation

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ABSTRACT

Today, stroke is a major global health burden that contributes to mortality and continues to be a cause of both long-term impairment and death (as determined by disability adjusted life years) {GBD 2019 stroke collaborators} Aiming to improve a stroke patient's physical, emotional, behavioral, and cognitive functioning, stroke rehabilitation is a dynamic, goal-oriented procedure. ADLs, or activities of daily living, are disrupted and survivors of stroke must continue living their lives with persistent physical impairment. Neurological, muscular, sensory, cognitive, perceptual, and linguistic recovery all includes after a stroke. Clinical and home-based therapy are two possible avenues for achieving stroke recovery.

Keywords: Stroke Rehabilitation, Phases of stroke recovery, Role of Nurse, Exercises.

INTRODUCTION

Today, stroke is a major global health burden that contributes to mortality and continues to be a cause of both long-term impairment and death (as determined by disability adjusted life years) {GBD 2019 stroke collaborators} [1,2,3,4,8,9]. Because cerebrovascular disease (CVD) is a heterogeneous disease that encompasses multiple disorders, its prolonged limiting impairs quality of life and daily tasks [5,6]. In India, 1,85,000 stroke cases are reported

annually, while over 80 million instances are reported globally [7]. ADLs, or activities of daily living, are disrupted and survivors of stroke must continue living their lives with persistent physical impairment [4].

Aiming to improve a stroke patient's physical, emotional, behavioral, and cognitive functioning, stroke rehabilitation is a dynamic, goal-oriented procedure [10]. Neurological, muscular, sensory, cognitive, perceptual, and linguistic recovery all includes after a stroke [7]. Research studies on rehabilitation and recovery therapies are underway in order to develop acute stroke interventions; these treatments will have a treatment time window assessed in days, weeks, or months following stroke. This is accomplished by targeting the parts of the brain that survive the stroke to the greatest extent possible through various therapies, which also encourage compensatory strategies to enhance overall functionality [11]. Clinical and home-based therapy are two possible avenues for achieving stroke recovery.

The option of hospital-at-home, which was first explored in 1997 for acute stroke patients in Italy, offers the ideal solution to meet the demand for acute-care hospital services starting in the 1990s.

3 set of instructions for stroke care rehabilitation at home includes:-

1. Rehabilitation at home to replace acute care-the early supported discharge (ESD) model.

2. Rehabilitation at home to replace institutional rehabilitation
3. Rehabilitation at home including exercise to prevent deterioration and promote health through physical activity [12].

MATERIALS & METHODS

The literature search was done by using PUBMED, Google Scholar, Cochrane Library and online data sources. After reviewing, total twenty-one relevant literatures and eight online data has been included, short listed and framed by the authors.

FRAMEWORK FOR REHABILITATION



1. HOPE: The right to be given the best chance of healing, both now and in the future.
2. EMOTIONAL SUPPORT: Right to get appropriate emotional and psychological help in order to meet their requirements.
3. INCLUSION: Right to get full inclusion in society whatever the nature of the patient's disability.
4. LONG-TERM CARE: The entitlement to assistance in order to guarantee long-term care.
5. SMOOTH TRANSITIONS: The right to assistance returning to one's previous activities and workplace.
6. ACCESS: Right to both official and informal advocacy to help obtain the services they require.
7. COMMUNITY: Right to social media connections with other stroke victims

In addition to improving quality of life, physical rehabilitation can reduce and avoid stroke consequences.

For stroke survivors looking to improve their health, a variety of workouts can be most beneficial.

Susan B. O'Sullivan lists three categories of interventions:

(a) Restorative, which aims to improve impairments; participation restrictions; and activity constraints

(b) Preventive, with the intention of reducing any problems and unintentional impairments

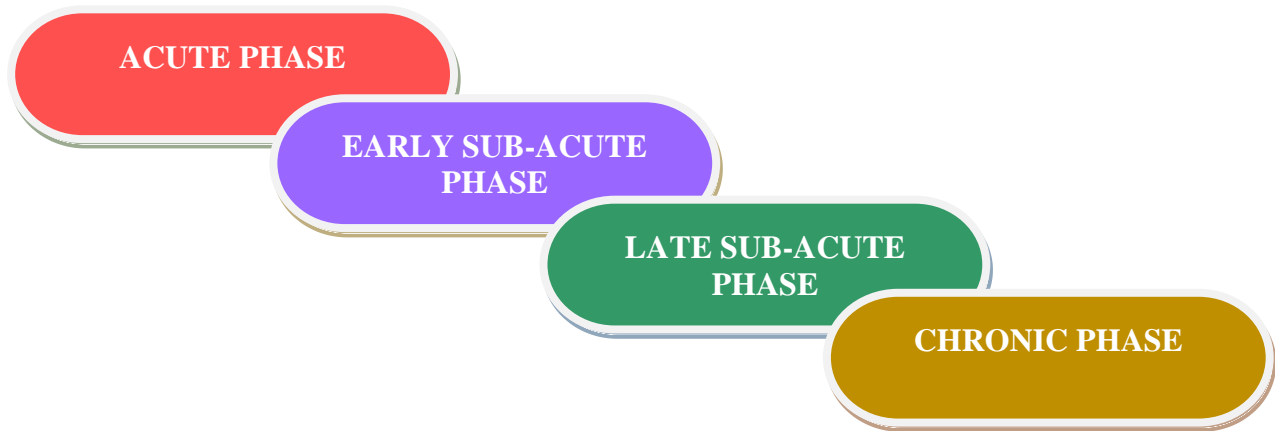
(c) Compensatory, meaning it tries to improve function by changing the task and activity surroundings.

There are some rights for stroke survivors:

and caregivers in order to receive stroke

recovery support.

PHASES OF STROKE RECOVERY



➤ ACUTE PHASE

Low-intensity rehabilitation begins in an ICU or stroke specialty unit about 72 hours later. Functional mobility training, ADL training, ROMs, splinting, and bed mobility are the main components of the treatments that begin with positioning. Following the proper supervision, prompt movement lessens mental decline, anxiety, and stress while enhancing the patient's level of consciousness and preventing the negative consequences of bed rest and deconditioning. Newer studies concentrate on treating stroke patients' upper limb symptoms within seven days after the onset, as well as early mobilization and aphasia and dysphagia. It is both safe and possible to mobilize patients for acute ischemic stroke within 24 to 48 hours after the stroke's beginning.

➤ EARLY SUB-ACUTE PHASE

Inpatient or home rehabilitation may be appropriate for patients falling into the early sub-acute phase first three months. Offering three hours of mobility therapy, electromechanically aided supporting walking, and B/L training six days a week. The Transitional Care Unit (TCU) offers less rigorous rehabilitation services, lasting

60 to 90 minutes five days a week, to patients in need of them. These therapies are intended to restore patients' strength, balance, endurance, and ability to move around.

A stimulating adjunct to traditional rehabilitation, virtual reality rehabilitation training (VR) enhances upper limb function in the subacute phase following a stroke. It consists of 30 days with 4–5 training sessions each week, lasting up to 60 minutes.

➤ LATE SUB-ACUTE PHASE

From months 4-6, it begins. Following a stroke, patients are expected to regain approximately 70% (+/- 15%) of their lost function, according to the "proportional recovery rule," between three to six months.

➤ CHRONIC PHASE

After six months following their stroke, stroke survivors can receive a home exercise program for maintaining their level of intensity, preventing falls, shifting positions, and promoting their health.

Enhancement of function can also be achieved through community fitness programs, water-based exercise, and ninety hours of physical therapy.

Motor recovery can be categorized into three stages:



1. **Cognitive Stage:** In this stage, patient gets help to learn a piece of work.
2. **Associative Stage:** In this stage, patient is assisted for task performance.
3. **Automatic Stage:** In this stage, patient is skilled and can perform tasks. [13,14]

Physical therapy

Having a stroke frequently results in a loss of muscle tone, which at first causes flaccid paralysis that lasts for a few days or weeks before being replaced by extreme spasticity or hypertonicity. When using many interventions at once, rather than just one exercise, is more effective for motor recovery. Benefits of proprioceptive neuromuscular facilitation, neurodevelopmental therapy, functional training, and motor learning have all been reported by several studies.

- **Conventional Stroke Rehabilitation Exercises**

Improved trunk mobility, improved muscle coordination, improved postural control, and increased mobility are achieved by stroke survivors utilizing a combination of traditional rehabilitation techniques and active mobilization, muscle strengthening, nervous system stimulation, and task-oriented activities. Supine and seated positions both benefit from "The Bridge" and "The Tentacle" exercises. The typical three-month motor rehabilitation intervention for the affected side of stroke survivors included reflexive, synergistic, out-of-synergy movements of the paretic upper and lower limbs, as well as functional activities like sit-to-stand, stepping and reaching, sideward walking, and straight-

line walking. These movements improved the patients' mobility, balance, and overall quality of life.

- **Gym-Based Exercise**

Strengthening muscles with a Swiss ball can improve balance in stroke survivors more than other methods. These methods include passive mobilization, bed mobility exercises, transfer activities, gait training, weight-bearing exercises, balance training exercises, and pelvic bridging abdominal curl-ups. Static balance exercises can also improve balance.

The use of leg press and leg extension rehab machines with pneumatic resistance to promote 90° knee joint flexion of the paretic leg is used in close and open kinetic chain activities on muscle activation and balance. Enhancement in balance, walking speed, and cardiovascular fitness can be achieved by performing backward walking on a treadmill at a speed of 0.2 km/h.

- **Vibration Therapy**

Following a 30-minute whole body vibration therapy session, subacute stroke survivors' ability to regain their balance and do everyday tasks improved functionally.

- **Rhythmic Auditory Stimulation Training**

For stroke survivors, intensive gait training using individualized music cassettes and rhythmic auditory stimulation training enhances balance and gait function.

- **Boxing Therapy**

Boxing instruction based on Bobath training combined with functional level exercises, trunk control exercises, weight shifting training, balance activities, and gait training can be used to treat neurodevelopmental disorders. Three postures are used in another boxing exercise: direct punch (high and low), hook (punch against the opponent's ear), and block position (high and low). These boxing exercises enhance punching timing and balance.

- **Technology-Based Rehabilitation**

Three sessions of sitting balance, sit-to-stand, and standing balance training are included in the robot aided trunk control training program for postural control and balance.

Training with a robot has a significant positive impact on trunk control and balance.

Postural control and daily activity level are improved in stroke survivors with at-home exercise utilizing balance disc training in conjunction with data from a smartphone inclinometer application. *Robot-assisted rehabilitation* by this, gait and upper limb motor function can be restored with the use of an exoskeleton or a robotic hand, respectively. In addition to offering improved control and monitoring for certain jobs and patient demands, these devices assist the patient's motions in many axes. The functional performance of the arm and hand as well as postural balance are enhanced by game-based canoe paddling movements with both hands and holding the motion controller into a different types of canoe paddle accessory exercise.

A height-adjustable levelling block without a backrest or armrest combined with a real-time visual feedback system for sit-to-stand training helps participants maintain optimal alignment with observation while improving their muscle strength, balance, gait, and overall quality of life.

Three video games that focus on endurance, coordination, and balance-hula hoop, bubble

blower, and sky slalom-are used to teach balance. This improves balance and lessens the symptoms of post-stroke handicap.

Virtual Reality therapy utilizes hardware and software to mimic interactions with the outside world. This enables the development of sensory associations that closely resemble reality.

- **Dual task Aquatic and Land motor training**

In order to use a balancing board and handle a ball or cup, patients in land motor therapy must move forward, sideways, and backward. Exercise is done in a swimming pool for aquatic rehabilitation. Research on water motor dual task training for chronic stroke survivors revealed improvements in their gait and balance [15].

- **Spinal Cord Stimulation (SCS)**

Motor activity is activated through sensory afferents in the dorsal roots of the cervical spinal cord through selective muscle activation produced by pre-existing myotomal maps. Arm and hand muscular strength increases significantly and instantly as a result.

With rapid improvement, SCS allows clients to move their arms smoothly and effectively, extending and flexing their elbows fully, while also reducing compensatory shoulder activity by targeting the dorsal root at particular cervical segments.

Enhancements in functional abilities and everyday living activities are enhanced by SCS.

There have been no documented severe side effects from SCS [16].

- **Non-invasive Brain Stimulation Technique**

This method of treating post-stroke deficits increases the neuroplastic potential of the brain circuitry, allowing for the restoration and formation of new connections to replace vascular functions. It does this by producing

an electric field that modifies the rate at which cortical firing occurs. An efficient treatment for post-acute or sub-acute stroke is transcutaneous vagus nerve stimulation, which enhances upper limb motor function and increases the capacity to do ADLs.

Repetitive Transcranial Magnetic Stimulation involves placing an electromagnetic coil above the scalp through which alternating current flows, creating a pulse magnetic field in the brain and causing current to flow in a specific region, stimulating neuronal tissue up to 1.5 cm deep in the brain. When it provides theta burst stimulation (TBS), which synchronizes with theta rhythms in the brain, it follows two main patterns: Continuous *theta-burst stimulation (cTBS)*, Intermittent *theta-burst stimulation (iTBS)*. iTBS is a successful treatment for chronic stroke that enhances upper limb motor function. The typical application pattern involves applying it in three bursts of three at a frequency of 50 Hz for a total of two seconds, with ten-second breaks in between each batch of stimulation. cTBS is comparable, with the exception that there are no 10-second pauses between the pulses of stimulation. While cTBS is thought to have an inhibitory effect, iTBS is thought to have an excitatory effect.

Transcranial Direct Current Stimulation applying a steady direct current to specific cortical regions and delivering low-amplitude currents (0-4 mA) is necessary for post-stroke motor retraining. TDCS has more rehabilitative potential as compared to other rehabilitative training methods.

Vagus Nerve Stimulation employed in the rehabilitation of the upper limbs following a stroke. It involves implanting an invasive stimulator and cuff electrodes to send electrical current to the vagus nerve.

Peripheral Nerve Stimulation for the treatment of stroke is both a therapeutic and an assistive tool. It permits increasing the dosage of motor therapy by increasing the number of movement repeats. There are three different types of peripheral stimulation: TENS, NMES, and FES. While

NMES stimulates muscular contraction, TENS stimulates sub-motor and sub-sensory thresholds, and FES stimulates functional tasks.

Upper limb clinical application mostly concentrates on hand opening. The devices covered by NMES are the Bioness H200 (Bioventus) and Neuromove (Zynex Medical, Inc, Englewood, CO). TENS and NMES for hand opening increase function and lessen disability. In upper limb hemiplegia, contralaterally controlled FES improves more.

Lower limb clinical applications using readily accessible surface stimulation devices, such as Walkaide, Odstock dropped foot stimulator, and L300Go (Bioventus), to increase muscle activation in the peroneal nerve in order to prevent foot drop. [16,17,18,19]

ROLE OF NURSES IN STROKE REHABILITATION

In order for patients to regain their health, nurses are known to be essential. One crucial area where nursing excels in aiding recovery from a stroke is in the rehabilitation phase. Specialized in providing care to those with disabilities are rehabilitation nurses. Primary treatment in hospitals for stroke patients is not combined with rehabilitation services. These specialist nurses educate patients on how to perform their everyday activities and assist stroke survivors with personal care concerns. It is the responsibility of nurses to support patients receiving speech, occupational, and physical therapy treatments while they are in the hospital, as these therapies enable patients to recover as much as possible from a stroke.

Managing common health issues like diabetes and high blood pressure, which can cause another stroke, is something that rehabilitation nurses assist stroke survivors with. Furthermore, they provide stroke survivors with education on basic health care, including how to take medications on time, take care of their skin, and get from bed to a wheelchair.

The purpose of the patient's rehabilitation nursing relies on the impact of the stroke, the degree of dependency, the patient's pre- and post-stroke abilities, as well as their interests and aspirations. Therefore, the rehabilitative nurse should take into account the rights of stroke survivors in the stroke rehabilitation program.

Role of nurse includes:

1. Helping with daily life tasks involves feeding, toilet, mobility, hygiene, clothing, and bathing.
2. Carrying out and keeping an eye on therapeutic interventions
3. Medical and nursing services
4. Treatment for diabetes, hypertension, wounds, edema, and other conditions includes physical, occupational, speech, and medicinal treatment.
5. Instruction and guidance
6. Assistance with emotional and psychosocial aspects.
7. Collaboration, management, advocacy, and coordination of care.
8. The strategy for discharge and community assistance.
9. The prevention of secondary strokes.
10. Putting stroke competency programs into place to enhance evidence-based procedures.
11. Developing and executing professional development initiatives to help bedside caregivers, including staff nurses, in the inpatient setting recognize stroke symptoms in hospitalized patients.
12. Recognition of the challenges that stroke survivors and their carers faces.
13. Evaluating and Meeting the Family Caregivers' Needs.
14. Building and Managing Networks of Community Resources[10,20,21,22,23].

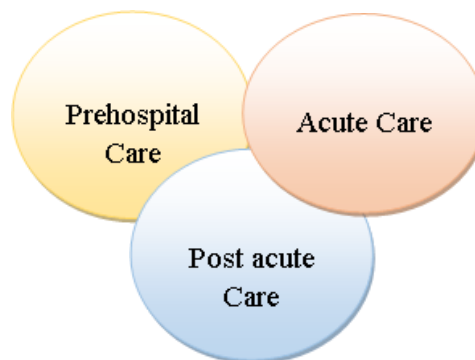


Figure: Role of nurse in hospital setting in stroke recovery

PREHOSPITAL CARE

a. Triage phases

- Determine the symptoms and signs of a stroke quickly.
- Identifying the beginning of the stroke symptoms from the last time the patient was considered normal
- Turn on the stroke code.
- Start the quick transition to a reserved bed.

Recognize medical history and lifestyle risk factors for onset of stroke, including

- Medical/Surgical history
- Medication/anticoagulant history
- Stroke risk factors

ACUTE CARE

- As quickly as possible, get ready for CT or CTA scan.
- Evaluate airway, breathing and circulation
- Link the patient to the cardiac monitor and track their vital indicators
- Determine the intensity of a stroke by utilizing the National Institutes of Health Stroke Scale (NIHSS).
- Examine the eligibility requirements for both inclusion and exclusion for the tPA administration.
- As directed by a doctor, monitor blood sugar levels and treat patients if they are less than 60 mg/dl.

- Monitor and maintain the necessary blood pressure levels for a particular stroke patient.
- Identify the targeted blood pressure required for a particular stroke patient.
- Determine and distinguish between stroke signs, symptoms, and stroke mimics.
- Obtain a 12-lead electrocardiogram and recognize irregular heart rhythms.
- Keep oxygen saturation levels over 94%.
- Establish an intravenous access, preferably using two eighteen-gauge cannulas.
- Give the right amount of fluids based on the type of stroke and as directed by your doctor.
- Prior to administering tPA, determine whether NG/OG tube insertion and catheterization are necessary.
- Conduct a preliminary bedside swallowing screening.
- Using the appropriate technique, assess the risk of recurrence and transient ischemic attack (TIA).

Post-tPA administration and considerations

- Following a tPA, keep an eye on your vital signs.
- If necessary, move to the intensive care unit or hyperacute stroke unit. Follow protocol by attaching a cardiac monitor for 72 hours.
- Conduct a post-tPA neurological evaluation.
- After a tPA, take precautions
- Keep a watch out for thrombolytic consequences.
- Adequately place the patient after a tPA.
- 24 hours after taking a tablet, find out your NIHSS score.

Pre and post operative management

- Prior to the surgery, ascertain the NIHSS score.
- Perform a preprocedural evaluation, encompassing vital signs, medical

history, allergies, prescriptions, and test findings.

- Preprocedural: Obtain the postprocedural NIHSS score.
- Monitor vital signs and do neurological assessment at least every 30 to 60 minutes.
- Discuss sedation with the physician and record the blood pressure plan.
- Examine the surgery site, take a neurological and postprocedural circulatory examination, and monitor vital signs.
- Track any complications following the procedure.

POSTACUTE CARE

- As needed, administer oxygen treatment and suctioning.
- Keep an eye out for signs of worsening.
- Keep an eye out for symptoms of deep vein thrombosis (DVT).
- Determine past falls and evaluate the risk of falls.
- Watch for indications of infection.
- Assess oral hygiene and provide oral care as necessary.
- Safely handle a nasogastric feeding tube.
- Assess the patient for aspiration risk.
- Evaluate dietary needs and deficiencies.
- Identify constipation and urine retention in the intestines and treat according to doctor's orders.
- Use the modified ranking scale or additional instruments to evaluate the physical impairment of the patient.
- Keep an eye on your gag response and swallowing skills.
- Examine for dysphagia as a result of damage to the voice recognition system.
- Feed the patient safely based on the degree of dysphagia following a stroke.
- Determine whether physical restraints are necessary, then apply them safely.
- Perform pain evaluation and administer analgesics as directed by a physician.
- Assess skin using the Braden Scale.
- Offer a mattress with pressure alleviation.
- Position the patient every two hours.

- Exercise your range of motion passively to avoid contractures.
 - Safely move a patient from one bed to a chair or another bed to another.
 - Administer proper care to a patient who has cognitive impairment.
 - Neglect syndrome: instruct patient to utilize and touch both limbs
 - Hemianopsia: assist patient in rotating head to examine entire field of vision.
 - As per patient tolerance and physiotherapist-approved, increase the range of motion.
 - Promote self-sufficiency in everyday tasks in a secure manner.
 - As directed, refer the patient to a speech and language pathologist.
 - Check for post-stroke depression.
 - Evaluate and document psychosocial needs.
 - Encourage the sufferer to communicate their emotions.
 - Inform the patient and their family about stroke prevention and the post-discharge follow-up clinic.
 - Send family members to a health educator so they can get information on how to give care at home.
 - Give the patient end-of-life care.
 - Assess the patient's need for a rehabilitation program and refer them to a psychiatrist or rehabilitation team. [24]
- Seated Marching
 - Ankle dorsiflexion
 - Assisted Reverse Leg Swings
 - Bridging include “Inner Range Quad Movement” Leg Raises
 - Intermediate Bridging Exercise: Ski Squats; Wall Sits
 - Advanced Bridging Exercise Ski Squats; Wall sits with Pilates Ball
 - Calms; In sitting
 - Intermediate Calms exercise; Hip Openers
 - Knee to chest
3. Arms Exercise: -
 - Inner arm stretch
 - Wrist and hand stretch
 - Elbow Stretch
 - Crawling Stretch
 - Wrist Motion
 - Elbow Weight Training
 - Finger Walk
 - Seated Pushup
 - Tabletop circle exercise
 - Unweighted bicep curls
 - Weight bearing lean
 4. Hand Exercise: -
 - Ball Grip
 - Thumb Extend
 - Pinch
 - Opposition
 - Side Squeeze
 - Extend Out
 - Scissor Spread
 - Thumb Press
 - Thumb Extension
 - Thumb Pinch Strengthening
 - Thumb Adduction
 - Three Jaw Chuck Pinch
 - Finger Hook
 - Full Grip
 - Finger Pinch
 - Finger Extension
 - Finger Scissor
 - Finger Spread
 - Roll Movement
 - Wrist Curl
 - Wrist flexion and extension
 - Pinch & Release

REHABILITATION AT HOME

INCLUDES:

Stroke exercises include:

1. Balance exercise: -
 - Heel Raise (Holding on)
 - Side stepping (Holding on)
 - Heel Raises (Not Holding on)
 - Side stepping (Not Holding on)
 - Heel-to-toe walking
 - Squats against gym ball
 - Single leg standing
 - Backward walking
 - Weighted ball pass
2. Leg Exercise: -
 - Assisted lateral leg swings
 - Assisted Knee Raises

- Pen Spin
- Coin Drop
- Finger Opposition [25,26,27,28,29]

RESULT

A total 21 articles were identified relevant after selecting and analysing from database PUBMED, Google Scholar, Cochrane Library and 8 online resources. After reviewing relevant literature, the data synthesis produced including framework for rehabilitation, four phases of stroke recovery: (i) Acute phase (ii) Early sub-acute phase (iii) Late sub-acute phase (iv) Chronic phase along with motor and physical recovery with various current advanced technologies of stroke rehabilitation, Role of nurse in stroke rehabilitation in three phases of care: *Prehospital care, Acute Care & Post acute care*. Various home-based exercise for stroke rehabilitation can be provided to help in improvement of stroke affected person at home.

DISCUSSION

The current review synthesizes the various recovery methods with current advances regarding stroke affected lifelong disabilities. Recovery from stroke is an essential part of life long disability which affects daily livings activity. The goal of this review was to provide various important rehabilitation techniques including home based exercises to make fast recovery including various recent technological for improvement and make able to the person to do daily living activities. Each phase of recovery differs according to time like acute phase requires early mobilization and aphasia and dysphagia related training. Early sub-acute phase includes three hours of mobility therapy, electromechanically aided supporting walking, and B/L training six days a week. Late sub-acute phase begins at 4-6 months and regains 70% of disabilities. Chronic phase includes home based exercises, various advanced trainings are available for each affected organ including upper limb, lower limb, trunk etc.

[13,14,15,16,17,18,19] A stroke rehabilitation nurse can provide adequate education and information regarding these rehabilitative approaches to the stroke fighters and their caregivers and can assist regarding this by posthospital telehealth nursing, telerehabilitation as well as community-based evaluation [10,20,21,22,23,24].

CONCLUSION

Stroke rehabilitation can be improved and promoted by implementation of various training and exercises as per each phase of care for the stroke affected person. Information regarding these available services with advanced technologies with great benefits will help the stroke survivors and their caregivers in reduction of the symptoms and burdens physically as well as mentally. Early recovery from stroke prevents lifelong disability related suffering and burden and make person to regain self ability to perform daily activities. The information regarding this can be provided during discharge teaching, informational material in printed form and telehealth, telerehabilitation etc.

Declaration by Authors

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