Rehabilitation of a patient with stroke

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ABSTRACT

Stroke is a significant cause of long-term disability world-wide. The post-stroke disabilities are due to loss of locomotion, activity of daily living, cognition and communication skills. Rehabilitation is an integral part of medical management and continues longitudinally through acute care, post-acute care and community reintegration. The objectives of stroke rehabilitation are to maximize the functional independence, minimize the disabilities, reintegrate back into the home and community and improve the self-esteem of patient. A comprehensive stroke rehabilitation service should provide early assessment of impairments and disabilities, management and prevention of complications and well-organized rehabilitation program in both in-patient and out-patient settings. A multidisciplinary or interdisciplinary team approach is necessary to reduce the post-stroke disabilities. It has many members, including physicians, physical therapists, occupational therapists, speech and language pathologists, orthotist, psychotherapists, social workers, vocational rehabilitation therapists, rehabilitation nurse, patients, families and other caregivers. Physicians caring for patients with stroke during rehabilitation must be aware of potential medical complications, as well as a number of special problems that may complicate recovery, including cognitive deficits, aphasia, dysphagia, urinary incontinence, shoulder pain, spasticity, falls and depression. Involvement of patient and caregivers in the rehabilitation process is essential. This article outlines the salient features of the early comprehensive rehabilitation after stroke.

Key words: Disability, rehabilitation, stroke

INTRODUCTION

Stroke is the second common cause of disability after dementia in elderly population.[1] It causes tremendous impact on survivors and family members.[2,3] As per World Health Organization Disability Assessment Schedule, 72.5% stroke survivors are severely disabled in rural India.[4] The post-stroke disabilities are primarily due to loss of locomotion, activity of daily living (ADL), cognition and communication skills.[5] During the 1st week, 78-90% patients become partial to completely dependent on family members for daily activities and at the end of 6 months, 40-62% patients remain dependent.[5] The incidence of complete dependence in ADL decreases from 58% at 1 week to 9% at 6 months among stroke survivors.[6]

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Well-organized rehabilitation program, initiated immediately after stroke, enhance the recovery process and minimize the functional disability in post-stroke patients. Hence it is very important to make a proper guideline for the rehabilitation of stroke patients with multiple disabilities, especially during the early phases of post-stroke periods.

This article has been adapted from various literatures and outlines briefly the problems experienced by stroke survivors and provides a summary of the early comprehensive rehabilitation post-stroke.

OBJECTIVES OF REHABILITATION

The objectives of stroke rehabilitation are to maximize the functional independence, reintegrate patients back into the home and community and improve the self-esteem of patient.[7] The ultimate goal is to improve the quality-of-life of patient.

The-team-approach

Stroke patients often suffer from multiple disabilities and hence, require either an interdisciplinary[8] or

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multidisciplinary[8,9] team approach. An interdisciplinary or multidisciplinary team may have many members, including physicians, physical therapists, occupational therapists, speech-language pathologists, rehabilitation nurses, social workers, psychologists, vocational councilors, orthotists and caregivers.[8] Role of individual professions in the team has been described in Figure 1. The primary treatment goals and strategies are made by all the team members jointly for each stroke patient. Relevant goals are set, for the optimum recovery of patients within their social situations, interests and abilities. The family, equipped with knowledge and skills becomes the key support to patient eventually after discharge and returning home.

Stroke patients have better outcome if treated in specialized stroke care unit as it improves long-term survival and functional status of the patients.[9-12] Stroke Unit Trialists' Collaboration[12] defined stroke unit as "organized inpatient (stroke unit) care, when compared with conventional care, was best characterized by coordinated multidisciplinary rehabilitation, programs of education and training in stroke and specialization of medical and nursing staff." Success of the stroke rehabilitation depends on detailed assessment of medical problems, impairments and disabilities.[7] Some of the standard assessment scales, used in various studies have been mentioned in Table 1.

MEDICAL COMPLICATIONS

There is a high incidence of coexisting medical disorders, ranging from 59% to 95%.[29,30] Sackley *et al.*[31] reported

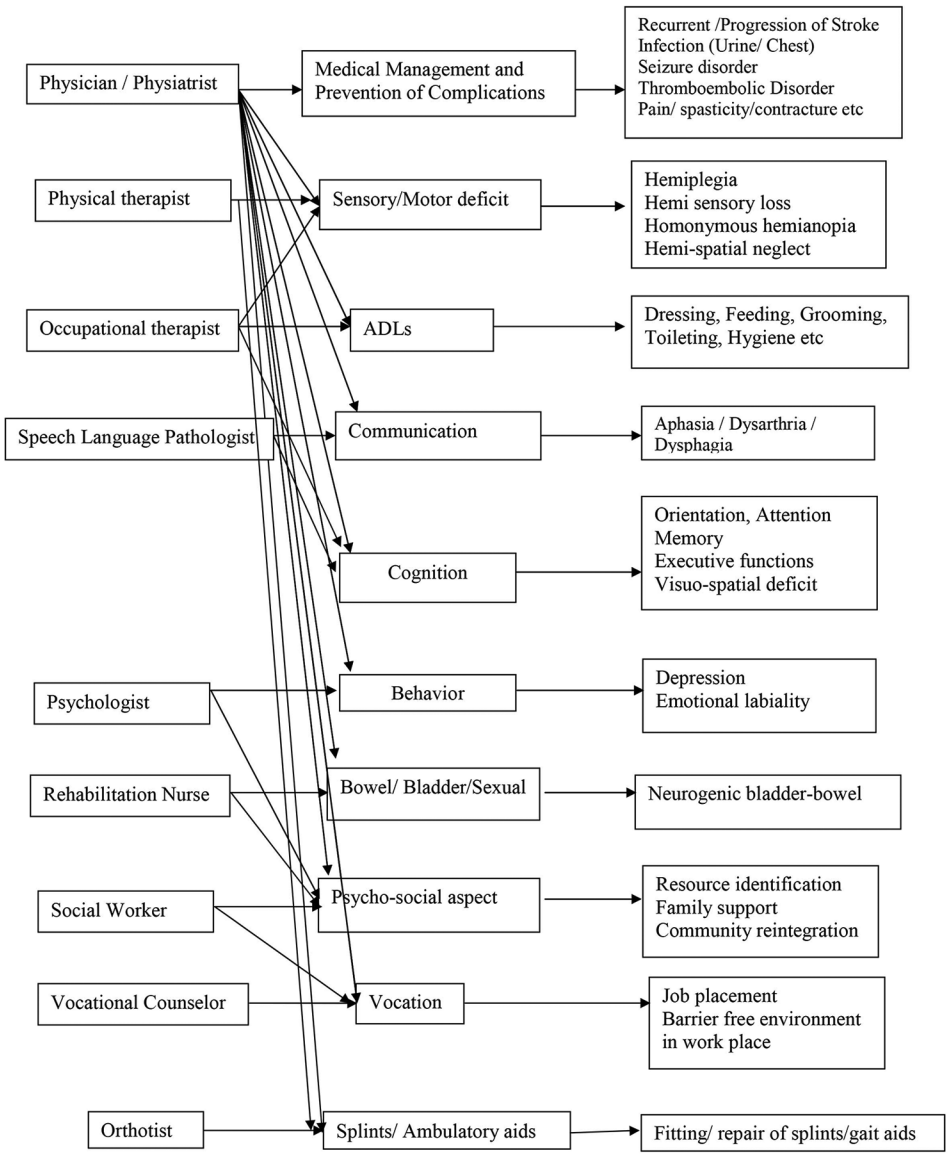

Figure 1: Role of professions in stroke rehabilitation

Table 1: Some of the standard assessment scales, used in various studies for stroke patients

Assessment	Commonly used scales
Level-of consciousness	Glasgow coma scale[13]
Deficits in stroke	National Institutes of Health Stroke Scale,[14] canadian neurological scale[15]
Global disability in stroke	Rankin scale[16]
Mental status screening	Folstein mini-mental state examination,[17] Neurobehavioral cognition status exam[18]
Assessment of functional independence	Functional independence measure,[19] Barthel index,[20] Fugl-Meyer motor assessment scale,[21] Motricity index,[22] Rivermead mobility index[23]
Balance assessment	Berg balance scale[24]
Assessment of speech and language	Boston diagnostic aphasia examination,[25] Western aphasia battery,[26] Porch index of communicative ability[27]
Assessment of depression	Beck depression inventory[28]

that stroke patients who are more functionally dependent have a greater tendency to develop more number of complications. Outcome of the stroke patients largely depend on the prevention and timely management of complications.[11] Indredavik *et al.*[32] reported that pain, progressing stroke, infections, myocardial infarction and falls are the predominant causes of complications. Literature[2,3] has mentioned that other complications such as shoulder pain, deep venous thrombosis (DVTs), pulmonary embolism (PE), stroke recurrence, seizure and pressure sores also occur very frequently after stroke.

Shoulder pain, prevalence ranges from 34%[3] to 84%[33] can develop within weeks or months after stroke.[3] Incidence of complex regional pain syndrome- type I and shoulder subluxation were found 12.5[34]-70%[3] and 50%[35] respectively. Most of the time, shoulder subluxation is associated with shoulder pain.[3] Range of motion exercises[2,3] neuromuscular electrical stimulation,[3] shoulder tapping[36] and shoulder hemisling[2,3] are effective to in reducing shoulder pain and preventing subluxation.

Kelly *et al.*[37] reported DVTs, which is very common in the paralyzed leg, can develop as early as the 2ndday, with the peak incidence between 2 and 7 days. In absence of heparin prophylaxis, the incidence of DVT is around 50% in 2 weeks.[37] Incidences of clinically apparent PE in stroke patients of 10-13%.[37] Untreated, clinically apparent DVT is associated with mortality from PE of up to 37%.[37] The incidence of post-thrombotic syndrome, characterized by persistent pain and swelling, with or without venous ulceration, approaches to 90% inpatients with untreated symptomatic DVT.[37] Unfractionated heparin and low molecular weight heparin were found to be equally effective in the prevention and treatment of venous thromboembolism.[37] Though there have been no large studies on graded elastic compression stockings[37] and intermittent pneumatic compression,[2,37] they were found to be effective in preventing DVT.

Spasticity, appears shortly after stroke, may remain in as many as 40% patients, even after 3-6 months.[3] Spasticity can be managed with anti-spastic medications along with positioning of the limbs, physical therapy, serial casting, splinting and electrical stimulation. Nerve blocks (phenol injection),[3] focal injection of botulinum toxin[3] and intrathecal baclofen[3] were found to be effective in stroke patients in reducing spasticity. Monitoring the effects of antispastic medications are very essential as reduced spasticity may decrease gait performance in those patients who have started walking with the help of certain level of spasticity. If spasticity remains untreated, increased resting and dynamic tone may lead to soft-tissue contracture.[3] Literatures[2,3] has reported that static resting splints for hand (e.g., wrist cock-up split) and ankle-foot (e.g., ankle foot orthosis) can significantly reduce tone and prevent contracture.

REHABILITATION TEAM MANAGEMENT OF SPECIFIC PROBLEMS

Mobility and ADL

Stroke rehabilitation begins as soon as the diagnosis is established and life-threatening problems are under control[2,3] Paolucci *et al.*[38] found strong inverse relationship between the starting date of therapy and functional outcome. Literature[2,3] has suggested to start passive range of motion exercises to the paretic limb at the earliest to prevent contractures. Passive mobilization must be progressed quickly to active participation by patient in the activities[2] Knecht *et al.*[11] at his review advised to take the stroke patients "out of bed!" within 2 days of achieving hemodynamic stability. Mobilization over the edge of the bed into a wheelchair, with repeated practicing of transfers, can be supplemented by wheelchair training and therapeutic standing.[11] Concurrently, patients can be encouraged to participate in self-care activities like self-feeding, dressing and grooming.[2] Duncan *et al.*[8] has reported that early mobilization reduces the risks of contracture formation, skin breakdown, DVTs, gastroesophageal regurgitation, aspiration pneumonia and orthostatic intolerance. It also has a strong positive psychological effect on the patient.[2]

Physical therapy helps in motor recovery of the stroke patients. Conventional physical therapy[5] methods consist of stretching and strengthening exercises. Neurophysiological approaches[3,5,11] (e.g., proprioceptive

neuromuscular facilitation technique, Bobath's neuro-developmental technique approach, Brunmstorm's technique and Rood's approach) stress on enhancement of the natural recovery process, facilitate recovery of motor control through different strategies. In task-specific repetitive approach,[11] the motor tasks to be learned are practiced repeatedly as many times as possible.

Studies[39,40] on role of drug, fluoxetine on motor skills have shown that early prescription of fluoxetine may enhance motor skills on the affected side in post-stroke patients with moderate to severe disability.

Functional electrical stimulation (FES), applied within 1st few weeks of stroke[8] promotes active muscle contraction, improves muscle strength, prevents disuse atrophy, reduces muscle tone and spasms and helps in motor relearning (posture, standing and walking).[41] FES can be used to deliver electrical stimulation to the ankle dorsiflexor muscles and supraspinatus and posterior deltoid muscles to correct foot drop[41] and to prevent and manage the shoulder subluxation.[5,42-44] Studies[1,45-47] on FES based orthosis have shown that it enhances walking speed and reduces number of falls and patient's effort.

Nair and Taly[5] reported that electromyographic (EMG) biofeedback can be used to improve arm and hand functions in hemiplegic patients. EMG biofeedback involves recording surface EMG from the test muscle and using auditory or visual display of the EMG signal as feedback to patient on the ongoing activity status of the muscle. Studies[48-50] have shown that virtual reality technology significantly improve the motor function of paretic upper and lower limbs. The Rehabilitation Gaming System[48] uses virtual reality technology to address the motor and cognitive deficits.

Restoration of ability of independent walking and improvement of balance-coordination are the primary goals of gait rehabilitation for patients who are unable to walk independently post-stroke.[51] Once stroke patients start ambulating in wheelchair, sitting unsupported at the edge of the bed and tolerate verticalization for at least 10 min, patients are made to stand inside the hemibar with or without an ankle foot orthosis. Nair and Taly[5] has suggested that initially during gait training, therapist can help moving the patient's paretic limb with therapist own leg. Once patient start walking around 25-50 feet length inside the hemibar, they are progressed to gait training with a walking aid (e.g., Forearm Crutch, cane with four points, walker) outside the hemibar. Once patients are comfortable in walking on even surface, they can be planned for gait training on uneven surface, ramps and stairs. Studies[52-54] have shown that partial body weight supported treadmill training results in better walking and postural abilities in some non-ambulatory hemiplegic patients and improves their walking speed and endurance.

One of the major objectives of stroke rehabilitation is to maximize the functional independence for ADLs.[2] An occupational therapist train patients in improving the ability to carry out ADL and using of various assistive devices within a contextually appropriate environment. Physical and occupation therapists try to train the patient returning arm and hand function with repetitive practice, paying special attention to strength, coordination and speed and to integrate hand function into these everyday activities.[11,55] Constrained induced movement therapy[11,56] mirror therapy,[57,58] robot-assisted exercise training[56,59] and virtual reality exercise training[60] may help to improve voluntary control of the hand. Botulinum toxin injections can be used to treat spastic flexion, with the aim of reducing muscle tone, facilitating hand care and alleviating pain.[11,61]

Communication disorder

Kelly *et al.*[62] reported in Cochrane review that around one-third of all stroke patients experience aphasia. Hoffman and Chen[63] reported, among aphasia subtypes, Broca, global, anomic and subcortical aphasias account the major subtypes. Language therapy is based on the detailed evaluation of the stroke patient's cognitive and linguistic capabilities and deficits. Speech therapists attempt to improve communicative ability by circumventing the language deficit or by helping the patients to compensate. Constraint-induced language therapy protocols[64,65] can improve functional communication in chronic aphasia after stroke. Specific techniques (e.g. computer based therapy program, augmentative and alternate communication devices)[66] improve comprehension, word or phoneme retrieval and gestures to supplement verbal communication. There is also evidence that low frequency repetitive transcranial magnetic stimulation[67] can improve language abilities in patients with chronic non-fluent aphasia.

Bakheit[68] has reported that dopamine agonists (Bromocriptine), piracetam (Nootropil), amphetamines and donepezil, may help in the treatment of aphasia in both acute and chronic stages. However, Ozeren *et al.*[69] Ashtary *et al.*[70] did not find any significant improvement with Bromocriptine. Further studies are warranted to see the efficacy of pharmacological agents in communication disorder.

Dysarthria can also occur too frequently after stroke.[71] Oral musculature exercises, biofeedback or

a voice amplifier, compensatory strategies, to change intensity and increase loudness; palatal lift to compensate for velopharyngeal incompetency, can improve dysarthria. Interventions for dyspraxia of speech include modeling, visual cueing, integral stimulation and articulatory placement cueing.[72]

Cognitive and behavioral disorder

Cognitive impairments have been reported in 74% of patients with cortical stroke and <50% in sub-cortical or infratentorial stroke.[67] Cumming *et al.*[67] reported that infarcts in the middle cerebral artery territory are more prone to develop cognitive impairment. It commonly involves attention, orientation, memory, language, executive functions, visuospatial ability. Cognitive rehabilitation can be either compensatory or restorative. Compensatory approaches involve adapting the external environment to altered cognitive abilities, where as restorative approaches aim for the compelling goal of direct restoration of function.[67]

The site and size of a brain lesion determine the severity of behavioral and psychological changes.[2] Patients with the left anterior hemisphere lesions are more likely to be depressed, whereas patients with right hemisphere lesions are more likely to be unduly cheerful. Emotional labiality is more common in patients with right hemisphere lesions. Cognitive, behavior therapy and/or antidepressants may be used for patients with anxiety disorders. Antidepressants and/or psychological interventions may be provided for patients with depression or emotional labiality.[2]

Visuo-spatial deficits

The incidence of visual deficits following stroke ranges from 20% to 68%.[73] Homonymous hemianopia[74] is very common after stroke. Schofield and Leff[74] reported that optical therapies, eye movement-therapies and visual field restitution therapies can improve the visual outcome of the stroke patients. Keane *et al.*[75] reported that Fresnel prisms adaptation to eyeglasses significantly improve vision in patients with complete hemianopia. Fresnel prisms shift images in the affected hemi visual field toward the center of the retina.[76]

Hemispatial neglect syndrome (occurs in approximately 23%) compromises functional outcome of the left hemiparesis patients.[77,78] It arises due to damage of the right inferior parietal lobule, the visuomotor component to the right dorsolateral prefrontal cortex and the object-centered component to the deep temporal lobe regions.[67] It manifests heterogeneously in clinical deficits such as poor visual exploration to the left, inaccurate assessment of the midpoint of a line, left limb hypokinesis and anosognosia.[79] Therapy is directed at retraining, with repetitive exercises or use of compensatory techniques, to teach new methods of task completion. Therapies include visual scanning, vestibular stimulation of the left side, sensory activation of the left limb, environmental adaptations and transcranial magnetic stimulation of the overactive left hemisphere.[79]

Swallowing disorder

Dysphagia, is very common after stroke, frequencies ranging from 19% to 81%,[80] is more prominent in brain stem stroke.[81] Early detection of dysphagia can reduce the incidence of pulmonary complications and even mortality.[81] The presence of dysphagia can be identified by cursory screening technique, clinical testing (e.g., cranial nerve examination and swallowing assessment with variety of modified liquids and solids) and video-fluoroscopy swallowing test.[81] McCullough and Kim[82] reported that compensatory strategies such as the Mendelsohn maneuver and voluntary prolongation of laryngeal elevation improve upper esophageal sphincter opening and bolus flow during swallowing. Consistency modification of liquid and solid foods, oromotor exercises for oral musculature, thermal-tactile stimulation,[83] electrical stimulation[83] and transcranial direct stimulation[84] facilitate safe swallow.[83] Bath *et al.*[85] reported percutaneous endoscopic gastrostomy feeding can improve the nutritional status and outcome of the severely disabled patients.

BOWEL-BLADDER DYSFUNCTION

Irregular bowel not only causes discomfort, but it can also affect a patient's physical and psychological well-being. Studies[6,86,87] have reported 31-40% of stroke patients experience bowel incontinence at the time of admission, whereas 30-60%[88] patient experience constipation after stroke. Constipation can be prevented by diet modification (adequate fluid and fiber intake), stool softeners, structured bowel training program, abdominal massage and increased mobility. Structured bowel-training program includes timely rectal suppositories and digital stimulation.

Urinary incontinence is common (ranging from 28% to 79%)[89] after stroke, with Detrusor overactivity is the most common.[89] Studies[90-92] have shown that lesions in the frontal cortex or the frontoparietal lobes and internal capsule are associated with urinary dysfunction after stroke. The incidence of incontinence depends on the time interval after the stroke. Gelber *et al.*[93] have suggested three major mechanisms responsible urinary incontinence in stroke patients: Disruption of neuro micturition pathways (overactive detrusor and urge

incontinence); stroke-related cognitive and language deficits, with normal bladder function; and concurrent neuropathy or medication use (underactive detrusor and overflow incontinence). Urinary incontinence can be managed by scheduled voiding program. The post-stroke patients should be encouraged to pass urine every 4 hourly by placing the patient on a bedside commode or taking patient to toilet. In event of failure, an external collecting device like a condom catheter for male patients may be used.

SEXUAL DYSFUNCTION

From 40% to 70% of stroke survivors may have sexual dysfunction.[3] Psychological factors (e.g., fear, anxiety, depression and discomfort) rather than organic and impairments such as sensory-motor deficits, severe spasticity and pain can cause sexual problems for stroke patients.[3] Regular counseling regarding positioning, techniques and assurance may increase the stroke patient's confidence and self-esteem.

VOCATIONAL AND PSYCHO-SOCIAL REHABILITATION

Although stroke is predominantly a disease of older individuals, a significant portion of stroke survivors are of working age. Prevalence of stroke in India has been reported 27-34/100,000 in the 35-44 age group.[1] Once ADL have been mastered, vocational counseling may assist individuals seeking to return to work.

About 34-52% of family members of stroke patients suffer from depression.[5] Spouse, family and patient's own psychological adjustment and coping mechanisms play important role in ultimate outcome of the stroke patients. Health education about disease itself, risk-factors, life-style modification and sexual counseling can help patients with stroke and their families to cope up with the disabilities.

Follow-up is an important tool, which helps the rehabilitation team to evaluate and improve the quality of services provided. Common follow-up strategies include the out-patient services, home visits. Literature[5] has reported that good family as well as financial support, higher educational levels, early initiation of rehabilitation program and expertise of the center with stroke rehabilitation can result in good outcome of the stroke patients.

CONCLUSION

Stroke patients can have a wide range of medical, physical, mental, cognitive and social problems. Hence, it is very necessary to start well-organized comprehensive rehabilitation program along with medical management. The comprehensive assessment of medical problems, impairments and disabilities, active physiological management, early mobilization, skilled nursing care and tightly organized rehabilitation schedule can significantly improve thequality-of-life of stoke patients. An overview of this multidisciplinary team model attempts to describe comprehensive rehabilitation program as a treatment standard for patients with multiple disabilities following post-stroke. Further experimental and clinical studies are required to expand our knowledge and improve the efficacy of rehabilitation.

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