Activation of ankle dorsiflexors by backward walking in stroke: A case report

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Abstract:

The aim of this study was to give balance and gait training to the patient. This patient along with sensory impairment, coordination impairment and balance problem, had problem in the activation of ankle dorsiflexors. Stroke rehabilitation was given to the patient including PNF, sensory re-education, motor re-education, frenkels exercises, balance and gait training. Backward walking was included in the gait training of the patient. It has been observed that ankle dorsiflexors activation increased with backward walking.

Introduction:

Stroke is the second major cause of mortality throughout the world mainly in the developing countries[1]. Stroke is a neurological deficit which can be of gradual or sudden onset based on the type of stroke whether hemorrhagic or ischemic results in hindrance to the brain tissues[2] [3]. Consequently most of the stroke cases have difficulty to live independently [4]. Stroke can be genetic or it can be due to any cardiac anomalies like atrial fibrillation, aneurysm and other factors such as diabetes and hypertension [2].

Stroke results in various impairments related to cognition, perception, vision, sensory system, motor system, language and coordination[5][6][7]. Stroke rehabilitation mainly focuses on the improvement of upper limb functions and in restoring various gait related activities. Initially for three months stroke patients complaints of difficulty in walking. Most of the patients get recovery within one year but 5-9% cases are not able to recover from gait impairments [8].

Postural instability in the stroke patients leads to difficulty in standing[9][10]. Balance related impairments causes shift in COG to the unaffected side results in asymmetry in the posture[11][7][12]. Stroke cases require multidisciplinary approaches like patients with nutritional deficits, skin prone to pressure sores, bed mobility impairments, impairments related to bowel and bladder, these cases require more nursing supervision. Stroke cases with various medical combormidities, pain management problems and patients with acute illness require regular supervision of physicians. Multiple physiotherapy interventions are needed in case of communication, cognitive, sensory, motor, balance and coordination deficits. Out of 100, 10 cases of stroke have history of fall in acute phase after hospital discharge. Further fear related to fall leads to deconditioning due to decline in physical activity. Post stroke cases also suffer from depression, anxiety problems, osteoporosis, visual impairments like visual processing, visual acuity reduction, diplopia and dysphagia[13][14].

There are various approaches used in the rehabilitation of stroke such as bobath, PNF, mental imagery, mirror therapy and virtual reality training[7][15]. Although these techniques results in improved gait and balance in the patients, more techniques such as body weight supported treadmill training, various electromechanical

devices like hybrid assistive limb and cognitive motor interference are also useful in improving balance and gait in stroke patients[16][17]. Resistance training improves lower limb strength, quality of life and gait[13][14]. Exercises with high intensity are not much beneficial to improve quality of life, activities of daily living and various motor functions in case of stroke patients[18]. Mobilizations that are very early in stroke are the reasons for worse results[19]. Evidences shows effect of various approaches and techniques in stroke patients which also varies patient to patient.

Case Description:

A 55 years old male with the complaint of weakness of lower limb, difficulty in prolonged standing and inability to take more than 4-5 steps without loosing balance came to the LPU O.P.D. patient was apparently well 4 months ago then suddenly one day in the morning around 4 am while taking bath he started feeling chest pain, heaviness of head and within few minutes he became unconscious and fell on the ground.

Then he was taken to the local hospital from where he got referred to the multispecialty hospital of that area only. He was diagnosed with haemarrhagic stroke and took medical treatment from the same hospital for one month. Then he got discharged and started taking physiotherapy treatment that was only for 25 days. After that he was able to do activities of daily living related to upper limb but felt difficulty in prolonged standing and walking; now he came to the LPU OPD for the treatment of the same problem.

Patient had the history of hypertension from last 10 years and he was on regular medication. He was non alcoholic and retired government teacher by occupation. His sleep cycle was disturbed as he was not able to sleep properly. On observation built was ectomorphic, therapist did not find any synergy pattern in the patient and facial expression was normal. Short term memory was intact but long term memory was impaired. It was found during examination that his sustained attention was intact but he had problem in selective attention. Speech was normal in the patient and he was oriented to person, place and time.

Patient was assessed for body scheme and image disorders including anosognosia, somatognosia and right-left discrimination, therapist did not find any of this perceptual disorder in this patient. Cranial nerve v,vii,ix,x and xii were intact as others cranial nerves assessed in the patient. Sensory examination according to the area distribution pattern indicated that bilateral upper limb superficial and deep sensations were intact but was decreased in right lower limb as compared to the left side. Muscle tone was 2+ for upper limb muscles according to common clinical rating scale. For lower limb grade are as follows:

MUSCLES	RIGHT	LEFT
ANKLE PLANTARFLEXORS	2+	2+
ANKLE DORSIFLEXORS	2+	2+
KNEE FLEXORS	2+	2+
KNEE EXTENSORS	2+	2+
HIP FLEXORS	2+	2+
HIP EXTENSORS	2+	2+
HIP ABDUCTORS	2+	2+

Voluntary motor control grading indicate grade 6 for both upper limb and lower limb. Daniels and worthingham grading shows grade 4 for upper limb muscle in the patient on left side and 4- for right side. Manual muscle testing for lower limb are as follows:

MUSCLES	RIGHT	LEFT
TRUNK FLEXORS	3	***
TRUNK EXTENSORS	3+	***
HIP FLEXORS	3+	4
HIP EXTENSORS	3	4-
HIP ABDUCTORS	3	4
KNEE EXTENSORS	3	4
KNEE FLEXORS	3	4
ANKLE PLANTARFLEXORS	3+	4
ANKLE DORSIFLEXORS	3	4

According to Wexler grading, grade was 2+ for biceps jerk bilaterally, for knee jerk left side and 1+ for right side knee jerk. Ankle jerk was having value of 2+ bilaterally according to this grading system. Equilibrium testing was done to assess the coordination for lower limb and it was found that patient had grade 3 that is the moderate impairment of coordination. Dynamic functional balance scale depicts grade fair after assessing balance with this grading system. While assessing the gait it was found that patient was mainly having the problem to raise foot to neutral in swing phase. Again at the end of swing phase and terminal stance phase he was having more difficulty. After all the assessment of the patient he was diagnosed with right hemiplegia with anterior cerebral artery involvement.

Functional electrical stimulation was given to the patient of quadriceps, gluteus maximus and hamstring muscles. Then to strengthen the lower limb muscle further five strengthening exercises of one set were given to the patient for glutei, quadriceps, hamstring, abdominal and ankle dorsiflexors with minimal resistance.

This treatment was followed for one week then frenkels exerciser were given for lower limb with above treatment in which two exercises were given in sitting position and three exercises in standing position based on the principles of concentration, precision and repetition. In addition to it balance training for dynamic balance was given to the patient including reaching activities in standing, while sitting on therapeutic ball and standing while catching the ball. This protocol was followed for one month.

Then after one month with above protocol gait training was added in the treatment protocol for the patient that was started with one leg standing with the emphasis on right leg with the help of parallel bar, weight shifting while standing in parallel bar and weight shifting forward and backward with approximation stretch and resistance through the pelvis given by the therapist. Then training on steps was given with the support of therapist. Emphasis was given on backward walking as it was found that it was helping the patient in the activation of ankle dorsiflexors. Treatment was given for two months with the progression of these exercises and then post assessment was taken for the balance and gait.

RESULT

At the end of 13 weeks of treatment manual muscle testing, coordination, balance and gait assessment was taken in the patient again and in the showed improvement in the patient as lower limb grades for manual muscles testing became 4, coordination was normal and functional balance scale showed grade good in the patient.

DISCUSSION

Increase in the stroke incidences in middle and low income areas from 1970-1979 to 2000-2008 including India. Evidences are lacking in relation to prevalence of stroke. It is the major health related issue worldwide from past two decades. Main reasons are related to high blood pressure, increased cholesterol level, lack of physical activity, obesity and tobacco[20].In this patient recovery was good within shorter period of time as compared to other neurological patients. Muscle tone was normal in this patient but main problem was the muscle strength. Lower limb was more affected as compared to upper limb and in lower limb right side was more involved. Sensations were also decreased in the lower limb and it was more in right side as compare to left side.

These factors contributed in coordination, balance and gait impairments. After PNF, sensory re-education and balance training emphasis was given on gait training in which main problem was with ankle dorsiflexors activation. Evidences supported the fact that dorsiflexors activation is the major problem in the stroke patients[13]. Ankle dorsiflexors play vital role in raising foot to neutral in swing phase and then switch to eccentric work to lower forefoot to floor after heel strike. It has been noticed that backward walking was very beneficial in the activation of ankle dorsiflexors.

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