ISSN NO. 2320–7418 DOI: 10.22270/jmpas.V10I4.1276

International open access journal

Journal of Medical Pharmaceutical and Allied Sciences

Journal homepage: www.jmpas.com

Case report

Impact of locomotor training in improving function after stroke

Divya Badjate, Ragini Dadgal*, Suchitra Menon, Om C. Wadhokar

Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India.

ABSTRACT

Stroke is among the world's leading causes of death, disability and functional inability for adults. The incidence of stroke currently exceeds that of Western developed nations in India. Increased understanding of the risk factors for stroke is hoped to lessen the future prevalence**.** Recurrence rates of stroke are high. The incidence and ability of individuals to recover varies widely. Stroke affects health by affecting the functioning system resulting in disabilities, physical problems, and a lower quality of life. Physiotherapy is instrumental to restore lost sensations and motor skills and to deal with patient's emotional needs. This case report describes a case of A 66 year old male retired PWD worker, who was referred to physiotherapy with complaints of weakness in left upper and lower extremities and inability to perform movements of left side. He had a sudden loss of power in the left side one day prior and was diagnosed with stroke along straightening of the dorso-lumbar spine and disc bulges at C2-C6, L4-S1 levels on X-ray and MRI scan. Physiotherapy rehabilitation was started with bed mobility and transfer activities with further progress to sitting and standing activity. As the transfers improved, we progressed to balance training, lower limb strengthening, and gait training in which task specific training was focused. Later, we concluded that balance and locomotor training has a great impact on functional recovery post-stroke.

Keywords: Stroke, Locomotor Training, Function, Physiotherapy, Case Report.

Received - 07/07/2021, Reviewed - 19/07/2021, Revised/ Accepted- 04/08/2021

Correspondence: Ragini Dadgal* ✉ ragini.neuropt@dmimsu.edu.in

Assistant Professor, Department of Neuro Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India

INTRODUCTION

Stroke is among the world's leading causes of death ,disability and functional inability for adults [1].Ischemic stroke is normally caused by an atherothrombotic process which can block or narrow the vessel [2]. Hypertension, hypercholesterolemia, diabetes mellitus, smoking, obesity and other cardiovascular atherogenic diseases are the major modifiable red zones for stroke [3]. The incidence of stroke currently exceeds that of Western developed nations in India[4].The incidence of life-long stroke is 1 in 5 for women and 1 in 6 for men after 55 years [4]. In developed countries, more than four-fifth of all strokes occur[4]. Increased understanding of the risk factors for stroke is hoped to lessen the future prevalence [5].

The neurological manifestations of the stroke depend on site of brain lesion and the level of infarction [2]. Recurrence rates of stroke are high [2].It influences a patient`s potential to carry out activities of daily living [6]. The static and dynamic balance are strongly influenced, with more risk of falls [7].In a stroke, one side of the body, including the upper limb, trunk, and lower limb, is paralysed or weak, causing disturbances in the trunk muscles [8].Cerebral stroke causes a major decline in the functioning of the patient and a deterioration in the quality of life of the patient [9].The incidence and ability of individuals to recover varies widely. Stroke affects health significantly by affecting the functioning system resulting in disabilities, physical problems, and a lower quality of life [10].The recovery objectives are to optimize the functioning and quality of life of the individual after a stroke and the degree of independence [11].Stroke recovery physiotherapy is instrumental to restore lost sensations and motor skills and to deal with patient`s emotional needs.

Patient Information

A 66 year old male retired PWD worker was referred to physiotherapy with the complaints of weakness in left upper and lower extremities and inability to perform movements of left side. He had a sudden loss of power in the left side one day prior and was diagnosed with stroke along straightening of the dorso-lumbar spine and disc bulges at C2-C6, L4-S1 levels on X-ray and MRI scan. He was not advised hospitalization, but physiotherapy with medications was recommended. He has a history of hypertension since 10 years. He has been smoking, chewing tobacco, *Kharra* and supari since last 40 years.

Patient was conscious, oriented to time, place and person with speech, language, cognition and memory preserved. Some attention deficits were noted in patient. On observation, his limbs were hypotonic with no synergy and foot drop was present with no muscle wasting of the limb, no edema. The deep and cortical sensations on the left side were diminished with hypotonia and decreased active range of motions of joints of the left side. The left ankle jerk response is diminished with positive Babinski sign. He has a significant bladder and bowel involvement, impaired coordination on both sides and FIM score 48/126 (Grade 2- Complete dependence).

Table 1. Sensations

	Rt UL	Lt UL	Rt LL	Lt LL
Superficial				
Pain	Normal	Normal	Normal	Normal
Temperature	Normal	Normal	Normal	Normal
Pressure	Normal	Normal	Normal	Normal
Deep				
Movement sense	Normal	Normal	Normal	Diminished
Position sense	Normal	Normal	Normal	Diminished
Cortical				
Tactile localization	Normal	Normal	Normal	Diminished
Tactile discrimination	Normal	Normal	Normal	Diminished
Stereognosis	Normal	Normal	Normal	Diminished

Table 2. Muscle tone

The tone in right side is normal. The tone in left side is decreased

Joints	Right	Left
Shoulder joint	2+	1+
Elbow joint	2+	1+
Wrist joint and fingers	2+	1+
Hip joint	2+	1+
Knee joint	2+	1+
Ankle joint and foot	2+	1+

Table 3. Reflex Testing

Reflex	Right	Left
Biceps jerk	++ Normal	++ Normal
Triceps jerk	++ Normal	++ Normal
Supinator jerk	++ Normal	++ Normal
Knee jerk	++ Normal	++ Normal
Ankle jerk	++ Normal	+ Diminished
Babinski sign, Chaddocks sign	Negative	Positive

Table 4. Co-ordination Tests: Non-equilibrium tests

Coordination Tests	Grade: Right	Grade: Left
Finger to nose	3	3
Finger to therapist`s finger	4	3
Mass grasp	5	2
Pronation-supination	5	3
Pointing and past pointing	2	2

Equilibrium Tests: Grade 1 (activity impossible)

Berg Balance Scale: Score (at admission) –0/56

Table 5. Joint Range of Motions

	Right Active	Right Passive	Left Active	Left Passive
Shoulder flexion	170°	180°	80°	160°
Shoulder extension	60°	60°	0°	50°
Shoulder abduction	170°	170°	0°	170°
Shoulder adduction	30°	30°	0°	30°
Shoulder internal rotation	70°	70°	0°	70°
Shoulder external rotation	90°	90°	0°	90°
Elbow flexion	145°	160°	30°	160°
Elbow extension	0°	0°	0°	0°
Wrist flexion	80°	90°	20°	90°
Wrist extension	70°	90°	0°	90°
Hip flexion	120°	125°	0°	125°
Hip extension	20°	30°	0°	30°
Knee flexion	130°	145°	0°	145°
Knee extension	10°	10°	0°	10°
Ankle dorsiflexion	20°	25°	0°	25°
Ankle plantarflexion	40°	40°	0°	40°

Table 6. Timeline

Year of previous episode of CVA	2016
Date of CVA	04/01/2021
Date of visiting AVBRH	04/01/2021
Date of Investigations and imaging	04/01/2021
Physiotherapy rehab started on	05/01/2021

Diagnosis

MRI Brain**:** Acute infarcts in the right high frontal region and centrum semiovale. Chronic infarct in the right parasagittal occipital region**.** Chronic lacunar infarct bilateral corona radiata and ganglio capsular regions**.** Tiny chronic infarcts in midbrain and pons. Age related atrophic changes with chronic white matter ischemia

MRI spine**:** Straightening of the dorso-lumbar spine with posterior disc bulges at C2-C6, L4-L5, L5-S1 disc levels**.** Schmorl`s node seen in the lower endplate of L3 vertebra**.** Modic endplate changes in the lower endplate**.** Hemangioma in the body of L5 vertebra. Multiple anterior osteophytes throughout the visualized spine.

Figure 1. X-ray Hip joint

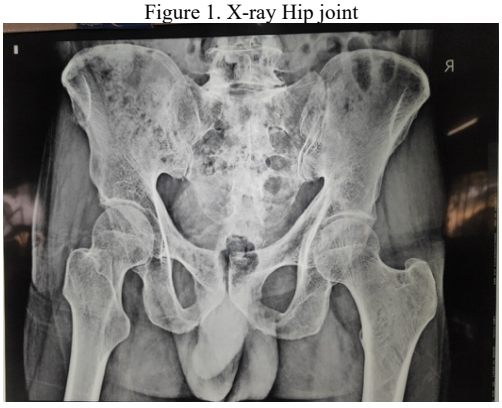


Figure 2. X-ray L-spine

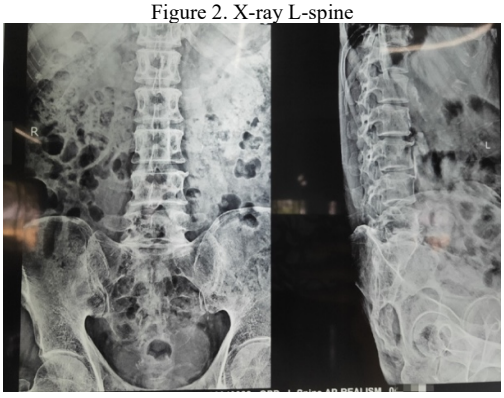
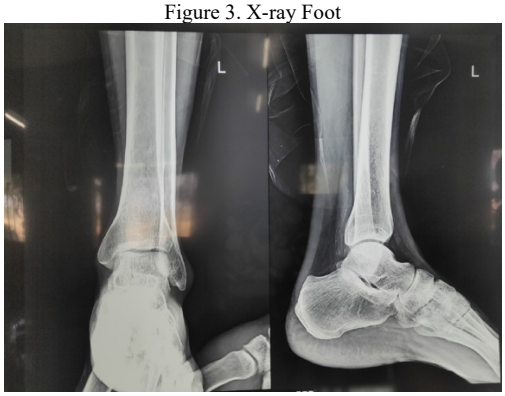


Figure 3. X-ray Foot



Therapeutic interventions

Stage 1 (0-4 weeks)

Initial stage of management was focused on bed mobility activities, transfer activities which further progressed to sitting and then standing activity. As soon as we noticed the patient was acquiring independent control, we progressed from guided to active movements. The following Bed Mobility tasks were part of the functional training.

Rolling to both sides was been practiced, To improve the movement, limb movement patterns (e.g., PNF D1 flexion of the LE) were used.

- The patient was taught to practise rising from supine to sit with both sides leading, with a focus on rising with the more involved side leading (closest to the edge of bed or mat).The therapist assisted the patient from side-lying on the more affected side by moving the LEs over the edge of the bed or mat, while the patient lifted himself up into a sitting position using both UEs for support. It's also a good idea to practise controlled lowering.
- Trunk and hip extensor control were also improved through bridging activities, which helped the patient in a few of his toileting activities like using bedpan .Also pressure relief on the buttocks , as well as sit-to-stand transfers and initial bed mobility (scooting) could be done.
- Once the patient could come to sitting position with minimal assistance, we focused on activities in sitting, so that he achieves a balanced stance with correct spine and aligned pelvis.
- Pelvic alignment and mobility (pelvic rotation) and proper trunk alignment can also be promoted by training on a therapeutic ball (gentle bouncing).The following is how the sitting control tasks advanced:

  -First, maintaining a steady stance (stability)

  -Changing positions in the posture (dynamic stability), and

  -finally, dynamic hardships (reaching).
- Transfers from sitting to standing were trained with an emphasis on symmetrical weight-bearing and synchronized muscular responses, and appropriate time period was given so that the patient could practice each task completely.
- We noticed that initially patient required maximum assistance for the transfer activities during early transfers, the patient may require maximal assistance. Hence proper care and assistance was provided manually by the therapist for the same. The patient was trained to transfer to both sides, with a focus on the side that was most affected.

Stage 2

As the transfers improved slowly we focussed on balance training lso lower limb strengthening activities.

The activities were as follows:

- Base of support: sitting, LEs uncrossed to crossed; standing position, wide to narrow to tandem; standing on one LE (beginning with less affected, progression to more affected LE).
- Support surface: lying on a mat to sit on a therapeutic ball; sitting on the floor to stand on thick foam;
- Sensory inputs: open eyes (EO) to closed eyes (EC); LE rested on a firm or foam surface.
- UE movements: Single UE raises to bilateral UE raises (symmetrical, asymmetrical); reaching movements with emphasis to the more affected side; picking objects off table, stool, and floor.
- LE movements: Single LE support, stepping (forward backward, side; step-ups); marching in place; foot on ball, moving ball.
- Trunk movements: Head and trunk rotational movements; looking up at ceiling or down to floor.
- Dynamic functional activities: Sit-to-stand, sit-down, turning, floor-to-standing, lunges
- Walking activities: Forward, backward, sideward, crossed step.
- Dual-tasking: Standing while catching or kicking a ball; standing while talking; standing while holding a tray with a glass of water.

The patient was basically trained for the gait through LE training exercises. This included breaking up the synergy pattern.

Bridging, supine hip extension with knee flexion involves behaviours that can be used to facilitate knee flexion with hip extension.

Pushing down over the side of the mat, pushing through.

The unilateral heel rises.

Stage 3

Here we focussed on gait training

Here we focused on performing a number of tasks and enhancing the level of endurance for walking. Significant preparatory therapies were done for the same such as proper stretching, especially calf muscle stretching exercises, and LE strengthening exercises were continued in order to achieve maximum strength [12].

Task specific training was focussed. Walking forward: By integrating hip and knee extension with hip abduction, the emphasis was on getting out of synergy. Backward walking: Emphasis was on getting out of synergy by pairing knee flexors with hip extensors. Side stepping: Aim is on moving out of synergy by combining hip abductors with hip and knee extensors. Crossed Stepping: The PNF braiding operation. It blends cross-stepping and side-stepping. Hence this was also been practiced.

Follow up and outcomes-

Functional Independence Measure Score:

At 0 - 4 weeks – 75/126

At 4-8 weeks – 95/126

Berg Balance Rating Scale Score:

At 0 – 4 weeks – 12/56

At 4 – 8 weeks - 28/56

DISCUSSION

Good outcome of rehabilitation appears to be strongly linked to high patient satisfaction, motivation and participation. An individual's specific rehabilitation goals may vary [13]. The main aim of stroke recovery is to enhance posture control, motor function, and patient self-perception and understanding of the danger of falls, thereby enhancing the patient's ability to act safe dynamically [14].The patient should receive rehabilitation with the aim of achieving safeguard, independence, and movement efficiency. Therapeutic approaches have been shown to be successful in minimizing complications and improving patient outcomes [15]. When clients' mobility is evaluated early on, the strengths and needs of each client can be easily recognized, and effective strategies and education for clients and their families can be implemented.

Hemiplegic gait is a blend of deviations and compensatory movements determined by residual functions after a stroke. Balancing, neurophysiological, and motor learning interventions are all used in gait recovery following a stroke.

Competing interests

The authors declare no competing interest.

Authors' contributions

All authors contributed equally.

Declaration of patient consent

The authors certify that appropriate consent forms were obtained from the patient for preparing the case report.

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How to cite this article

Divya B, Ragini D, Suchitra M, Om C. W, 2021. "Impact of locomotor training in Improving function after stroke". Jour. of Med. P'ceutical & Allied Sci. V 10 - I 4, 1276 P-3417-3420. doi: 10.22270/jmpas.V10I4.1276