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# Effectiveness of cognitive behavior therapy and goal-oriented physiotherapy intervention to improve cognitive and motor function in a patient with a sub-acute stroke – A case report

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**ABSTRACT**

A stroke is defined as the sudden loss of neurological function caused by the reduction of flow of blood to the brain. This is a leading cause of long-term disabilities. There are two classifications of stroke i.e., ischemic and hemorrhagic strokes. Ischemic stroke is common. A wide range of abnormalities occurs, including alterations in consciousness, sensory, motor, cognitive, and language problems. Physical therapy plays a vital role in treatment. It majorly works on sensory and motor components. Here, is a case of a 40-year-old male, who is a lawyer by profession, who suffered with a stroke. Underwent durotomy and craniotomy and further was referred for physiotherapy rehabilitation. The patient had a loss of power on the right side and unclear speech. Physiotherapy was initiated with training the bed mobility exercises, followed by sitting training, then standing progressing to gait training.

**Keywords:** Hemiplegia, cognitive behavior therapy, goal-oriented physiotherapy

**1. INTRODUCTION**

Stroke is one of the most common factors leading to death and disability. It requires a quick action plan of treatment to avoid adverse outcomes (Mugge et al., 2019). A stroke can be defined as the sudden loss of neurological function caused by the disruption in the blood flow to the brain. Ischemic stroke occurs most commonly and results in clot blocks or impairs blood flow. The incidences of disabilities include- hemiparesis and hemiplegia, which are

the most common symptoms, inability to walk without assistance, increased dependence for every activity, inability to speak, and psychological manifestations (Mugge et al., 2019). Stroke patients tend to stop or avoid using the paralyzed side of the body, which leads to further restrictions in daily functional activities. A decompressive craniotomy is performed in these patients to reduce the increased intracranial pressure and is usually combined with durotomy (Burger et al., 2009).

The emergency radiologist needs to be aware of expected neuroimaging findings in post-craniotomy and craniectomy patients to avoid erroneous results (Chughtai et al., 2019). The incidence of individuals recovering varies widely. Stroke affects health drastically by affecting the functioning system resulting in disabilities, physical problems, and a poor quality of life. The recovery goals are to improve the individual's functioning after a stroke, as well as their level of independence (Wu et al., 2001). The motive of this case study was to describe the case of sub-acute stroke in young adults, to plan interventional strategies, and describe the outcome measures.

## 2. PATIENT AND OBSERVATION

### Patient Information

A 41-year-old male, who is a lawyer by occupation, was apparently alright 4 months ago when he suddenly had a fall from bed at midnight and felt severe weakness in the right side of the body along with aphasia and an episode of vomiting. He was immediately taken to Sewagram hospital, where he was given medications and sent back home. He did not feel any relief in the next 24 hours also and was unable to speak, hence, the relatives took him to another hospital in Nagpur, where he was advised MRI, and after other few investigations, he was diagnosed with a left Middle Cerebral Artery Infarct on 09.09.2021 and therefore was admitted for further management. The patient was operated on for left fronto-temporoparietal decompression craniotomy with durotomy on 09.09.2021. He was managed over on antibiotics, antacids, antiepileptics, analgesics, antihypertensives, anticoagulants, and multivitamins. Later, on 12.11.2021 he underwent cranioplasty. The patient also had a history of MI, 18 years ago, but medications were not continued. No other history of any medications. The patient has been chewing tobacco for, 15 years. The patient was advised for physiotherapy for further rehabilitation, so he visited AVBRH for physiotherapy rehabilitation.

## 3. CLINICAL FINDINGS

The patient was conscious, well oriented to date, and place with speech affected. On observation, the patient's limbs were hypotonic with no synergy, and foot drop was present with no muscle wasting, and no edema. Deep and cortical sensations and active movements of the right side were reduced with hypotonia. The right ankle jerk is also diminished.

### On Examination

Sensations – all sensations were intact

Reflexes – the deep tendon reflexes on the right side were diminished and were normal. The reflex examination is shown in table 1.

Range of motion (ROM) – no active ROM of the right extremities; the tone on the left side is normal, and the tone on the right was decreased on examination. Table 2 shows the hand functions of the hemiparetic side.

**Table 1** Reflexes

Reflex	Right (pre-treatment)	Left (pre-treatment)	Right (post-treatment)	Left (post-treatment)
Bicep's jerk	+	++	+++	++
Triceps jerk	+	++	+++	++
Supinator jerk	+	++	+++	++
Knee jerk	+	++	+++	++
Ankle jerk	+	++	+++	++

**Table 2** Hand functions

Grasp-Spherical	No
Cylindrical	No
Hook	No

Grip –	
Pulp to pulp	No
Tip to tip	No
Lateral prehension	No

**Timeline**

The patient had a Stroke on 8<sup>th</sup> September 2021, after the medical management, the craniotomy and durotomy were done on the next day, followed by cranioplasty in November. Physiotherapy started after the vitals became stable and continued till January 2022.

**Diagnostic Assessment**

*MRI Brain*

Large area of restricted diffusion seen in left MCA territory showing a hypointense signal on ADC map suggestive of the acute non-hemorrhagic infarct. The rest of cerebral grey and white matter shows normal signal intensity on both T1 and T2 weighted scans. In left carotid vessels, complete stenosis of the distal portion of the M1 segment of left MCA. Intracranially, the internal carotid bifurcation is seen normally with good visualization of the anterior cerebral artery.

*CT SCAN Brain*

Large cortico-medullary hypodensity in left fronto-temporal-parietal region s/o acute infarction in the MCA area on the left; Mass effect was seen as effacement of left lateral ventricle with midline shift to right by 8 to 9mm.

*Radiology*

The x-ray of the Right Shoulder Joint showed subluxation of the right glenohumeral joint.

**Problem list**

The subluxated shoulder was the primary problem, followed by the decreased function of the upper limb and lower limb on the right/hemiplegic side post left MCA stroke.

**Goals**

- Mr. X will be able to do bed mobility by the end of 4 weeks.
- My patient will perform rolling and sitting over the side of the bed by the end of 6 weeks.
- My patient will initiate independent movement of the upper limb and lower limb by the end of 6 weeks
- Mr. X will be maintaining trunk balance while sitting and standing for 5 secs without falling in 8 weeks.
- Mr. X will do minor calculations without any mistakes in 8 weeks (cognitive training).

**Therapeutic Interventions**

*Week 1-4*

The physiotherapy rehabilitation was immediately started after the patient was operated on and discharged from the hospital. He visited the neuro-rehab on daily basis for rehabilitation. In the initial stage of rehabilitation, the major focus was on activities of bed mobility, transfers, and trunk control. Bed mobility tasks are necessary for initiating functional activities. Bilateral and unilateral pelvic bridging was initiated (Figure 1). The patient was taught rolling from lying to side-lying on both affected and non-affected sides. Segmental rolling was taught.

Once the patient was able to perform rolling, he was further taught to practice rising from supine to side-lying to sitting on both, affected and non-affected sides by moving the lower limb on edge of the plinth while lifting the upper body with help of non-affected upper extremity. Pelvic bridging exercises were also initiated to improve trunk control which helped the patient easily perform his basic daily living activities. Along with these, the patient was taught deep breathing exercises like pursed-lip breathing exercises to increase oxygen uptake and reduce exercise intolerance. Balloon blowing activity was also to improve the strength of respiratory muscles. Initially, the right extremities were in the complete flaccid stage. To improve the muscle tone, facilitatory techniques were started. It included facilitatory techniques of rood’s approach like quick icing, tapping, and joint approximation. This helped in improving the tone of the muscle and initiating movements.

At the beginning of the treatment, due to flaccidity, PROM exercises for all the joints of the right upper and lower limbs were started. Ankle-toe movements were initiated to avoid complications. Active movements for the unaffected limbs were taught.



**Figure 1** Week 2 of rehabilitation

*Week 4-6*

As we noticed the patient was able to control the trunk in a sitting position, weight shifts were added to the protocol. Scooting was also taught to patients at this stage. Transfers from sitting to standing were emphasized during this period. The patient required assistance during transfer so assistance was given manually by the therapist. The patient was taught to transfer on both sides. Exercises such as trunk rotations bilaterally in sitting were initiated first. As the patient was able to maintain balance in standing, trunk rotation was also taught in standing. To increase the power of muscles, strengthening exercises were given by adding resistance. Initially, manual resistance was given by adding weight cuffs of 0.5 kg on the affected side and 1.5 kg on the non-affected side with 5 repetitions with 3 sets. On the parallel bar, dynamic activities like forwarding lunges, standing on one foot, reach-outs exercises, and tandem standing. Stepping up and down on stepper to retrain functions, sensory inputs with eyes open and eyes closed.

**Walking activities**

Forward and backward walking and walking sideways with support; A dual-task like standing with reach-out activities, standing with talking with visual feedback from the mirror.

*Week 6-8*

*Cognition training*

The patient in his initial stage had echolalia, which was eventually decreased. Patient was asked to focus on the memories from his past, including his profession and lifestyle. The remedial approach was used. The patient was made to repeat a few familiar words during the therapy and even was instructed to practice the same at home. Compensatory approach- The patient was shown various charts of familiar words every day, use of wall calendar to assist the patient in remembering his daily routine activities.

*Gait training*

As the strength of the lower extremity improved, gait training was the area of focus. Preparatory exercises such as calf and hamstring stretches were given. The patient was asked to perform lunges for the same (Figure 2). Lower limb strengthening exercises continued with more weight-bearing to improve the endurance of muscles while walking. Forward walking was started as the goal was to break the synergy pattern. Backward walking helped in breaking the synergy pattern by pairing knee flexors with hip extensors. Sideways walking helped in breaking synergy by combining hip abductors and knee extensors. Proprioceptive neuromuscular facilitation patterns were also practiced to improve the strength and endurance of the muscles of the lower limb.



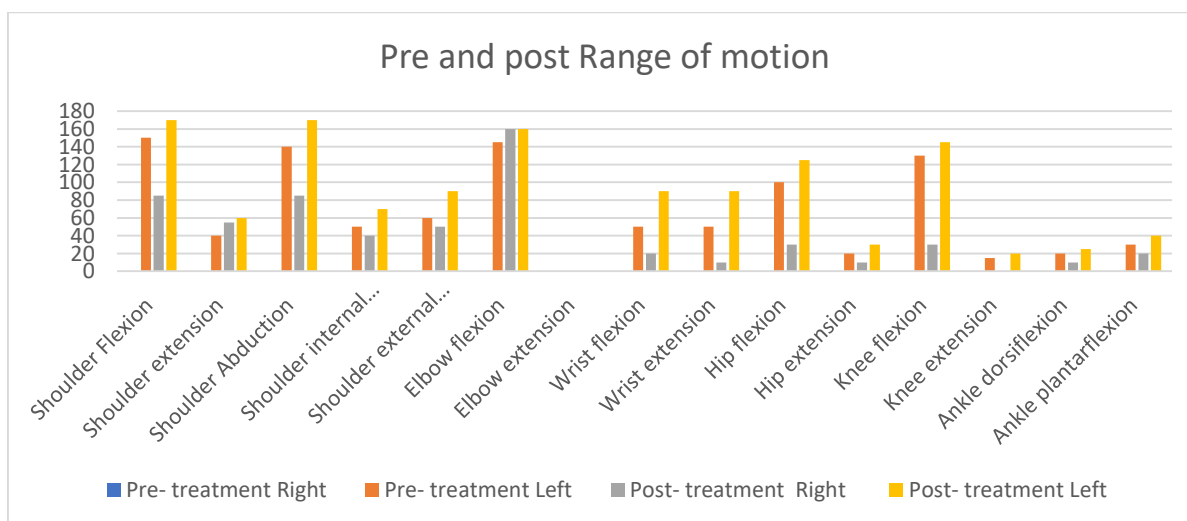
**Figure 2** Week 8 of rehabilitation

*Home program*

The patient and care givers were given assurance about the patient’s improving condition. A home exercise program was taught to the patient and his family members/caregivers. It included stretching of calf muscles, hamstrings, adductor stretching, pelvic bridging withhold, dynamic quadriceps, sit-to-stand activity on the chair without back support, and stair climbing for activation of muscles.

**Follow-up and outcome of interventions**

After giving the treatment for consecutive 8 weeks, there was a noticeable improvement in the patient’s condition. The improvement in ROM is depicted in Graph 1. There was an improvement in the balance. On the bergs balance scale, in week 1 the score was 20/56 and in week 8 the score was improved to 37/56. The voluntary control grading score increased, which in week 1 was 1, in week 4 it was 2 and in week 8 it was 4. The Functional Independent Measure scale score was improved from 75/126 to 110/126. Patient Perspective: Patient and his caregivers are very happy with therapy and willing to take further sessions. He is very passionate to return to work. Informed Consent was taken from the patient himself.



**Graph 1** Pre and Post-treatment Range of motion



## 4. DISCUSSION

Acute Ischemic strokes are caused by a barrier in blood flow that irrigates the brain, usually as a result of atherosclerotic changes that promote cerebral coagulation and emboli. The diagnosis is based mostly on the clinical presentation and CT/MRI scan of the brain, and care is targeted at cerebral restenosis based on the patient's illness (Chughtai et al., 2019). Good outcome of rehabilitation appears to be linked to high patient satisfaction, motivation, and participation. The lesion damages the lateral neocortex but spares the primary motor cortex, posing the question of where skillful movement limitations come from (Dadgal, 2021). Patients who underwent stroke have a high chance of facing cognitive problems. Speech is the most affected component in such patients regardless of their age. Cognitive behavior therapy is tailored to individuals. It is tailored based on interaction with the patient and requires active participation from the patient (Liu et al., 2018).

According to research, combining motor rehabilitation along with cognitive behavior helps in improving memory and speech problems. This integrated into daily therapy routines in the rehabilitation set up and major improvement was noticed in the patients (Schuster et al., 2012). The use of cognitive-behavioral interventions for the remediation of motor impairments is gaining scientific attention as it help to increase motor control in patients. According to these interventions within a variety of populations of healthy, chronically ill, the approach helps to enhance the fitness and activity level of patients (Camillieri, 2019). The goal-setting was important as it focuses on both, motivation to improve physically as well as work on speech and memory. Such training helps in improving and identifying obstacles for everyday skills that can be relearned in the rehabilitation setup (Naqvi and Sahu, 2020).

Early physiotherapy interventions were started in this case to help them recover faster so the patient can go back to his daily activities and occupational work. In many studies, it is mentioned that starting with early physiotherapy rehabilitation causes fastens the prognosis ultimately giving better results. Breathing exercises like deep breathing exercises were given to improve the oxygen uptake and decrease exercise intolerance (Blazek et al., 2019). As this happens, it leads to better patient cooperation and better recovery. In addition to passive and active movements, bed mobility activities, functional reeducation training, trunk balancing exercises, and balancing exercises, as well as cognition improving therapy, proprioceptive neuromuscular facilitation and constrained induced movement therapy were added to the exercise prescription (Beyaert et al., 2015). This eventually helped in achieving and enhancing postural control, motor function, and prevents further complications that patient may face, improving the overall quality of life. The typical hemiplegic gait is also improved gradually by following this exercise routine on an everyday basis. Task-oriented activities for both motor and cognition helped the patient with the quality of life (Brunelli et al., 2019).

## 5. CONCLUSION

We conclude that such a complicated case of MCA infarct with hemiplegia needs a team approach for complete recovery. Physiotherapy plays an equally important role as the medical and the surgery does. The physiotherapy management includes patient education, educating the relative about avoiding secondary complications, maintaining joint range of motion & strengthening the muscles of the affected lower limb and upper limb. This program showed improvement in inpatient.

### **Author's contribution**

All the authors conceptualized and took the case; authors designed the methodology and treatment protocol and documented the case. All wrote the manuscript. All the authors reviewed and approved the case report before submission.

### **Informed Consent**

The patient was first informed about the study followed by obtaining oral informed consent.

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### **Conflicts of interest**

The authors declare that there are no conflicts of interests.

### **Data and materials availability**

All data associated with this study are present in the paper.

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