



## Comprehensive physical therapy improves functional recovery in a rare case of stroke associated with asthma: A case report

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### General Note

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### ABSTRACT

**Background:** Globally, according to the WHO, cerebrovascular (stroke) injuries are the second largest cause of death and the third largest cause of disability. Sudden loss of any neurological feature due to disruption to the blood flow is called stroke. Most of the stroke patients develop permanent disability. Chronic inflammation in asthma patients due to their growing pathophysiology of

inflammation and immune dysfunction may influence the pathogenesis of cardiovascular disorders. In line with this, some studies have indicated a high risk of cardiovascular disorders in asthma, including myocardial infarction, angina, heart failure, and stroke. During vigorous activity, if there is no enough supply of oxygen to the brain it can lead to acute stroke with features of hemiparesis, aphasia, loss of balance and coordination, spasticity, etc. There is increased risk of stroke when associated with asthma. *Clinical findings:* The patient was unable to maintain balance, weakness in the right upper and lower limb, pain in shoulder joint, and restrictions in daily activities. *Diagnosis:* The features involved are according to the area of involvement in the brain. In this case, there is infarction of left corona radiata and lentiform nucleus. After medical interventions, a well-structured 9 weeks physical therapy treatment was initiated. *Conclusion:* This case report offers a crucial function for physical therapy in a patient's extensive rehabilitation that helped her with through strength and range of motion, coordination and improvements in routine everyday living activities, in pain relief over the shoulder joint.

**Keywords:** Asthma, Stroke, Spasticity, Chest Physiotherapy, Hemiplegic gait, Rehabilitation.

## 1. INTRODUCTION

According to the WHO, Globally, cerebrovascular (stroke) injuries are the second leading cause of death and the third leading cause of disability (Johnson et al., 2016). Stroke is the sudden loss of neurological function, a stroke occurs when a blood flow disruption occurs to the brain (Kim et al., 2019). Asthma is an airway condition with a cluster of associated symptoms of reducing reversible expiratory airflow and hyper-responsiveness to the airways. Asthma affects as many as 5-10 percent of the general population. Asthma is known to cause allergic inflammation in the airways. Asthma is associated with a significantly increased risk of stroke (Ernst, 1990). However, it has been proposed that several pathophysiological pathways associate with asthma. Middle cerebellar artery stroke tends to present sudden onset of focal neurological deficit which results from brain infarction or ischemia in the region supplied by the MCA. The largest cerebellar artery is MCA which is most commonly affected by cerebrovascular accident. Knowing these neurologic lacking and their correlation to the specific MCA region has been discussed for a quiet long time in research articles. Motor defects in upper and lower extremities following stroke and damage to the motor cortex is commonly noted. Hemiparesis, Paralysis, weakness, abnormal muscle tone, spasm, abnormal posture, abnormal function of synergic muscles, and loss of inter-joint coordination are the most common injuries due to damage to the motor cortex. The limb of the affected side is kept in extensor synergy. Approximately 60% of stroke survivors experience upper extremity dysfunction limiting participation in functional activity. Chronic deficit is especially prevalent in the hand. Motor function is lightly to impaired. Preventing effective occupational performance and independent participation in daily life is due to loss of hand function. The goal of physiotherapy rehabilitation include improvements in balance, initiate self-care assessment and promote functional mobility (Sullivan, 2007). In this case report, we present a female patient who suffered a stroke and underwent medical treatment followed by a comprehensive well-structured physiotherapy rehabilitation that led to improving the functional goals progressively which is a major aspect in leading to a successful recovery in such stroke patients.

## 2. PATIENT INFORMATION

A 56-year-old female, left-hand dominance, housewife by occupation visited the physiotherapy OPD on a wheelchair with her husband presenting with the complaints of spastic hemiparesis. She experienced difficulty in performing ADLs, difficulty in maintaining balance. She was suffering from Asthma for 40 years and had a history of hypertension from 25 years. MRI brain was done which reveals acute infarct in left corona radiata and lentiform nucleus. Necessary medical management was done at AVBRH hospital, sawangi, meghe, Wardha which comprised medication as follows Inj. Mannitol 300ml, T. Ecosprin 75mg, Strocit, Emeset, and Grilinctus. After a gross medical recovery patient was discharged and subsequently referred to physiotherapy rehabilitation.

To the physiotherapy department, the patient visited complaining of maintaining balance, weakness in the right upper and lower limb for 2 months. At assessment spasticity brought her affected arm rested in flexion posture and she was unable to flex or extend the fingers and unable to grasp a pen and write letters. Moreover, the paralyzed right lower extremity prevented her from standing up and walking, our patient was a not able to walk and occasionally required caregiver assistance for transfers.

### Timeline

Date of CVA	03-01-2020
Date of Hospital Admission	03-01-2020

Date of Discharge	18-01-2020
Date of Physiotherapy rehab initiated	20-01-2020
Date of final assessment	24-03-2020

### 3. CLINICAL FINDINGS

Arm motor function and gait were evaluated pre-treatment. Modified Ashworth Scale: (shoulder flexion, elbow flexion/extension, forearm supination/pronation, wrist dorsal extension /palmar flexion) (Table 1). During higher function evaluation GCS found to be Eye-opening: 4, Verbal response: 5, Motor response: 6, she was well oriented, conscious and cooperative to time, place, person, self, and answerable to all our questions. Vision was good, no slurring of speech, hearing intact, no short term and long-term memory loss. Cranial nerve examination was done, cranial nerves from 1 to 12 were examined, and all nerves were intact. Sensory examination superficial, deep, and cortical sensation were examined all the senses were intact. Reflexes elicited are deep tendon reflexes which are tabulated in Table 1.

Table 1 Deep Tendon Reflexes		
RIGHT	REFLEX	LEFT
Normal	Biceps	2+
Normal	Triceps	2+
Normal	Supinator	2+
Normal	Knee	2+
Normal	Ankle	2+

*Coordination:* Non-equilibrium tests were performed which is tabulated in Table 2. Equilibrium test could not be performed.

*Hand Function Assessment:* Hand function were assessed for grasp and grip, the following findings were obtained which are tabulated in Table 3. Shoulder evaluation was done by using the special tests, the sulcus sign test was performed the test was positive with a grade of 2 (1-2 cm inferior translation).

Table 2 Non-equilibrium test		
RIGHT	NON EQUILIBRIUM	LEFT
Poor	Finger to nose	Good
Poor	Finger to finger	Good
Fair	Heel to shin	Good
Poor	Pronation supination	Good

Table 3 Hand Function Assessment		
Grasp	a) spherical	No
	b) cylindrical	No
	c) hook	No
Grip	a) pulp to pulp	No
	b) tip to tip	No
	c) three jaw chuck	No
	d) lateral prehension	No

Posture was assessed and on evaluation forward head posture was appreciated. Postural control in sitting was moderately independent (Figure 1, 2). Walking is an independent, automatic, symmetrical, and economical event.

*Gait analysis with maximum support:* In the swing phase, the pelvis was tilted upward on the involved side with hip circumduction. There was inadequate knee flexion, uncontrolled swing. In the stance phase, the first contact was on the toes, thus the heel strike was the missing component in the hemiplegic limb.

*Berg balance scale:* All the components included in this scale were dynamic components. It has a score of 56 points which for this case is described under diagnostic methods for pre and post physiotherapy intervention. Pretreatment score was 28 (i.e. moderate risk of fall).



**Figure 1** Posture assessment (Anterior View)



**Figure 2** Posture assessment (Lateral View)

### Diagnostic methods

For the diagnosis of problems associated with the patient's day to day life including the activities of daily living and motor function, motor assessment scale was used. Basic mobility activities were assessed using FIM, which further helped to design the rehabilitation program and achieve the functional goals. Motor assessment scale -Pretreatment score was 20, FIM- pretreatment score was 78, Berg balance scale- pretreatment score was 28(moderate risk of fall).

### Diagnostic challenges

Patient's lack of education and ignorance of the condition about prognosis was a challenge for each session to council and make her understand the necessity of rehabilitation. The major challenge was the patient was not able to come to the OPD regularly due to travel time and arrangements.

### Therapeutic Intervention

The patient was managed through a multidisciplinary approach, which included the team of doctors, nurses, physiotherapists, and occupational therapists to achieve a good prognosis. The patient underwent physiotherapy sessions for the duration of 9 weeks, 6 days a week. Physiotherapy intervention was planned on the basis of functional goals, the primary aim being the prevention of further complications, and improvement of quality of life of the patient. Then the physiotherapy session was started after the patient's discharge. We took the patient's follow-up regularly.

### Phase 1 (0-3 week)

The respiratory physiotherapy management for this patient was designed based on a study which should evidence for the treatment techniques being effective to improve the patient's concerns with asthma (Jeon Hyeong Lee et al., 2009). Deep breathing exercises, Chest expansion techniques, and spirometer exercises were started to keep the airway clear. Passive movements comprised of the right ankle, knee, hip and shoulder, elbow, wrist. Active ankle toe movement were advised for the left lower limb to prevent deep vein thrombosis, and strengthening for left upper and lower extremity with 1kg weight cuff to improve the strength and improve its participations in transfers. Motor learning exercises which showed significant improvements over conventional physiotherapy was incorporated in the program (Chan et al., 2016). Scapular mobilization was initiated for painful right shoulder; the major cause of painful stiff shoulder. Right hip, shoulder active assisted movements, were performed in gravity eliminated position.

Peripheral neuromuscular and motor learning program facilitation was performed to facilitate movements of limb. Stretching was given to hamstrings, ten-do Achilles, wrist flexors, pronators with 10 repetitions for 10 sec. Bed mobility techniques of rolling from supine to side-lying and from side-lying to bedside sitting then to standing was also initiated to release spasticity and to facilitate movement in trunk and limbs. Transfer techniques and sitting on a chair with moderate to minimum assistance was taught to the patient and caregivers. In sitting, lifting one leg at a time to weight transfer through the arm behind and to sideways to

another leg to stimulate balance reaction. Reach outs sideways and forward to control the trunk were carried out to improve the sitting balance.

Technique with moderate assistance namely sit to stand exercise of affected leg on the ground with the foot in dorsiflexion, while standing, stand with normal base of support for 2min and marching was performed to improve standing balance. Each exercise was carried out for a minimum of 15 repetitions and gradually was increased based on tolerance. Electrical Muscle Stimulation (EMS) was introduced (Mackenzie-Knapp, 1999), surged faradic stimulation, 30 contractions for 3 sets, for deltoid, triceps, wrist extensors, flexors was given. The shoulder brace orthotics was given to prevent injury to shoulder joint and to prevent further subluxation. As the patient had asthma, the deep breathing exercise was performed to improve vital capacity, along with this patient performed pursed-lip breathing and diaphragmatic breathing each for 10 repetitions 3 sets and it was continued for 0-3 weeks.

### Phase 2 (4-6 week)

Above all exercises were continued to perform. In phase 2, the gait training was initiated more aggressively, the patient walked in a parallel bar in front of a mirror as a feedback to reduce the tendency to walk with a wide base of support, step up was performed for 20 repetitions to prepare the patient for stance phase. Stair climbing with support of railing and physiotherapist was initiated where the level of assistance was moderate. With the initiation of shoulder active assisted exercises there was a decrease in the shoulder pain and helped to focus on improving the range of motion in the available pain-free range. The patient started to initiate a movement of elbow flexion. In 4-6 weeks along with deep breathing exercises, and expiratory muscle training exercise was also continued and all the exercises were recommended for home programs with minimum assistance of the caregivers.

### Phase 3 (7-9 week)

Walking was improved and with increased step speed forward-backward, and sideways. After the patient had achieved all the prerequisites to maintain balance, the exercise program was made more challenging with respect to speed, intensity, and repetitions. All exercises were performed with not less than 25 repetitions. Physiotherapy in this phase was focused on increasing challenges to improve fine motor activities and targeted movement for functional training which would indeed help the patient for minimal to no assistance in activities of daily living. Targeted activities such as lift up the object and keep on a stable surface to an unstable surface were carried out. Activities that required more time for completion were advised to practice more often to improve the duration required for these tasks. All the exercises were advised as a part of a home program which would indeed improve the patient's tolerance to the exercise program.

## 4. RESULTS

Significant improvement was observed in her motor skill after the physiotherapeutic intervention of 9 weeks she was able to walk and can climb stairs with minimal assistance. The patient was assessed on day 1 of physiotherapy intervention, during phase two (MAS, VCG) and the last day of the 9<sup>th</sup> week of intervention (table 4 & 5).

Spasticity – spasticity changes were grade 2 on day 1, and grade 3 in the 9<sup>th</sup> week of intervention.

Reflex – reflex was 2+ on day 1 and 1+ in the 9<sup>th</sup> week of intervention.

Motor assessment scale - Pretreatment score was 20 and after 9 weeks of rehabilitation score was 30.

FIM- pretreatment score was 78 and after 9 weeks score was 98.

Berg balance scale- pretreatment score was 28 (moderate risk of fall) and after 9 weeks score was 36 (mild risk of fall).

Muscles	0-3 weeks	4-6 weeks	7-9 weeks
Shoulder flexors	0	2	1
Shoulder extensors	0	2	1
Shoulder abductors	0	2	1
Shoulder medial rotators	0	2	1
Shoulder lateral rotators	0	2	1
Elbow flexors	0	2	1
Wrist flexors	0	2	1

Muscle group	0-3 weeks	4-6 weeks	7-9 weeks
Upper limb	2	2	3
Lower limb	3	3	4

### Limitations

As the patient was a known case of asthma, she was not able to perform vigorous exercise for sustainable duration. Shoulder subluxation following stroke was a major challenge during the rehabilitation which was prevented for further damage by the use of shoulder brace orthotics. The treatment session which was being planned for her was not continued for a longer duration due to fatigue and hence frequent breaks were taken. This treatment protocol is specific and varies among patients with different baseline assessments and patient concerns oriented.

## 5. DISCUSSION

Stroke till today forms the most factors for life-limiting to the patient and causing a major setback in the recovery of the disability (Holloway Robert et al., 2014). Asthma a causative factor in stroke is rare and has shown evidence with it being the significant risk factor for stroke in women (Low Ronald et al., 2006; Onufrak et al., 2008). A systemic review and meta-analysis provides strong evidence that asthma is a significant risk factor for stroke. Given the high prevalence and incidence of asthma and stroke in the general population (Wen et al., 2016). In this case report based on the evaluation of patient's concerns, a structured physiotherapy rehabilitation was carried out comprising respiratory and muscle-strengthening exercises, motor learning, electrotherapy, functional training. The chest physiotherapy, passive movements, rolling, stretching and electrical stimulation began on the first day of physiotherapy, and electrical faradic stimulation was initiated to improve the shoulder stabilization to reduce subluxation. In a study by Chiang et al. the scapular stabilization exercises seemed to be effective in improving the shoulder function in chronic stroke patients, in this case, report incorporation of electrotherapy along with the scapular stabilization exercises proved to be effective in improving the shoulder stability and function (Song, 2013). On the improvements noted during the rehabilitation during the phases, the treatment program was made more challenging and with difficult tasks, further major exercises such as walking, stair climbing, and marching; were incorporated with minimal assistance to improve gait and posture. Jeon et al. in their study documented similar improvements in gait and balance stability in chronic stroke patients with the treatment approach of stair training (Lee and Seo, 2014). Vigorous activity was avoided because the patient is hypertensive and has a history of asthma. Activities were performed with frequent and timed halts, and in the meantime, the patient was asked to perform relaxed deep breathing exercises. This modification in the program led to enhanced patient involvement in the rehabilitation and allowed the patient to sustain the exercise duration. It is important to consider certain variables that can lead to the outcome. Electrical stimulation in early stroke rehabilitation of the upper limb shows that the electrical stimulation may influence motor performance (Merilym Mackenzie-Knapp, 1999). Hopefully, the important improvements in the arm function described here will encourage controlled studies to evaluate the early implementation of electrical stimulation in management, especially those that initially display inattention, shoulder subluxation, and non-use. In our case, comprehensive therapeutic interventions aided in successful improvements in patient's functional outcomes pain, range of motion, muscle strength, balance, gait, activities of daily living illustrating the need to target the specific limitations and importance of physical therapy in stroke patients to recover from their activity limitation which would help for further studies involving more subjects and other types of stroke.

## 6. CONCLUSION

This case report provides a vital role of physical therapy for a comprehensive recovery of a patient that helped her in pain relief over shoulder joint with increasing strength and range of motion, balance, and improvements in basic activities of daily living. Physiotherapy in such stroke patients with asthma being associated helps to improve their vital functions which are a major aspect to be targeted posts CVA.

### Abbreviation

WHO- World Health Organization  
 CVA- Cerebrovascular Accident  
 EMS- Electrical Muscle Stimulation  
 MCA – Middle Cerebellar Artery

OPD- Out Patient Department  
MAS- Modified Ashworth Scale  
FIM- Functional Independent Measure scale  
ADLs – Activity of Daily Living

### Conflict of interest

The authors declare that they have no conflict of interest.

### Informed Consent

Written and Oral informed consent was obtained from the participant included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

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### Author's contribution

All author made best contribution for the concept, assessment and evaluation, data acquisition and analysis and interpretation of the data.

### Data and materials availability

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

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