Case Report

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Overcoming Barriers: Telerehabilitation for Subacute Stroke in an Elderly Woman with Low Economic Status

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Abstract

Background: Stroke is one of the main causes of long-term disability. Getting proper and consistent rehabilitation in the golden time of stroke recovery phase plays a vital role in optimizing functional outcomes. However, people with low socioeconomic backgrounds often meet obstacles to get the proper rehabilitation, including financial restrictions, accommodation problems, and geographic isolation. Telerehabilitation breaks down those barriers by providing remote access to rehabilitation programs.

Objective: To assess the impact of telerehabilitation on older women with subacute stroke facing socioeconomic barriers.

Case: An elderly woman suffered from subacute hemorrhagic stroke with dominant-side hemiplegia, sensory and cognitive impairment. Due to economic and rural living limitations, telerehabilitation was conducted through home-based caregiver-assisted exercises and provided with simple tools for six weeks. The programs included standing and walking exercises, as well as sensory and self-care activity training. Improvement in muscle power, trunk control, mobility, and self-care function were observed after 6-week telerehabilitation.

Conclusion: The outcome improvement in this case study showed that telerehabilitation could be effectively applied to patients facing financial and geographic challenges, thus providing access to appropriate rehabilitation programs.

Keywords: Socioeconomic barriers, stroke recovery, telerehabilitation

Introduction

Stroke is the primary cause of functional impairment in many developed nations, with only about 60% of patients achieving independence in activities of daily living (ADL), while approximately 40% of patients are unable to regain independence.[1] The severity of post-stroke issues varies based on the location and extent of brain injury, often encompassing speech difficulties, cognitive impairments, motor deficits, and a reduced ability to perform daily activities. Efficient and proper rehabilitation is important for optimizing recovery, reducing impairment, and regaining functional ability particularly during the acute and subacute phase of stroke.[2,3]

Stroke rehabilitation needs interdisciplinary strategies to restore functional ability. Not everyone has the same access to the proper rehabilitation treatments, and socioeconomic factors have a major influence on the level and quality of care they get. People from lower socioeconomic backgrounds often have a hard time getting rehabilitation services due to financial problems, unintegrated healthcare system that also limit the rehabilitation care and lack of information about the available rehabilitation options.[4]

Telerehabilitation could help close the gap in stroke recovery care for people from low-income backgrounds. This technology makes rehabilitation easier and cheaper by allowing people to attend therapy sessions from anywhere, which means they don't have to travel.[4,5] This strategy is very helpful for older stroke survivors who had trouble getting around in low-income areas. There is a lot of potential, but to make it work effectively, some issues such as digital literacy, internet access and the cost of technology need to be addressed. This case study illustrated the beneficial effects of telerehabilitation and home-based rehabilitation programs on functional recovery in stroke patients facing economic challenges.

Case

A case of a 63-year-old woman, an illiterate homemaker with limited educational and economic resources was presented with right hemiparesis and hemihypesthesia. The patient received a diagnosis of hemorrhagic stroke affecting the left thalamus and intraventricular region four weeks before the physical medicine and rehabilitation (PMR) clinic appointment (Fig. 1). Hypertension was a concomitant condition currently under control. During the first assessment in the clinic, the patient was frail and sarcopenic, exhibiting a clinical frailty score of 7 (indicative of severe frailty) and a SARC-F of 18. The reports included right-sided weakness, difficulty in moving the right leg, and the ability to slide the leg, bend the knee, and barely move toes and ankle. The patients can elevate the body from a supine to a seated position using the left hand and sustain an upright sitting posture unaided. However, this patient reported incapability in standing and walking, mostly conducting all activities in bed due to the absence of a wheelchair for mobility assistance. Fatigue was also experienced when the patient transitioned from lying to sitting or remained seated for more than three minutes, and there was fear of falling when attempting to stand.

The patient is right-handed and experiences difficulties doing self-care chores with the right hand due to weakness. Forward elevation of the right arm to chest level is possible, with gradual flexion and extension of the elbow, opening of the palm, and grasping of objects with the right hand. However, persistent

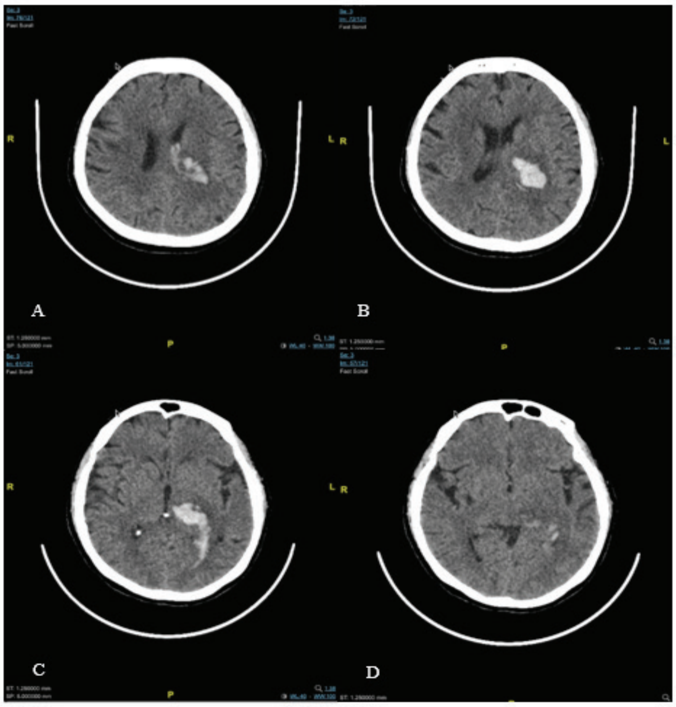

Fig. 1 A-D: Brain CT Scan (without contrast). Left Thalamic Hemorrhage with Perifocal Edema and Intraventricular Extension to The Left Lateral Ventricle, Plus Chronic Right Corona Radiata Infarct and Cerebral Atrophy

Table 1 Sensory Function

Function	Items	Result (After)	Result (Before)
Tactile, touch	Pin prick	Impaired (decreased 50%)/normal	Impaired (decreased 50%)/normal
	Light touch	Impaired (decreased 50%)/normal	Impaired (decreased 50%)/normal
Proprioception	Kinesthesia	Impaired/good	Impaired/good
	Joint position sense	Impaired/good	Impaired/good
Temperature		Impaired/good	Impaired/good
Nottingham sensory assessment	Tactile sensation	1 for light touch, pressure and pinprick (Identifies the test sensation, but not on all three occasions in each region of the body or feels duller) and 0 for temperature and tactile location (Fails to identify the test sensation on three occasions)	1 for light touch, pressure and pinprick (Identifies the test sensation, but not on all three occasions in each region of the body or feels duller) and 0 for temperature and tactile location (Fails to identify the test sensation on three occasions)
	Kinesthetic sensation	1 (appreciation of movement taking place)	1 (appreciation of movement taking place)
	Stereognosis	0 (unable to identify the object in any manner)	0 (unable to identify the object in any manner)

deficits in tactile perception and stereognosis were observed, as shown in Table 1. The patient also struggled to accurately position the hand at the intended location. The patient's assessment showed a Modified Ashworth Scale (MAS) score of 1, inadequate postural control and static balance while standing, and manual muscle testing (MMT) scores are summarized in Table 2.

A decline in cognitive function was experienced following stroke, particularly in memory and processing speed, as reported by the children. This study used the mini-mental state examination (MMSE) as a fundamental instrument to evaluate cognitive function due to alliteration. The MMSE score showed severe cognitive impairment and the Barthel index assessment for ADL had a baseline score of 50/100. This result categorized the patient as having a moderate dependency.

Fig. 2 **Home Program Exercises Supervised and Monitored with Telerehabilitation. A: Wooden Block Hand Exercise; B: Self-Care Exercise Using Affected Hand; C: Standing Exercise Using Walker; D: Walking Exercise Using Walker 6 Weeks After Telerehabilitation**

Table 2 Involuntary Movement Reaction Functions

AssessmentTool	Items	Result (Before)	Result (After)
Postural control	Vision	No glasses	No glasses
	Sensory proprioception	Poor/normal	Poor/normal
	Vestibular	Good	Good
Post-stroke postural assessment	Sitting without support	Can sit 5 min without support	Can sit 5 min without support
	Standing with support	Can stand with strong support of 2 people	Can stand with moderate support of 1 person
	Standing without support	Can not stand	Can not stand
	Standing on non-paretic leg	Can not stand	Can stand for few seconds
	Standing on the paretic leg	Can not stand	Can not stand
	Maintaining posture subtotal	4/15	10/15
	Supine to paretic side lateral	2/3*	2/3*
	Supine to non-paretic side lateral	0/3*	1/3*
	Supine to sitting up on the edge of the mat	1/3*	2/3*
	Sitting on the edge of mat to supine	2/3*	3/3*
	Sitting to standing up	0/3*	1/3*
	Standing up to sitting down	1/3*	2/3*
	Standing, picking up a pencil from the floor	0/3*	0/3*
	Changing posture subtotal	6/21	11/21
Functional balance in standing		Impaired	Impaired
General physical endurance	Standing for 1 minute	Borg Scale 14/0/0	Borg scale: 14/0/0

*Post-stroke postural assessment score[6] (3) : Can perform without help; (2) : Can perform with little help; (1) : Can perform with much help; (0) : Can not perform

The patient could not participate in a hospital-based rehabilitation program due to the proximity of the residence to the hospital and the restricted transportation resources, attributable to poor socioeconomic status. Therefore, telerehabilitation program was provided for the patient at home with caregiver assistance three times weekly, as shown in Table 3. A text reminder and phone call were used to remind the caregiver for every home exercise session. Following each session, the caregiver sends us a video and photo report detailing the patient's exercise session that are shown in Fig. 2. Additionally, assistive devices and therapeutic aids were provided, including a walker, a transfer belt to facilitate caregiver assistance with standing and walking, and a set of wooden blocks for hand function exercises. Following 6 weeks of the telerehabilitation program, the patient returned to the hospital for evaluation. Functional outcomes were assessed using the same measures applied during the initial assessment. The patient demonstrated measurable improvements in lower limb strength, as assessed by MMT, and in postural control, with detailed outcomes presented in Tables 2 and 4. Regarding upper limb motor function, there was an enhancement in the ability to control movements for fundamental

Table 3 Home-Based Exercise Program

Type of Exercise	Description	Dosage
Supervised Standing and Sit-to-Stand	Transition from sitting to standing under supervision using a stable chair to improve lower limb strength and postural control. Avoid compensatory movements.	3 sets x 8–12 reps, 2x/day
Tactile Sensitization	Sensory stimulation of the right-hand using textures (brush, soft/rough cloth, rubber ball) with eyes closed to enhance tactile perception.	10 minutes/session, 2x/day
Self-Care Activity (Right Hand)	Independent practice of daily tasks with the right hand: - Eating (grasping utensils), - Dressing (buttoning), - Hygiene (brushing teeth).	15–20 minutes/session, every day, 2-3x/day

self-care ADL, such as independent feeding and hair combing with the right hand, despite no increase in MMT score. The cognitive function showed no significant enhancement, and there was a drop in the MMSE score.

Discussion

The thalamus is a part of the brain that connects to many other parts and is important for sensory processing and cognitive function. This structure is also in charge of consciousness and helps send not only sensory but also motor signals. Hemorrhage in the thalamus can cause motor paralysis and sensory loss, making it hard for the patient to do even a basic ADL.[7–9] The patient experienced difficulties in performing ADL independently due to thalamic hemorrhage, leading to limited mobilization from right hemiparesis and hemihypesthesia. A case report by Kelly *et al*. shows a patient with bilateral thalamic stroke

Table 4 Muscle Power Function

Joint	Movement	Result (Before)		Result (After)	
		Right	Left	Right	Left
Shoulder	Flexion	3	5	3	5
	Abduction	3	5	3	5
Elbow	Flexion	3	5	4	5
	Extension	3	5	4	5
Wrist	Flexion	4	5	4	5
	Extension	4	5	4	5
Finger	Flexion	4	5	4	5
	Extension	4	5	4	5
Hip	Flexion	3	5	3	5
	Extension	2	5	3	5
	Abduction	2	5	3	5
	Adduction	2	5	2	5
Knee	Extension	3	5	4	5
	Flexion	3	5	4	5
Ankle	Dorsiflexion	3	5	4	5
	Plantarflexion	3	5	4	5

leading to severe somatosensory and visual impairments, and causing imbalance and the inability to stand.[10] The enhanced postural control shows partial motor recovery, though static balance deficits persisted. The patient was provided with exercises to enhance tolerance for unsupported sitting, augment postural awareness, and refine the perception of midline.

A scoping review by Jharbadee *et al*. found that mobility is a crucial function of the lower extremities, contributing to postural control and the execution of tasks.[11] Activities that involve posture are important for making the muscles in the lower limbs contract and keeping balance and stability.[12] After a stroke, the upper limb's impaired sensory function disturbs normal motor network feedback, which makes it more difficult to control movement, especially manipulation movement of hand such as reaching, gripping, and force regulation. Consequently, enhanced sensory function is crucial for motor skill acquisition. Despite tactile sensitization exercises, stereognosis remained absent, and light touch/pinprick sensation only improved marginally, showing persistent sensory deficits.[12,13] Based on this result, there is a need to incorporate sensory re-education alongside motor training, such as task-oriented exercises. These exercises are recognized for enhancing hand function following stroke via goal-directed practice with repetition.[13,14] A regimen was designed for the patient that included particular hand function exercises, such as manipulating wooden blocks, task-oriented activities using the right hand for self-care, and a basic sensory re-education exercise for recognizing textures and objects with her right hand. After four weeks of home-based telerehabilitation, patient showed enhancement in right hand function.

The prognosis for ambulation has various contributory elements that may impede rehabilitation. Hiraoka *et al*. investigated the determinants of independent ambulation in patients with thalamic hemorrhage and the result showed that walking outcomes could be anticipated based on cognitive impairment and the severity of the thalamic hemorrhage, including the presence of ventricular bleeding and hematoma volume. Persistent cognitive impairment, as shown by low MMSE score, significantly contributed to the inability to achieve independent ambulation. Patients with low MMSE scores often require assistance in clinical settings due to difficulties adapting to environmental demands, thereby increasing the risk of falls.[9] Patient also has severe frailty and sarcopenia which exacerbate the functional limitations of the patient, restricting bed-to-chair mobility despite improved lower limb strength post-telerehabilitation.

The patient made a lot of progress in her recovery because the rehabilitation program started during critical period of stroke recovery phase, which is most prominent within the first 3–6 months after stroke and potentially extending beyond 12 months.[3] Rehabilitation program was initiated within 60 days following the onset of the stroke, attributable to elevated neuroplasticity activity during this interval. Therefore, the improvements of functional recovery may result from the combined contribution of natural recovery and the telerehabilitation program. Economic, distance and accommodation limitations prevent patients from obtaining essential rehabilitation at the clinical setting which may squander the chance for prompt optimal functional recovery.[15] Consequently, telerehabilitation was implemented as part of the rehabilitation program. Exercises that could be easily performed at home by both the patient and caregiver were prescribed. Patient from low economic household often resides in an inaccessible home environment for mobility training and also having difficulty to own a proper mobility aid, which shows that resources need to be allocated in low-income areas. Telerehabilitation was acknowledged for improving functional outcomes in stroke patients, demonstrating comparable efficacy and potential cost-effectiveness relative to clinic-based rehabilitation. This was because the number of hours worked by physical therapists decreased and transportation costs were eliminated. These savings were important for people living in remote or low-income areas who had trouble getting to services. Telerehabilitation is a long-term solution for making rehabilitation more accessible without hurting patients' functional recovery because it is both cost-effective and clinically effective.[16,17]

Although this report shows some useful perspectives about the gain of functional recovery potential through telerehabilitation in low-income settings, there are some limiting factors that should be considered when analyzing the findings and outcomes. First, the particular mix of severe frailty, sarcopenia, and cognitive impairment of the patients caused difficulty in separating the effects of telerehabilitation intervention from other elements affecting recovery. Second, sensory outcomes were assessed subjectively, while motor gains were observed, the absence of objective neurophysiological testing (e.g., quantitative sensory testing or somatosensory evoked potentials) makes it impossible to firmly estimate the benefits of sensory re-education. Third, reliance on the caregiver's reports and photographic/video documentation introduces reporting bias and variability in exercise quality, despite the efficient application of telerehabilitation through caregiver-assisted workouts and remote monitoring. Finally, even when the motor performance improved, no formal cognitive therapy was included despite recorded cognitive deficiencies that most certainly affected ambulation potential and learning capacity. This draws attention to a gap in meeting the whole range of recovery demands in patients with complicated post-stroke disabilities.

The combination of a home-based and caregiver-assisted telerehabilitation with simple aids led to significant improvements in lower limb strength and the ability to move from sitting to standing. However, independence in ambulation was not achieved in this 6-weeks telerehabilitation. This condition was supposedly happened due to the ongoing cognitive problems, severe sarcopenia/frailty, and not getting enough sensory feedback for the sensory re-education training. Although caregiver-assisted telerehabilitation effectively enhanced motor function outcomes and certain functional activities, difficulties in achieving ambulation independence highlight the need of a multidisciplinary approach addressing non-motor barriers.

This case report illustrates the distinct challenges and outcomes of implementing telerehabilitation in a low-economic environment for a frail and sarcopenic elderly woman with subacute stroke. Despite significant barriers, such as economic constraints, limited digital literacy, and distance to rehabilitation centers, the patient was still able to receive appropriate rehabilitation through a caregiver-assisted home-based program, which facilitated stroke recovery and resulted in measurable improvements in functionality. The use of simple, low-cost tools and remote supervision shows the flexibility of telerehabilitation in low-income settings. This case supports the effectiveness of telerehabilitation as a scalable solution in stroke care. Future research should focus on larger controlled trials with multidimensional outcomes and integrated interventions, such as cognitive training, nutritional support, and enhanced sensory feedback.

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