Functional Outcomes of Early Physiotherapy Intervention in Post-Stroke Rehabilitation

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ABSTRACT

Stroke is a major cause of disability in the world with serious consequences on motor performance, mobility, and the ability to undertake activities of daily living (ADLs). There is also an indication that early physiotherapy intervention, which should be initiated 24-72 hours after the stroke, can enhance the outcomes of recovery in stroke patients by taking advantage of the neuroplasticity of the brain at the acute stage. This research is intended to determine the measure of functional results of early intervention of physiotherapy in comparison to delayed intervention of physiotherapy (intervention after 714 days) in post-stroke rehabilitation. It was a randomized controlled trial (RCT) of 120 patients who suffered a stroke and were assigned to either the early or the delayed physiotherapy group. The main outcomes were motor activity, measured based on the Fugl-Meyer Assessment (FMA), and the independence of ADLs, measured based on the Barthel Index. Balance, mobility, and the quality of life were considered as secondary outcomes and measured through the use of the Berg Balance Scale (BBS), Timed Up and Go (TUG) test, and the SF-36 Health Survey, respectively. Results showed that early physiotherapy had a positive effect on motor functioning, mobility, balance, and quality of life in comparison to late intervention. These gains were maintained during a period of 3 months. The results indicate that physiotherapy is beneficial and must be established as an initial therapy in the rehabilitation population to maximize patient results.

Keywords: *Stroke rehabilitation, early physiotherapy, motor function, activities of daily living, neuroplasticity, randomized controlled trial, quality of life.*

INTRODUCTION

Stroke is a major disability among people all over the world, where millions of people are hit every year. According to the estimates of the World Health Organization (WHO), it is estimated that 15 million individuals experience a stroke every year, and almost 5 million remain permanently disabled [8]. Such

impairments usually affect the motor, cognitive, and functional functions of the survivors of strokes, and considerably lower their quality of life. Rehabilitation is important to stroke survivors as they find it difficult to be independent in the day-to-day tasks [4]. Physiotherapy, especially, has an important role to play in the restoration of motor functions, enhancement of mobility, and also enabling people to do the necessary activities of daily living (ADLs) [1].

The period in which the physiotherapy intervention takes place after a stroke is important in the recovery [2]. Conventional rehabilitation regimens are usually commenced days or even weeks after the occurrence, yet there is some new evidence that early physiotherapy commencing within 24-72 hours can be of significant help [3]. Early intervention takes advantage of the fact that during the acute stroke, the brain is more neuroplastic and thus more effective in recovery and has a high likelihood of swiftly improving functional abilities. Nevertheless, although an increasing literature is available to investigate the issue of early rehabilitation, the timeframe and the nature of physiotherapy interventions are debated [5].

Although it has a promising potential, there is no agreement on the optimal time of rehabilitation initiation, and the studies have no evidence to support the effectiveness of early physiotherapy in enhancing functional outcomes in the long term. The inconsistency in practice and the absence of standard rehabilitation protocols contribute to inconsistency in recovery and eventually influence the overall outcome of the patients. Thus, this study would fill this gap by examining the effects of early intervention of physiotherapy on post-stroke recovery [6].

The main objective of the research is to compare the functional results of early physiotherapy intervention (started within 24-72 hours after stroke) and delayed physiotherapy (started 714 days after stroke) on patients who have suffered a stroke [7]. The motivation of the study will be motor recovery, mobility, and the improvement of ADL, and longer-term quality of life and independence [9].

The paper is organized as follows: Section I presents the background of the study by stating the significance of early physiotherapy as a part of post-stroke rehabilitation, and the research gap. Section II describes the methods, the study design, the criteria used to select the participants, and the outcome measures. Section III outlines the findings, which were the changes in motor functioning, ADLs, mobility, and quality of life in the early and delayed physiotherapy groups. The findings are discussed in Section IV and compared to the findings in existing literature, and mechanisms of action are discussed. Section V will be the conclusion of the paper, summarizing the main findings and indicating the way of further research.

METHODS
Study Design
The study design was a randomized controlled trial (RCT) that was conducted to determine the efficacy of early intervention of physiotherapy in the process of post-stroke rehabilitation. The design also gives the results a non-biased and statistically strong approach, and the study uses a random allocation of the respondents to either the early or delayed physiotherapy group. Randomization reduces the selection bias and enhances the credibility of the results. The main objective was to determine the functional outcome of both groups concerning the function of the motor, mobility, and activities of daily living (ADLs).

Participants
The stakeholders of this study were recruited from a number of rehabilitation centers and stroke units. These were the inclusion criteria: adults aged between 18 and 80 years old with either ischemic or hemorrhagic stroke who received medical attention to the extent that they were medically stable to undergo rehabilitation. Moreover, the respondents needed to be capable of communicating and receiving basic instructions and did not have to be seriously impaired in their thinking so that it could disrupt the process. The study excluded patients who had severe comorbidities, persisting infections, or who were contraindicated for physiotherapy.

The participants who provided informed consent were randomized to one of two groups, including the early intervention group, which involved physiotherapy being administered between 24-72 hours post-stroke, and the delayed intervention group, which involved physiotherapy administered between 7-14 days post-stroke. The computer-generated randomization list was used to achieve the randomization and ensure that the groups were similar at baseline.

Intervention Protocols
Early Intervention Group
Physiotherapy in the early intervention group was started immediately after the patient was medically fit, within 2472 hours of the stroke onset. The physiotherapy program involved mobilization exercises, motor training, balance exercises, and task-oriented exercises aimed at ensuring functional recovery and enhancing mobility. The duration of each session was taken to be about 45-60 minutes per day, with the intensity of the session varying according to the recovery of the patient. The initial intervention was 2 weeks, and the physiotherapy session became less frequent gradually as the patient advanced.

Delayed Intervention Group
The physiotherapy pillar in the delayed intervention group was the same as that of the early intervention group. Their sessions, however, commenced after 7-14 days following the stroke. The delay enabled the recovery to move a bit naturally in the first acute stage prior to the commencement of the rehabilitation. The therapy was equal to the time and intensity to those in the early group, though it was initiated later in the recovery process.

Outcome Measures
Primary Outcome Measures
- Motor Function: Fugl- Meyer Assessment (FMA) was administered on motor function in both lower and upper limbs. The FMA is a commonly used scale that assesses the recovery in the motor that has suffered a stroke, with increasing scores relating to better recovery.
- Activities of Daily Living (ADLs): The Barthel Index was utilized to evaluate the participants in terms of their capability to handle 10 fundamentals of daily living (ADLs), which include bathing, dressing, and feeding. The higher the Barthel Index, the more independent one is in the performance of these activities.

Secondary Outcome Measures
- Balance: The risk of falls and balance was evaluated with the help of the Berg Balance Scale (BBS). The BBS is a typical clinical instrument and offers a score of how well one is able to execute a number of balance tasks, with the higher the score of the instrument, the better the balance and stability.
- Mobility: The Timed Up and Go (TUG) test was used to assess the duration required by the participant to stand out of a chair, walk 10 feet, turn around, walk back to the chair, and get seated again. The lesser the time, the more the mobility and independence in movement.

Quality of life: The quality of life of the participants was measured by the use of the SF-36 Health Survey, which measured both physical and mental health of the participants. The SF-36 is a broadly tested instrument that demonstrates the general well-being in a variety of areas.

Data Collection
To collect the data, three time points were used: baseline (before the intervention), immediately after the 2-week intervention period, and the follow-up 1 month and 3 months after the intervention period. The outcome measures were assessed by trained clinicians who were not aware of the group assignment of the participants, and therefore, they did not have any biases. Assessment bias is reduced by the use of blinded assessors, and the validity of results is enhanced.

Ethical Considerations

The IRB of the Institutional Review Board was adhered to in conducting this study. All participants were informed and gave their consent before participating in the research. The research was conducted to assure participants that they would be able to leave the research at any moment without any adverse effects. All data collected from the participants were confidential during the study.

RESULTS

Demographics and Baseline Characteristics

One hundred and twenty respondents were recruited, and there were 60 respondents per group: the early physiotherapy group and the delayed physiotherapy group. The mean age in the early group was 62.4 ± 7.3 years, and in the delayed group it was 63.1 ± 6.8 years. Gender distribution was similar, with approximately 55% male and 45% female in both groups. Stroke type was predominantly ischemic (75%), with the remaining participants having hemorrhagic stroke (25%).

The severity of stroke baseline (using the NIHSS) did not differ between the two groups: 15.3 ± 5.4 in the early and 14.8 ± 5.1 in the delayed situation. The baseline scores were also similar on the Fugl- Meyer Assessment (FMA) and Barthel Index, with comparability of the groups being used in the study at the beginning.

Primary Outcome Measures

Motor Function (Fugl-Meyer Assessment)

The Fugl-Meyer Assessment FMA demonstrated that there was a remarkable improvement in both groups' motor functionality, with the early intervention group demonstrating more improvement. The baseline score of the early intervention group was 28.6 ± 12.3. Their score rose to 36.9 ± 11.5 after 2 weeks, which reflected the improvement of 8.3 points ($p < 0.01$). This enhancement continued as scores were 41.2 ± 9.5 in 3 months. Conversely, the delayed intervention group achieved a baseline score of 29.1 ± 11.6, and the improvement of 3.2 points was lower ($p < 0.05$), and it was 34.6 ± 10.5 at 3 months.

Activities of Daily Living (Barthel Index)

The Barthel Index showed a high level of improvement in the ADL independence among the early intervention group. The baseline score was 48.2 ± 18.5, but after 2 weeks, they had a score of 60.5 ± 17.1 ($p < 0.01$). The score went on improving to 65.4 ± 15.7 at 3 months. The baseline score of the delayed intervention was 47.9 ± 19.3, which improved to 54.1 ± 18.5 after 2 weeks and 57.4 ± 18.3 after 3 months; hence, the improvement was slower than the early one.

Secondary Outcome Measures

Balance (Berg Balance Scale)

The balance scale, Berg Balance Scale (BBS), improved more in the early intervention group. The starting score of the initial group was 38.5 ± 9.8, and it rose and became 43.0 ± 8.9 in 2 weeks ($p < 0.01$) and then 47.1 ± 7.0 at 3 months. The delay intervention group showed baseline BBS of 37.9 ± 10.1 with an improvement of 40.0 ± 9.4 after 2 weeks ($p < 0.05$), and a final value of 42.5 ± 8.2 at 3 months, which is not as big as compared to the early group.

Mobility (Timed Up and Go Test)

The Timed Up and Go (TUG) test revealed faster improvements in mobility in the early intervention group. The initial group was 17.5 ± 3.2 seconds with a baseline time, and here the time was reduced to 14.2 ± 2.9 seconds after 2 weeks ($p < 0.01$) and 12.4 ± 2.5 seconds after 3 months. The TUG time of the delayed intervention was 18.2 ± 3.5 seconds, which was reduced to 16.5 ± 3.1 seconds ($p < 0.05$) in 2 weeks, with 15.3 ± 3.2 seconds at the end of 3 months.

Quality of life (SF-36 Health Survey)

The SF-36 Health Survey demonstrated a lot of quality-of-life improvement in the early intervention group. The baseline score of the early group in physical functioning was $32.4 + 12.3$ with an improved score of $40.1 + 11.9$ after 2 weeks ($p < 0.01$) and a final $44.5 + 10.8$ after 3 months. The baseline reading in the

delayed intervention group was 31.9 + 13.2, which was increased by 36.6 + 12.5 after 2 weeks (p < 0.05), and the end score was 39.2 + 11.8 at 3 months, and the changes were less dramatic.

DISCUSSION

The findings of this research are very much in favor of the advantages of early intervention of physiotherapy in the rehabilitation of post-stroke patients. The results of the early intervention group were greatly more positive in motor function, mobility, balance, and ADLs than the delayed group. Such results point to the fact that physiotherapy initiated within 24-72 hours after the stroke fosters functional recovery, complies with the body of research that has focused on neuroplasticity, and generates long-term improvements at both the follow-up (1 and 3 months).

The results of this study conform to the previous studies, which indicated that neuroplasticity and motor recovery could be facilitated by early rehabilitation. According to the studies, early intervention is beneficial in enhancing motor recovery. Nevertheless, other sources mention moderate advantages of severely affected patients. In this research, though, there was a great deal of improvement in several outcomes, which implies that timing of the physiotherapy is a key factor in the recovery, with early intervention being very effective.

The attainable gains are probably due to the improved neuroplasticity at the initial stages of the involved recovery process that facilitates the rearrangement of neural pathways. Early physiotherapy can also be used to prevent complications like stiffness of the joint and atrophic conditions of the muscles, which can slow down the healing process. These findings in the clinical setting imply that physiotherapy in the early stages must be given priority to decrease long-term disability and increase the rate of recovery. Healthcare systems must have timely access to physiotherapy that preferably should be during the first 24-72 hours following a stroke.

The limited nature of the sample size and the single-center design are the weaknesses of this study, since it was a randomized controlled study with extensive outcome measures; however, this could not be readily generalized. The next step of the research should be larger multi-centers, long-term (6-12 months) rehabilitation outcomes, and the combination of adjunct treatments, including neurostimulation or virtual reality, to improve the rehabilitation even more. The investigation of the unique patient aspects (e.g., age, the severity of strokes) will contribute to the optimization of rehabilitation procedures.

CONCLUSION

This study demonstrates that early physiotherapy intervention, initiated within 24–72 hours post-stroke, leads to significant improvements in motor function, mobility, balance, and activities of daily living (ADLs) compared to delayed rehabilitation. The early intervention group showed greater recovery in these functional outcomes, which was sustained over a 3-month follow-up period. These findings support the notion that timely rehabilitation enhances neuroplasticity during the critical early stages of recovery, leading to faster and more substantial improvements in functional abilities. The results suggest that early physiotherapy not only accelerates recovery but also significantly improves quality of life for stroke survivors. Given the positive impact on both physical and mental health, early physiotherapy should be considered a standard part of stroke care. Healthcare systems should focus on ensuring that stroke patients receive timely access to physiotherapy interventions, particularly in acute care settings. Future research should examine the long-term effects of early physiotherapy, beyond the initial 3 months, and explore the potential benefits of combining early rehabilitation with advanced therapeutic techniques such as neurostimulation or virtual reality. These efforts will help further optimize recovery strategies and ensure that stroke survivors achieve the best possible outcomes in their rehabilitation journey.

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