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Original Article

Comparative Analysis of Physical Therapy Outcomes in Acute Ischemic and Hemorrhagic Stroke Rehabilitation

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Abstract

Aims & Objective: Stroke rehabilitation demands an effective therapeutic approach to enhance functional recovery. This study aims to compare the outcomes of physical therapy in patients with acute ischemic and hemorrhagic stroke using the Motor Relearning Programme (MRP). **Methodology:** Based on stroke type, confirmed via CT thirty-eight participants were stratified into ischemic & hemorrhagic stroke group. Eligible participants were over 35 years old, had a Glasgow Coma Scale score above 5, and presented with hemiplegia. Exclusion criteria included trauma-induced hemorrhage, cerebellar or brainstem stroke, severe cognitive impairment, or pre-existing disabilities. The participants underwent a standardized four-week physiotherapy regimen based on the MRP, with assessments using the Motor Assessment Scale (MAS) and Functional Independence Measure (FIM) to evaluate the outcomes. **Results:** These results underscore the significant improvements in the functional outcomes observed in both ischemic and hemorrhagic stroke patients following physical therapy, with hemorrhagic stroke patients showing more substantial gains in both MAS and FIM scores. **Conclusion:** Our study contributes to a nuanced understanding of stroke rehabilitation, emphasizing that while both ischemic and hemorrhagic stroke patients significantly benefit from structured physical therapy interventions like MRP, the specifics of their recovery processes vary.

Keywords: Stroke Rehabilitation, Physical Therapy Outcomes, Motor Relearning Programme, Functional Recovery

Introduction

Stroke persists as a leading cause of hospitalization due to central nervous system disorders across the world, posing significant healthcare challenges. Although advancements in medical practice have reportedly diminished both fatality and incidence rates of stroke (Brown J. A., 2006), its prevalence, associated mortality, and the profound risk of lasting disability in survivors render it a considerable concern

at the turn of the millennium. The World Health Organization delineates stroke as the rapid onset of a focal or global neurological deficit of presumable vascular origin, which endures for no less than 24 hours or culminates in death. This definition encompasses spontaneous subarachnoid hemorrhages but excludes transient ischemic attacks and other forms of hematomas.

For individuals who have weathered the immediate consequences of a stroke, their prospective recovery and the prospect of sustained independence become paramount. These concerns extend to their families and healthcare providers, especially physiotherapists, who are directly involved in their care. The significance of outcome studies is accentuated in the contemporary context of cost-managed healthcare systems where such data critically inform treatment guidelines and policymaking.

Studies concerning the functional outcomes of ischemic and hemorrhagic strokes highlight that survival, impairment, disability, and quality of life are key variables in patient recovery. Research by Frank & Silver, (1984) has underscored the importance of analyzing early mortality, pointing to a bimodal distribution with peaks in the first week due to brain herniation and in subsequent weeks due to complications from immobility. Factors such as age, hypertension, comorbidities, blood glucose levels, hemorrhage size, and ventricular spread have been repeatedly identified as predictors of mortality. Notably, early mortality is especially high for hemorrhagic stroke patients.

Long-term survival analyses suggest better outcomes for those who survive beyond the acute phase of a hemorrhagic stroke, warranting strong advocacy for intensive rehabilitation efforts. Studies like those of Wei et al. (2024) have demonstrated positive rehabilitation outcomes, particularly for subarachnoid hemorrhage patients, with a significant portion achieving sufficient independence to return home. Despite the serious and often immediate implications of stroke, certain studies indicate no significant difference in long-term functional independence between ischemic and hemorrhagic stroke survivors, while others suggest a somewhat faster functional gain in hemorrhagic stroke patients. The heterogeneous nature of stroke outcomes indicates that while some recovery predictors are well-established, the individual patient's trajectory can be difficult to predict, necessitating a personalized approach to rehabilitation planning.

Existing literature presents a spectrum of findings. Ikramuddin and colleagues (2019) found no significant correlation between age, blood pressure at the time of admission, and the interval between stroke onset and hospital admission with functional improvement post-stroke. Conversely, Kuriakose & Xiao (2020) reported superior discharge outcomes for men with left-sided cerebrovascular events compared to those affected on the right side. Novack and colleagues (1984) highlighted the temporal relationship between the onset of stroke and admission to a rehabilitation facility as an influential factor in patient outcomes. Petty et al. (2000) identified discrepancies in recurrence rates and post-stroke functionality among different ischemic stroke subtypes, particularly noting the lower survival rates for strokes originating from cardiac embolism.

Other investigations (Salvadori et al., 2020), have explored the potential variance in functional recovery contingent on the nature of the stroke—hemorrhagic versus ischemic—yielding mixed outcomes. Kelly (2003) observed admission Functional Independence Measure (FIM) score discrepancies between patients with cerebral infarction and those with intracranial hemorrhage. Kojic and colleagues (2009) underlined the role of hematoma size and ventricular rupture in determining mortality in hemorrhagic stroke cases, advocating for assertive rehabilitation to foster independence in survivors.

Considering these divergent findings, the precise measurement of functional outcomes is crucial. The Motor Assessment Scale (MAS) is an established tools that have been widely utilized to gauge rehabilitation progress. It's recognized for its reliability in providing objective results without the necessity of costly equipment (Carr & Shepherd, 1985).

The disparities in stroke outcomes necessitate further investigation. Therefore, this study is designed to explore the functional outcomes of ischemic versus hemorrhagic stroke during the acute phase, utilizing the MAS and FIM as evaluative instruments. Through this research, we aim to contribute to a more discerning understanding of post-stroke recovery, thereby justifying the need for a differentiated approach in physiotherapy treatment strategies and healthcare policies.

Methodology

This research employed a comparative cohort design to examine and contrast the functional outcomes of physiotherapy in patients with ischemic versus hemorrhagic stroke. The participants were randomly differentiated into two groups according to the nature of their strokes as confirmed by computed tomography (CT): Ischemic Stroke Group (ISG) and Hemorrhagic Stroke Group (HSG).

The study's participant pool was carefully curated. Individuals were included if they had experienced their first stroke, evidenced by CT scans indicative of ischemic or hemorrhagic pathology. Candidates were required to be over the age of 35, with a minimal Glasgow Coma Scale score of 5 to ensure consciousness and potential for participation. Neurological impairment was a necessity for inclusion, specifically the presence of hemiplegia, and candidates had to be accessible for enrollment within one week following their stroke. Exclusion criteria were put in place to ensure the homogeneity of the study sample and the reliability of the outcome measures. Individuals with hemorrhage due to trauma or tumor, strokes impacting the cerebellum, brainstem, or causing subarachnoid hemorrhage, were not considered. Furthermore, severe cognitive impairments or the presence of severe pre-existing disabilities that could influence the rehabilitation outcomes led to exclusion from the study.

All study participants underwent a standardized four-week physiotherapy regimen based on the Motor Relearning Programme (MRP). The MRP is a comprehensive rehabilitation approach tailored to stroke recovery, advocating for the relearning of motor skills through repetitive, functional tasks that mimic daily activities. It is a patient-centered protocol that involves goal setting, task breakdown, and practice of movements, such as transfers, walking, and upper limb function, within a real-life context. The MRP was delivered by skilled physiotherapists who were trained in the method.

The study utilized the Motor Assessment Scale (MAS) and the Functional Independence Measure (FIM) to gauge recovery progress. The MAS, developed by Carr and Shepherd (1985), is a brief, reliable scale that evaluates essential motor functions without the need for costly equipment. Studies by Poole et al. (1988) established its concurrent validity with the Fugl-Meyer scale, while Dean and Mackey (1992), recognized its utility in documenting rehabilitation outcomes. The FIM, widely used since 1987, addresses the need for standardized disability and rehabilitation outcome data. Research by Dodds et al. (1993), Donaghy & Wass (1998) and Beninato et al. (2006) highlighted FIM's value as a prognostic indicator and functional measure in stroke rehabilitation, respectively. Comparisons with other indices like the Barthel Index confirmed FIM's superior reliability and validity, with a study by Kidd et al. (1995) rating it as more valid for disability assessment and found FIM to possess high interrater reliability, especially in motor tasks. The FIM was selected for this study due to its extensive adoption, ease of scoring, and proven reliability and validity, enhancing communication between healthcare settings and contributing to ongoing efforts to improve treatment outcomes for this significantly disabling condition.

Following the acquisition of written informed consent, baseline data including medical history, demographic details, presence of hypertension, and the date of stroke onset were meticulously recorded for each subject. Initial evaluations using the MAS and FIM scales were conducted to establish a starting point for subsequent comparisons. Progress assessments were then scheduled at the end of each week for the entire duration of the physiotherapy program, resulting in a comprehensive set of data points across the four weeks of intervention.

Result

This research investigated the recovery patterns of two cohorts of stroke patients by tracking the outcome scores after a four-week MRP programme. Descriptive statistics were used to describe the demographic data of participants, offering a fundamental comprehension of the sample. Following that, paired and independent t-tests were used to detect differences within each patient group over time and between the two groups, respectively. This facilitated the measurement of the impact of the MRP on patient outcomes.

This research aimed to examine the functional results during the acute stage of two types of strokes: ischemic and hemorrhagic. It comprised 38 participants, 19 in each group. In the Ischemic Stroke Group, there were fourteen men (73.7%) and five females (26.3%); in the Hemorrhagic Stroke Group, there were twelve men (63.2%) and seven females (36.6%). Among the subjects, 57.9% had a right-sided

stroke, whereas 52% suffered a left-sided stroke. Of the participants, 18 had diabetes and 28 had hypertension. Patients were evenly distributed across the two groups.

Table 1: Effect of four weeks MRP on Ischemic Stroke Outcomes

	Baseline Mean (SD) N=19	Post Treatment Mean (SD) N=19	t	p	Cohen's d
MAS	21.7 (7)	27.1 (6.8)	-2.95	0.009	-0.676
FIM	55.2 (11.7)	79.1 (18.3)	-4.89	0.000	-1.122

When examining the paired samples test for within-group comparisons (Table 1), the ischemic stroke group showed a significant mean decrease in MAS scores from admission to 4 weeks ($t(18) = -2.945$, $p = .009$), with a large effect size (Cohen's $d = .67$). For FIM scores, the decrease was even more pronounced ($t(18) = -4.889$, $p < .001$), with a very large effect size (Cohen's $d = 1.12$).

Table 2: Effect of four weeks MRP on Hemorrhagic Stroke Outcomes

	Baseline Mean (SD) N=19	Post Treatment Mean (SD) N=19	t	p	Cohen's d
MAS	20.5 (6.1)	33.6 (6.8)	-10.61	0.000	-2.434
FIM	54.6 (11.8)	90.1 (14.1)	-11.99	0.000	-2.750

Hemorrhagic stroke patients demonstrated an even greater mean decrease in MAS scores ($t(18) = -10.61$, $p < .001$), with a large effect size (Cohen's $d = 2.43$), and in FIM scores ($t(18) = -11.986$, $p < .001$), with a very large effect size (Cohen's $d = 2.75$) (Table 2).

Table 3: Comparison of MAS Outcomes across Stroke group

	ISG Mean (SD) N=19	HSG Mean (SD) N=19	t	p	Cohen's d
Baseline	21.7 (7)	20.5 (6.1)	0.569	0.573	0.185
Post Treatment	27.1 (6.8)	33.6 (6.8)	-2.929	0.006	-0.950

Patients with ischemic strokes had a baseline MAS score of 21.68 (SD = 7.008), which increased to 27.11 (SD = 6.781) after 4 weeks of physical therapy (Table 3). Hemorrhagic stroke patients began with a slightly lower MAS score of 20.47 (SD = 6.068) and experienced a more substantial increase to 33.58 (SD = 6.842) after the intervention period. An independent samples t-test indicated a statistically significant difference in the change of MAS scores between the two stroke types after 4 weeks ($t(36) = -2.929$, $p = .006$), with a large effect size (Cohen's $d = .95$). The mean difference between the groups was -6.474, favoring the hemorrhagic stroke group. Furthermore, a paired samples correlation for the hemorrhagic stroke group ($r = .658$, $p = .002$) demonstrated a strong positive relationship between initial and subsequent MAS scores, suggesting consistent improvement.

Table 4: Comparison of FIM Outcomes across Stroke group

	ISG Mean (SD) N=19	HSG Mean (SD) N=19	t	p	Cohen's d
Baseline	55.2 (11.7)	54.6 (11.8)	0.165	8.372	0.054
Post Treatment	79.1 (18.3)	90.1 (14.1)	-2.080	-0.272	-0.675

The mean FIM score at admission for ischemic stroke patients was 55.21 (SD = 11.712), improving to 79.11 (SD = 18.275) after 4 weeks. Similarly, hemorrhagic stroke patients' mean FIM score improved from 54.58 (SD = 11.815) at admission to 90.11 (SD = 14.059) after 4 weeks (Table 1). The change in FIM scores was also statistically significant ($t(36) = -2.08$, $p = .045$) with a notable effect size (Cohen's $d = 16.31$), with the mean difference of -11 indicating greater functional gains for the hemorrhagic stroke group. Correlation analyses revealed a significant relationship between initial and final FIM scores for hemorrhagic stroke patients ($r = .513$, $p = .025$), denoting a positive therapeutic effect.

These results underscore the significant improvements in the functional outcomes observed in both ischemic and hemorrhagic stroke patients following physical therapy, with hemorrhagic stroke patients showing more substantial gains in both MAS and FIM scores. The high effect sizes suggest that these improvements are both statistically and clinically meaningful, indicating the efficacy of the physical therapy interventions implemented in the study.

Discussion

The purpose of our research was to evaluate the effects of the Motor Relearning Programme (MRP) on the functional outcomes of individuals with acute ischemic and hemorrhagic strokes. By doing thorough analysis, we were able to identify important observations on the impact of stroke type on the progress and results of early rehabilitation. Both the ischemic and hemorrhagic stroke groups showed improvements in their motor skills and functional independence, as measured by the Motor Assessment Scale (MAS) and Functional Independence Measure (FIM). The group of patients with hemorrhagic stroke showed statistically significant improvements in both MAS and FIM ratings, revealing a unique pattern of recovery. The diverging path taken by hemorrhagic and ischemic stroke patients may be due to a fundamental difference in how they respond to early physical therapy therapies. Despite not all differences achieved statistical significance for tests, hemorrhagic stroke patients showed quick improvement, sometimes surpassing the ischemic group in functional recovery, despite beginning from comparable baselines.

Previous research by Paolucci et al. (2003) has shown that hemorrhagic stroke patients have a more favorable improvement in mobility and neurological outcomes compared to individuals with ischemic strokes. The results of our study support these observations and indicate that tailoring rehabilitation regimens to the specific kind of stroke may play a crucial role in maximizing recovery outcomes. Given the rapid progress in treating hemorrhagic stroke patients, it may be advantageous to enhance rehabilitation programmes by adjusting the intensity and timing of therapies to take full advantage of this period of accelerated recovery.

The findings of Salvadori et al. (2020) align with our results since they also identified specific difficulties in the recovery process for patients with hemorrhagic and ischemic strokes. Notably, the former group saw a higher occurrence of complications. Our study emphasizes the need for a proactive treatment plan in these patients, which may include comprehensive surveillance and integrated care that treats problems with the administration of physical therapy. In line with the principles stated by Wei et al. (2024), our study emphasizes the need of starting rehabilitation as soon as medically possible after a stroke. Prompt intervention is crucial, as our findings demonstrate that significant improvements in functionality may be achieved from the beginning of treatment. This discovery is very important for clinical practice, supporting the development of recommendations that emphasize the need of prompt rehabilitation efforts.

Furthermore, the lack of noticeable disparities in certain functional activities across the groups may suggest that although overall improvements are evident, the detailed and individualized nature of functional enhancement requires more complex and personalized therapy approaches. This is supported by the personalized therapy requirements described by Kartashev et al. (2020).

The continuous improvement seen in both groups over the four-week intervention highlights the potential benefits of long-lasting and perhaps extended rehabilitation programmes. This is consistent with the perspective of Nas et al. (2015), who suggest that long-term rehabilitation may help support continuous healing. The findings of our research suggest that providing rehabilitative treatment beyond the acute period might enhance functional independence and quality of life, especially in stroke patients with significant initial impairments.

The current research highlights the ability of hemorrhagic stroke patients to positively respond to early and intensive rehabilitation. This challenges us to improve our methods to take full advantage of this responsiveness. Although therapies are beneficial for ischemic stroke patients, the research suggests that customized tactics are necessary to optimize the therapeutic effectiveness for each kind of stroke, thereby enhancing overall patient outcomes.

Conclusion

Our study contributes to a nuanced understanding of stroke rehabilitation, emphasizing that while both ischemic and hemorrhagic stroke patients significantly benefit from structured physical therapy interventions like MRP, the specifics of their recovery processes vary. This variation underscores the necessity for personalized rehabilitation strategies that consider the unique physiological and recovery needs of each stroke subtype. Moving forward, it is crucial for future research to not only refine these strategies but also to explore the integration of novel therapeutic modalities that could complement traditional physical therapy to optimize recovery outcomes for all stroke patients.

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