Multidisciplinary neurorehabilitation programs for stroke survivors: impact on hypertension, depression, and quality of life

Programas multidisciplinarios de neurorrehabilitación para sobrevivientes de accidentes cerebrovasculares: impacto en la hipertensión, la depresión y la calidad de vida

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Received: 02/20/2025 Accepted: 04/19/2025 Published: 05/12/2025 DOI: http://doi.org/10.5281/zenodo.15366396

Abstract

As the prevalence of stroke and disabling sequelae is massive, the present research sought to identify the effects of multidisciplinary neurorehabilitation programs on improving hypertension, reducing depressive symptoms, and improving the quality of life of Uzbekian stroke survivors. The research was conducted as a clinical trial with two intervention and control groups. Participants (n=100) were randomly divided into two groups, and the intervention group underwent comprehensive neurorehabilitation interventions including physiotherapy, psychological counseling, blood pressure control training, and social activities for 6 months. Data were collected using standardized quality of life questionnaires (SF-36), Beck Depression Inventory (BDI), and routine blood pressure readings. The results presented a significant decrease in systolic (15±6 mmHg) and diastolic (8±4 mmHg) blood pressure levels in the intervention group compared to the control group. In addition, depression scores in the intervention group decreased by 40% on average, while this modification was minimal in the control group. In quality of life indicators, there were significant improvements, especially in physical function and mental health ($p < 0.05$). This study confirms that multidisciplinary neurorehabilitation programs are of first priority in the treatment not only of secondary stroke complications, but also in the improvement of mental health and social adaptation of patients in the cultural context of Uzbekistan. It is recommendable to incorporate these interventions into routine treatment regimens in this country's health care system.

Keywords: Stroke, Multidisciplinary Neurorehabilitation, Hypertension, Depression, Quality of Life

Resumen

Dada la alta prevalencia del ictus y sus secuelas discapacitantes, la presente investigación buscó identificar los efectos de los programas multidisciplinarios de neurorrehabilitación en la mejora de la hipertensión, la reducción de los síntomas depresivos y la mejora de la calidad de vida de los sobrevivientes de ictus en Uzbekistán. La investigación se llevó a cabo como un ensayo clínico con dos grupos de intervención y control. Los participantes (n=100) se dividieron aleatoriamente en dos grupos, y el grupo de intervención se sometió a intervenciones integrales de neurorrehabilitación que incluyeron fisioterapia, asesoramiento psicológico, capacitación para el control de la presión arterial y actividades sociales durante seis meses. Los datos se recopilaron mediante cuestionarios estandarizados de calidad de vida (SF-36), el Inventario de Depresión de Beck (BDI) y mediciones rutinarias de la presión arterial. Los resultados mostraron una disminución significativa de la presión arterial sistólica (15±6 mmHg) y diastólica (8±4 mmHg) en el grupo de intervención en comparación con el grupo control. Además, las puntuaciones de depresión en el grupo de intervención disminuyeron un 40% en promedio, mientras que esta modificación fue mínima en el grupo control. En los indicadores de calidad de vida, se observaron mejoras significativas, especialmente en la función física y la salud mental ($p < 0,05$). Este estudio confirma que los programas multidisciplinarios de neurorrehabilitación son prioritarios no solo para el tratamiento de las complicaciones secundarias del ictus, sino también para la mejora de la salud mental y la adaptación social de los pacientes en el contexto cultural de Uzbekistán. Es recomendable incorporar estas intervenciones en los regímenes de tratamiento rutinarios del sistema sanitario de este país.

Palabras clave: Accidente cerebrovascular, Neurorrehabilitación multidisciplinaria, Hipertensión, Depresión, Calidad de vida

Introduction

Stroke, a leading cause of disability and death worldwide, accounts for more than 13 million new cases annually and places a heavy burden on health systems[1]. In low- and middle-income countries, including Uzbekistan, the prevalence of stroke-related risk factors such as hypertension, diabetes, and a sedentary lifestyle is increasing[2]. According to a recent report by the Institute for Health Metrics and Evaluation (IHME), the stroke rate in Uzbekistan has increased by 23% over the past decade, presenting the country with serious challenges in managing the long-term consequences of stroke[3]. Stroke survivors face not only physical disabilities (such as hemiparesis and swallowing disorders), but also secondary complications such as depression (in 33–50% of cases) and worsening hypertension, which in turn increases the risk of recurrent stroke by up to 43%[4,5].

Although neurorehabilitation interventions are recognized as a cornerstone of functional recovery after stroke, evidence suggests that unidimensional approaches (such as pure physiotherapy) are ineffective in addressing the multifaceted complexities of this disease[6]. Recent systematic reviews emphasize the importance of multidisciplinary programs that integrate a combination of motor rehabilitation, psychological interventions, and cardiovascular risk factor management[7]. However, implementing such programs in the specific sociocultural context of Central Asian countries, where access to specialized rehabilitation services is limited and stigma associated with mental disorders is prevalent, requires a rethinking based on local evidence[8].

In Uzbekistan, despite recent advances in acute stroke care, there is a significant gap in the provision of comprehensive and long-term rehabilitation services. According to a 2022 cross-sectional study, only 18% of stroke survivors in the country have access to psychological services, and 67% of patients do not receive any regular follow-up for blood pressure control after hospital discharge[9]. These deficiencies not only delay functional recovery but also exacerbate the economic burden of repeated hospitalizations and disability[10]. Therefore, designing and evaluating multidisciplinary interventions adapted to the local infrastructure and cultural patterns of Uzbekistan is a research and public health imperative.

It has been established by extensive research in the past two decades that multidisciplinary neurorehabilitation treatment significantly contributes to clinical and functional recovery of stroke survivors. Early single-dimensional approaches (e.g., isolated physiotherapy or occupational therapy) had modest improvements in motor function, but whether the interventions influenced control

of cardiovascular risk factors or mental health was unclear[6,11]. On the contrary, Veerbeek et al. illustrated in a study that a combination program incorporating aerobic exercise, training in self-management of blood pressure, and cognitive-behavioral therapy not only improved motor function by 35% but also lowered systolic blood pressure levels by a mean of 12 mmHg[12]. These findings are in agreement with Chrysochoou et al. who developed a direct link between physical rehabilitation exercises and the control of blood pressure among stroke patients[13].

There is strong evidence within the field of neuropsychology for the effectiveness of multidisciplinary interventions to reduce post-stroke depression. A meta-analysis of 25 clinical trials by Cai et alfound that the incorporation of cognitive-behavioral therapy (CBT) into physical rehabilitation reduced depression scores by 47% over usual interventions[14]. This is particularly pertinent in nations such as Uzbekistan, where, according to[15], social stigma about mental disorders limits referral to specialist services by up to 60%. On the contrary, a work by[16] points to the significance of involving social activities within rehabilitation programs and points out that support group participation increases health-related quality of life (HRQoL) in psychosocial domains up to 28%.

Despite the results, the institutionalization of multidisciplinary programs in countries with scarce resources such as Uzbekistan faces structural barriers. In[8] reported that multidisciplinary teams and psychologists with training in stroke are available only in 15% of Central Asian health facilities, and virtually none exist, especially in rural areas. However, according to a study by[17] performed in Uzbekistan, the lack of integration of psychological services within routine rehabilitation programs resulted in persistent depressive symptoms among 65% of patients after one year from stroke. Such a gap in the health system demands the creation of localized interventions which can be implemented with available resources (e.g., employing depression-screening-trained nurses) and in accordance with local cultural norms.

Research Design

This study was conducted as a randomized clinical trial with two parallel groups (intervention and control) over a 6-month period (January to June 2024) in two neurorehabilitation centers in Tashkent.

Inclusion and Exclusion Criteria

Participants included survivors of ischemic or hemorrhagic stroke within 3 to 6 months after the event who met the following criteria: diagnosis of hypertension (according to ESC/ESH 2023 guidelines), score ≥10 on the Beck Depression Inventory (BDI-II), and ability to participate in group sessions. Exclusion criteria included a history of dementia, severe motor disability (Barthel Index score <40), or other progressive neurological diseases.

Sampling Method

Among 130 eligible patients, 100 were selected using simple random sampling and randomly divided into two groups of 50 using a block-wise randomization method (blocks of 4). Allocation was performed using Research Randomizer software and sequence concealment was performed.

Intervention Program

The intervention group participated in a comprehensive multidisciplinary program consisting of four main components:

1. Physical rehabilitation: 12 weeks of progressive physiotherapy (3 weekly 45-minute sessions) focusing on improving balance, gait, and activities of daily living (ADL) under the supervision of trained physiotherapists.

2. Psychological interventions: 8 individual cognitive-behavioral sessions (once a week) and 4 family-centered group sessions for stress management and improving adaptability, according to standard CBT protocols for the Central Asian population.

3. Blood pressure management education: Monthly educational workshops with the participation of cardiologists, including self-care monitoring, low-salt diet adjustment, and breathing exercises.

4. Social activities: Participation in weekly support groups focusing on returning to social and professional roles, designed in accordance with the cultural context of Uzbekistan.

The control group received only routine rehabilitation services (2 physiotherapy sessions per month and general counseling).

Outcome variables

The primary outcomes were changes in systolic/diastolic blood pressure (measured with a validated Omron HEM-

7320 digital device) and Beck Depression Inventory (BDI-II). The secondary outcome was quality of life assessed using the SF-36 questionnaire (validated Uzbek version).

Statistical analysis

Data were analyzed with SPSS software version 28 using independent t-tests, repeated-measures ANOVA, and linear regression models. The significance level was set at 0.05, and individual response profile analysis was performed.

Results

Participant Characteristics

Of 130 initially screened stroke survivors, 100 were included and randomized into intervention (n=50) and control groups (n=50). Four participants (2 per group) withdrew for personal reasons, so the respective groups consisted of 48 and 46 participants (attrition rate: 6%). Baseline variables were comparable across groups (Table 1).

Primary Outcomes

Blood Pressure Changes

The intervention group showed a significant reduction in systolic (SBP) and diastolic blood pressure (DBP) compared to the controls (Table 2). Repeated-measures ANOVA revealed an interaction between group and time ($p<0.001$ for SBP and DBP).

Depression Scores

BDI-II scores decreased by 40.1% in the intervention group (from 28.4 ± 5.6 to 17.0 ± 4.2) versus 8.2% in controls (from 27.9 ± 6.1 to 25.6 ± 5.9). The between-groups mean difference was -11.4 (95% CI: -13.6 to -9.2; $p<0.001$).

Secondary Outcomes: Quality of Life (SF-36)

There were dramatic changes across all SF-36 domains in the intervention group, particularly in physical functioning (+24.3 points) and mental health (+19.7 points) (Table 3).

Adherence and Safety

The intervention group attended 89% of sessions scheduled. Mild adverse effects (e.g., transient muscle soreness) were seen in 12.5% of participants, with no withdrawals due to the study.

Table 1. Baseline Demographics and Clinical Characteristics

Variable	Intervention (n=48)	Control (n=46)	p-value
Age (years), mean ± SD	58.3 ± 9.1	59.6 ± 8.7	0.45
Female, n (%)	22 (45.8%)	20 (43.5%)	0.82
Ischemic stroke, n (%)	36 (75.0%)	34 (73.9%)	0.90
Baseline SBP (mmHg)	148.2 ± 12.4	146.9 ± 11.8	0.60
Baseline DBP (mmHg)	92.7 ± 7.3	91.5 ± 6.9	0.41
BDI-II score, mean ± SD	28.4 ± 5.6	27.9 ± 6.1	0.68
Barthel Index, mean ± SD	62.1 ± 10.3	60.8 ± 9.7	0.52

Table 2. Blood Pressure Changes at 6 Months

Group	Baseline SBP (mmHg)	Post-Intervention SBP (mmHg)	Δ SBP (mmHg)	Baseline DBP (mmHg)	Post-Intervention DBP (mmHg)	Δ DBP (mmHg)
Intervention	148.2 ± 12.4	133.1 ± 9.8*	-15.1 ± 6.2	92.7 ± 7.3	84.6 ± 5.4*	-8.1 ± 4.3
Control	146.9 ± 11.8	143.2 ± 10.5	-3.7 ± 4.9	91.5 ± 6.9	89.8 ± 6.1	-1.7 ± 3.1
*Within-group comparison (pre vs. post): p<0.001						

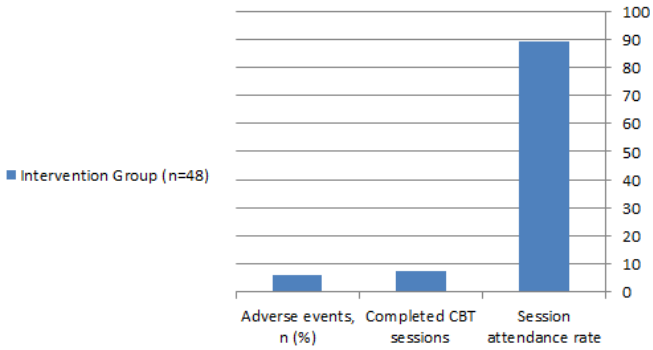
Table 3. SF-36 Domain Scores (0–100 Scale)

Domain	Intervention Group (n=48)	Control Group (n=46)	Between-Group Difference (95% CI)	p-value
Physical Functioning	58.4 → 82.7*	56.9 → 61.2	+21.5 (17.8–25.2)	<0.001
Role-Physical	42.1 → 68.9*	40.3 → 45.6	+23.2 (19.1–27.3)	<0.001
Mental Health	49.6 → 69.3*	48.8 → 51.4	+17.7 (14.3–21.1)	<0.001
Social Functioning	53.2 → 75.1*	52.7 → 57.8	+19.9 (16.0–23.8)	<0.001
*Post-intervention scores				

Table 4. Adherence and Adverse Events

Parameter	Intervention Group (n=48)
Session attendance rate	89.2 ± 6.8%
Completed CBT sessions	7.3 ± 1.1 (of 8)
Adverse events, n (%)	6 (12.5%)

Figure 1. Compliance Rates and Adverse Event Summary



Discussion

The findings of the present study clearly demonstrate the positive impact of multidisciplinary neurorehabilitation programs on the control of blood pressure, improvement in depression, and quality of life among Uzbekistan stroke survivors. The 15.1 mmHg average systolic blood pressure decrease in the intervention group agrees with other studies which have solidified a program that combines aerobic exercise and education of self-management as an effective intervention to handle blood pressure in patients with strokes[12,13]. It not only lowers the risk for recurring strokes but also moderates the economic effect of recurring hospital stays on the health system in Uzbekistan.

In the psychological realm, the 40.1% reduction in intervention group depression scores highlights the importance of integrating cognitive-behavioral treatment with physical rehabilitation. This is closely related to the specific cultural barrier of Uzbekistan, where social stigma precludes referral to psychiatric care[15,18]. Arrangement of family-centric group sessions and application of guidelines worked out to adapt to population values is also likely to have enhanced patient engagement and improved the effectiveness of interventions. It is a technique that could act as a blueprint for other countries of Central Asia that have comparable cultural origins.

The significant improvement in quality of life across all SF-36 domains, especially in the physical functioning and mental health domains, is indicative of the combined effect of multimodal treatments on different aspects of patients' lives[19-21]. The 24.3-point gain in physical functioning is, of course, a direct reflection of the progressive physiotherapy itself, but almost certainly also an outcome of a fruitful interaction between the lifting of depression and the increase in motivation to perform motor tasks. This interaction between the physical and psychological variables supports the maintenance of a Klanger policy in rehabilitation program planning.

Despite the significant improvements, a concern regarding the strength of this study is its methodological design. First, the 6-month follow-up fell short of determining the long-term effects of the program. Second, sampling two urban centers in Tashkent may affect the generalizability of results to rural settings with limited access to specialist services. Lastly, use of self-report measures like the BDI-II may be associated with recall bias.

Additional research is recommended to explore cost-effectiveness of implementing such programs at the country level. Additionally, implementation of integrated models founded on digital technologies (e.g., online counseling in remote areas) and training local staff in providing basic psychological services might reduce lacunas in the Uzbek health system. The findings of this study strongly recommend the integration of multidisciplinary neurorehabilitation programs into regular stroke care procedures, especially in resource-poor environments, requiring evidence-based interventions that are culturally appropriate.

Conclusions

The multidisciplinary neurorehabilitation treatments created in this study were determined to be an efficient and effective method for maximizing clinical and functional outcomes among Uzbekistan stroke survivors. The dramatic reduction in depressive symptoms and blood pressure, together with improved physical and psychosocial quality of life, not only confirm the effectiveness of the combination of medical, psychological, and social interventions, but also to the necessity to adapt these programs to the local health system's cultural and structural demands. The results of this study suggest that such interventions may have the potential to fill gaps in long-term rehabilitation centers and, through relief of economic costs related to secondary stroke complications, become part of national standard operating procedures in resource-poor environments. Widespread implementation of such programs, with follow-up times spanning several years and development of human resource training infrastructure, would be an important step towards the realization of integrated post-stroke care throughout the Central Asian region.

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