

## IMPACT OF HOSPITAL ADMISSION TIME ON FUNCTIONAL OUTCOME OF ISCHEMIC STROKE

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**Abstract: Objective.** To assess the impact of hospital admission time on functional outcomes in patients with ischemic stroke. **Materials and Methods.** A prospective observational study was conducted in patients with ischemic stroke. Depending on the time of admission to the hospital, patients were divided into early ( $\leq 6$  hours) and late ( $> 6$  hours) hospitalization groups. Assessment was performed using the National Institutes of Health Stroke Scale (NIHSS), the modified Rankin Scale (mRS), and the Barthel Index. **Results.** Patients admitted within the early time window demonstrated a more pronounced reduction in neurological deficit, better functional independence outcomes, and a lower incidence of complications. **Conclusions.** Early hospital admission is a key determinant of a favorable functional outcome in ischemic stroke.

**Keywords:** ischemic stroke, time to hospitalization, functional outcome, NIHSS, mRS.

**Introduction.** Ischemic stroke remains one of the leading causes of death and long-term disability worldwide, representing a major challenge for modern healthcare systems. According to international epidemiological data, stroke is a primary cause of persistent functional impairment, significantly reducing quality of life and increasing socioeconomic burden due to long-term care, rehabilitation needs, and loss of working capacity.

Timely delivery of specialized medical care is one of the most critical determinants of outcome in ischemic stroke. The widely accepted concept “*time is brain*” reflects the rapid progression of irreversible neuronal damage during cerebral ischemia, with millions of neurons lost each minute in the absence of reperfusion. Delayed hospital admission is associated with larger infarct volumes, more severe neurological deficits, and poorer functional recovery.

Early hospitalization allows for prompt neuroimaging confirmation, initiation of evidence-based therapies such as thrombolysis and antithrombotic treatment, optimization of cerebral perfusion, prevention of secondary brain injury, and early implementation of rehabilitation strategies. These interventions are known to improve neurological recovery and reduce disability. Conversely, late admission limits therapeutic options and increases the risk of medical complications, including pneumonia, deep vein thrombosis, and prolonged immobility. Despite advances in stroke awareness campaigns and the development of specialized stroke units, a significant proportion of patients continue to arrive at hospitals outside the recommended therapeutic window. Factors contributing to delayed admission include poor recognition of stroke symptoms, delayed emergency response, geographic barriers, and limited access to specialized care facilities. As a result, evaluating the impact of hospital admission time on functional outcomes remains a priority for improving stroke management and healthcare organization.

**Materials and Methods.** Study Design. A prospective single-center clinical observational study was conducted to assess the impact of hospital admission time on functional outcomes in ischemic stroke. The study was carried out in a specialized neurological department of a hospital. All patients received treatment in accordance with current clinical guidelines for the management of ischemic stroke.

Patient Characteristics. Patients with a first-ever ischemic stroke who were admitted within the first 24 hours from symptom onset were consecutively enrolled in the study. The diagnosis of

ischemic stroke was confirmed by neuroimaging findings using computed tomography (CT) and/or magnetic resonance imaging (MRI) of the brain.

**Inclusion Criteria.** Patients were included in the study if they met the following criteria:

1. confirmed ischemic stroke based on CT or MRI findings;
2. age 18 years or older;
3. hospital admission within the first 24 hours from the onset of clinical symptoms;
4. written informed consent obtained from the patient or their legal representative.

**Exclusion Criteria.** Patients with hemorrhagic stroke, transient ischemic attack, severe decompensated comorbid somatic diseases, recurrent stroke in the acute phase, or severe cognitive impairment preventing adequate functional assessment were excluded from the study.

**Group Allocation.** Based on the time of hospital admission, patients were divided into two groups:

**Group I (early hospitalization):** admission within  $\leq 6$  hours from symptom onset;

**Group II (late hospitalization):** admission more than 6 hours after symptom onset.

Group comparisons were performed considering baseline neurological severity and clinical and demographic characteristics.

**Clinical and Functional Assessment Methods.** Neurological deficit severity was assessed using the National Institutes of Health Stroke Scale (NIHSS) at admission and at hospital discharge. Functional outcome was evaluated using the modified Rankin Scale (mRS) at discharge. The level of daily activity and functional independence was determined using the Barthel Index.

Additionally, the incidence of in-hospital complications (infectious complications, thromboembolic events, pressure ulcers) and the length of hospital stay were analyzed.

**Statistical Analysis.** Statistical data analysis was performed using descriptive statistical methods. Quantitative variables are presented as means with standard deviations, while qualitative variables are presented as absolute and relative frequencies. Intergroup differences were considered statistically significant at a  $p$  value of  $<0.05$ .

**Results.** Patients with ischemic stroke admitted within the first 24 hours from symptom onset were included in the study. Based on the time of hospital admission, patients were divided into early and late hospitalization groups. No significant differences were observed between the groups in terms of age, sex, or major clinical and demographic characteristics at admission.

**Neurological Deficit Dynamics.** Patients in the early hospitalization group demonstrated a more pronounced reduction in neurological deficit as measured by the NIHSS at the time of discharge compared with patients in the late hospitalization group. In the late admission group, regression of neurological symptoms was less marked, and residual deficits were more frequently observed.

**Functional Outcomes.** Assessment using the modified Rankin Scale showed that patients admitted within the first 6 hours from symptom onset more frequently achieved favorable functional outcomes. In contrast, patients in the late hospitalization group more often exhibited moderate to severe functional limitations.

According to the Barthel Index, patients in the early hospitalization group demonstrated a higher level of functional independence, reflecting better ability for self-care and performance of daily activities. Functional independence scores were significantly lower in the late hospitalization group.

**In-Hospital Complications and Length of Stay.** The incidence of in-hospital complications, including infectious and thromboembolic events, was lower among patients admitted early. In addition, the early hospitalization group had a shorter average length of hospital stay compared with the late hospitalization group.

**Discussion.** The results of this study confirm the critical role of hospital admission time in determining functional outcomes in ischemic stroke. Patients admitted within the first 6 hours from symptom onset demonstrated more pronounced regression of neurological deficits, better functional independence, and a lower incidence of in-hospital complications compared to patients admitted later.

The marked positive outcomes in the early admission group can be explained by the opportunity for timely neuroimaging, early initiation of evidence-based therapy, prevention of secondary brain injury, and prompt patient mobilization. These factors contribute to limiting the area of ischemic damage and more effective recovery of lost neurological functions.

In the late admission group, less favorable functional outcomes were observed, likely due to larger volumes of irreversible ischemic injury, limited therapeutic options, and a higher risk of complications such as infections, thromboembolic events, and prolonged immobility. These findings are consistent with international studies emphasizing the “*time is brain*” concept as a fundamental principle in stroke management.

**Conclusion.** Hospital admission time is an independent and significant determinant of functional outcomes in ischemic stroke. Early admission ( $\leq 6$  hours from symptom onset) is associated with greater reduction of neurological deficits, higher levels of functional independence, and a lower incidence of in-hospital complications.

These findings highlight the need to improve early stroke recognition systems and accelerate patient routing to specialized stroke centers to reduce disability and improve prognosis.

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