Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 31s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Adherence to Antihypertensive Medication in Post-Stroke Patients: Patterns, Barriers, and Clinical Outcomes in a Prospective Cohort Study

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Cite this paper as: Dr. Prateek Nitey, Dr. Piyush Bhagat, Dr. Rinkita Sahare, Dr. Anil Modak, Dr. Kartik Khurana, Ms. Diksha Wani, (2025) Adherence to Antihypertensive Medication in Post-Stroke Patients: Patterns, Barriers, and Clinical Outcomes in a Prospective Cohort Study. *Journal of Neonatal Surgery*, 14 (31s), 802-807.

ABSTRACT

Background: Medication adherence is crucial for secondary stroke prevention, yet non-adherence remains a significant challenge. This study evaluates adherence patterns, identifies key barriers, and assesses clinical outcomes in post-stroke patients receiving antihypertensive therapy.

Methods: A prospective cohort study was conducted in a single tertiary care center, enrolling 150 post-stroke patients. Adherence was assessed using the 8-item Morisky Medication Adherence Scale (MMAS-8). Barriers to adherence were identified through structured questionnaires. Clinical outcomes, including blood pressure control, recurrent stroke, and cardiovascular events, were recorded over a 12-month follow-up. Statistical analyses included Chi-square tests, logistic regression, and Kaplan-Meier survival analysis.

Results: Only 36% of patients exhibited high adherence, while 32% had moderate and 32% had low adherence. Key barriers included forgetfulness (42%), fear of side effects (28%), and cost-related constraints (25%). Patients with low adherence had a 3.2-fold increased risk of recurrent stroke ($p = 0.002$). Blood pressure control was achieved in 85% of high-adherence patients versus 29% in the low-adherence group ($p < 0.001$).

Conclusion: Adherence to antihypertensive therapy remains suboptimal in post-stroke patients, contributing to poor clinical outcomes. Targeted interventions addressing barriers to adherence are essential to enhance secondary stroke prevention and improve patient survival

Keywords: *Adherence, Anti-Hypertensive Medicines, Post-Stroke*

1. INTRODUCTION

Stroke is a leading cause of morbidity and mortality worldwide, with a significant burden of recurrent events in survivors.(1) Hypertension remains the most critical modifiable risk factor for both primary and secondary stroke prevention.(2) Adherence to antihypertensive medication plays a crucial role in reducing the risk of recurrent strokes, yet non-adherence remains a persistent challenge.(3) Studies have shown that poor adherence to antihypertensive therapy is associated with inadequate blood pressure control, increased hospitalization rates, and higher mortality in post-stroke patients.(4)

Despite the well-established benefits of antihypertensive therapy, adherence rates remain suboptimal due to a complex interplay of patient-related, healthcare system-related, and socioeconomic factors. Barriers such as medication side effects, lack of awareness, financial constraints, and healthcare accessibility contribute to poor adherence.(5) Understanding these barriers and their impact on clinical outcomes is essential for developing targeted interventions to improve adherence and optimize post-stroke care.

This study aims to assess the patterns of antihypertensive medication adherence among post-stroke patients, identify key barriers to adherence, and evaluate the clinical outcomes associated with varying adherence levels. Conducted as a prospective cohort study in a tertiary care center, this research will provide valuable insights into the real-world challenges of medication adherence and its implications for secondary stroke prevention. The findings will aid in designing patient-centered strategies to enhance adherence, ultimately improving long-term health outcomes in post-stroke patients.

2. METHODOLOGY

Study Design: This study is designed as a prospective cohort study conducted at a single tertiary care center. The study will follow post-stroke patients prescribed antihypertensive medications over a defined period to evaluate adherence patterns, identify barriers, and assess clinical outcomes.

Study Population

Inclusion Criteria:

- Patients aged ≥18 years diagnosed with ischemic or hemorrhagic stroke.
- Patients prescribed antihypertensive medications for secondary stroke prevention.
- Willingness to provide informed consent and participate in follow-up assessments.

Exclusion Criteria:

- Patients with a history of cognitive impairment affecting self-reporting.
- Patients with terminal illnesses or conditions limiting follow-up.
- Patients with incomplete medical records regarding antihypertensive prescriptions.

Sample Size and Sampling Technique: All patients diagnosed with hypertension with a history of stroke were included in the study(n=150), consecutive sampling techniques were used to recruit eligible patients from the medicine wards and intensive care units.

Data Collection Methods: Data was collected through patient interviews, medical record reviews, and follow-up assessments at regular intervals. The study employed standardized tools for adherence measurement and barrier identification.

Baseline Data Collection:

- Demographic Details: Age, sex.
- Clinical Characteristics: Stroke type, comorbidities.
- Medication Adherence Assessment: The 8-item Morisky Medication Adherence Scale (MMAS-8) will be used to categorize adherence levels (high, moderate, low).(6)
- Barrier Assessment: A structured questionnaire identified patient-reported barriers, including financial constraints, side effects, forgetfulness, and healthcare accessibility.

Follow-up Assessments:

- Patients followed at 3 months, 6 months, and 12 months to track adherence patterns.
- Blood pressure readings and recurrence of stroke or cardiovascular events was recorded.

3. OUTCOME MEASURES

Primary Outcome: Proportion of patients with high, moderate, and low adherence.

Secondary Outcomes:

- Association of adherence levels with blood pressure control.
- Incidence of recurrent stroke, hospitalizations, and cardiovascular events among adherent vs. non-adherent patients.

Statistical Analysis: Descriptive statistics will summarize baseline characteristics and adherence patterns. Chi-square tests and logistic regression will assess associations between adherence and clinical outcomes. Kaplan-Meier survival analysis may be used to compare stroke recurrence between adherence groups. A p-value < 0.05 will be considered statistically significant.

4. RESULTS

1. Baseline Characteristics(table 1)

A total of 150 post-stroke patients were enrolled in the study, with a mean age of 62.4 ± 9.8 years. The majority were male

(60%), and 40% were female. Ischemic stroke was the predominant type (78%), while 22% had hemorrhagic stroke. Hypertension (100%), diabetes mellitus (45%), and dyslipidemia (32%) were the most common comorbidities.

Table 1. Baseline Characteristics

Characteristic	**Value (n = 150)**
Mean Age (years)	62.4 ± 9.8
Male	90 (60%)
Female	60 (40%)
Ischemic Stroke	117 (78%)
Hemorrhagic Stroke	33 (22%)
Hypertension	150 (100%)
Diabetes Mellitus	67 (45%)
Dyslipidemia	48 (32%)
Loss to Follow Up	0

2. Medication Adherence Patterns

Based on the Morisky Medication Adherence Scale (MMAS-8):

- High adherence: 54 patients (36%)
- Moderate adherence: 48 patients (32%)
- Low adherence: 48 patients (32%)

3. Barriers to Medication Adherence

The most frequently reported barriers were(multiple responses were allowed):

- Forgetfulness (42%)
- Fear of side effects (28%)
- High medication costs (25%)
- Lack of awareness about stroke prevention (20%)
- Poor physician communication (15%)

4. Clinical Outcomes Based on Adherence(Table 2)

- Blood Pressure Control:
    - High adherence: 85% achieved target BP (<140/90 mmHg)
    - Moderate adherence: 56% achieved target BP
    - Low adherence: 29% achieved target BP

- Recurrent Stroke Events:
    - High adherence: 3 patients (5.5%)
    - Moderate adherence: 7 patients (14.6%)
    - Low adherence: 12 patients (25%)

Table 2. Outcomes

Outcome	High Adherence (n=54)	Moderate Adherence (n=48)	Low Adherence (n=48)
BP Control Achieved	46 (85%)	27 (56%)	14 (29%)
Recurrent Stroke	3 (5.5%)	7 (14.6%)	12 (25%)
Hospitalization (CV Event)	5 (9.2%)	9 (18.7%)	15 (31.2%)

5. Statistical Analysis

- A Chi-square test showed a significant association between adherence and blood pressure control ($p < 0.001$).
- Logistic regression revealed that patients with low adherence had a 3.2 times higher risk of recurrent stroke compared to high-adherence patients (OR = 3.2, 95% CI: 1.5–6.7, $p = 0.002$).
- Kaplan-Meier survival analysis indicated a significantly higher stroke-free survival rate in high-adherence patients (log-rank $p = 0.004$).

5. DISCUSSION

Medication adherence is a critical determinant of secondary stroke prevention, yet non-adherence remains a persistent challenge among post-stroke patients. In this prospective cohort study, we assessed adherence patterns, identified key barriers, and evaluated the clinical outcomes associated with varying adherence levels. The findings reveal that only 36% of patients demonstrated high adherence to antihypertensive therapy, while the remaining 64% exhibited moderate or low adherence, highlighting a significant gap in effective long-term management.

Adherence Patterns and Associated Factors

The low adherence rate observed in our study is consistent with previous research indicating suboptimal medication adherence in stroke survivors. A study by Burnier et al. (2019) reported that nearly 50% of hypertensive patients fail to adhere to prescribed therapy, leading to poor blood pressure control and increased cardiovascular risk. In this cohort, only 85% of high-adherence patients achieved target BP (<140/90 mmHg), compared to 29% of low-adherence patients ($p < 0.001$). This finding underscores the well-established link between adherence and effective hypertension management. (7)

Barriers to Medication Adherence

The most frequently cited barriers included forgetfulness (42%), fear of side effects (28%), and high medication costs (25%). Forgetfulness, as the leading cause of non-adherence, aligns with existing literature emphasizing the need for structured patient reminders and adherence-enhancing strategies.(8) Additionally, one in four patients cited cost as a barrier, reflecting the economic constraints that often hinder long-term treatment compliance, particularly in low- and middle-income settings. These findings support the need for targeted interventions such as patient education, financial assistance programs, and simplified dosing regimens to improve adherence.(9)

Impact of Adherence on Clinical Outcomes

The results demonstrate a clear association between adherence and clinical outcomes. Patients with low adherence had a 3.2

times higher risk of recurrent stroke (OR = 3.2, 95% CI: 1.5–6.7, p = 0.002) compared to those with high adherence. Similarly, hospitalization rates for cardiovascular events were significantly higher among low-adherence patients (31.2% vs. 9.2% in the high-adherence group). These findings are consistent with studies, which reported that poor adherence to antihypertensive medication increases the risk of recurrent stroke and cardiovascular mortality.(10)

Furthermore, Kaplan-Meier survival analysis showed significantly higher stroke-free survival in high-adherence patients (log-rank p = 0.004), reinforcing the protective role of medication adherence in secondary stroke prevention. The observed correlation between adherence and clinical outcomes suggests that adherence-promoting interventions should be an integral part of post-stroke management strategies.

Clinical and Public Health Implications

Given the strong association between adherence and stroke recurrence, healthcare providers should prioritize adherence assessment and counseling in routine follow-ups. Strategies such as medication reminders, improved physician-patient communication, and cost-reduction policies should be explored to mitigate barriers to adherence. The implementation of digital health interventions, such as mobile app-based medication reminders and telemedicine consultations, may also enhance adherence rates and improve long-term outcomes.

Limitations and Future Directions

This study has certain limitations. First, adherence was assessed using self-reported questionnaires (MMAS-8), which may be subject to recall bias and social desirability bias. Future studies should incorporate objective adherence measures such as electronic pill monitoring or pharmacy refill data for more accurate assessment. Second, as this was a single-center study, the findings may not be generalizable to broader populations. Multicenter trials with larger sample sizes are needed to validate these results.

Despite these limitations, this study provides valuable insights into the real-world challenges of antihypertensive medication adherence in post-stroke patients. The findings emphasize the urgent need for structured interventions to enhance adherence and prevent recurrent strokes, ultimately improving patient outcomes and reducing the healthcare burden.

6. CONCLUSION

In conclusion, our study highlights that medication non-adherence remains a major challenge in post-stroke patients, leading to poor blood pressure control and increased risk of recurrent stroke. Forgetfulness, fear of side effects, and financial constraints are key barriers to adherence. Targeted interventions, including patient education, affordability measures, and adherence-enhancing technologies, are essential to improving adherence and optimizing stroke prevention strategies. Addressing these factors is crucial for reducing stroke recurrence and improving long-term survival in post-stroke patients.

Conflicts of Interest:

Authors declare that there are no conflicts of interest.

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