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Spasticity Predictive Factors of Inpatients with Stroke During Hospitalization in a Rehabilitation Center

Konstantina Petropoulou*, Angeliki Paraschou, Avgoustinos Kampas, Dimitris Pikridas , Raisa Stylidi, Christina Ziagka, & Athanasios Tsivgoulis

Attica Rehabilitation Center, Greece

***Corresponding author:** Konstantina Petropoulou, Attica Rehabilitation Center, Greece.

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Abstract

Background: *To investigate the incidence, onset time, and predictive factors of early regional spasticity among first-time stroke patients hospitalized for rehabilitation.*

Methods: *"A total of 342 consecutive stroke inpatients were admitted to the Attica Rehabilitation Center between July 2023 and July 2024. All patients experienced their first-ever stroke 3–10 days prior to admission. A rehabilitation physician assessed muscle tone changes on the hemiplegic side weekly during hospitalization. Eighty-nine of the 342 patients (34.2%) developed spasticity, of whom 71 met inclusion criteria (hospitalization 7–90 days post-stroke; mean 17.8 days).*

Results: *Among the 71 patients, 41 (57.7%) were men and 30 (42.3%) women; 57 (80.3%) had ischemic and 14 (19.7%) hemorrhagic strokes. Left hemiplegia was present in 34 (47.9%) and right hemiplegia in 37 (52.1%). Age distribution: >80 years (22.8%), 71–80 (30.5%), 61–70 (25.7%), 51–60 (11.4%), and 41–50 (4.4%). Comorbidities were observed in 24.3% of patients, 55.7% were smokers, and 13.0% were obese. The admission Barthel Index ranged from 2 to 24/100 (mean 9). Treatment included Botulinum Toxin type A injections in 38 patients (53.5%) and oral antispastic medication in 26 (36.6%). Spasticity incidence was 34.2% (Modified Ashworth Scale ≥1 and Brunnstrom stage 2. Sex, hemiplegic side, and age were not associated with spasticity onset. Lower Barthel Index, ischemic stroke, smoking, and obesity were identified as predictive factors.*

Conclusion: *Approximately one-third of first-stroke patients developed early spasticity during rehabilitation. Functional dependence (low Barthel Index), ischemic stroke etiology, smoking, and obesity were significant predictors. Early identification of these factors may enable timely interventions—such as early Botulinum Toxin A administration—potentially improving long-term outcomes and rehabilitation cost-effectiveness.*

Keywords: Spasticity, Stroke, Predictive Factors, Botulinum Toxin Type A, Rehabilitation.

Introduction

Spasticity is a disorder of sensorimotor control resulting from upper motor neuron lesions, characterized by intermittent or sustained involuntary muscle activation [1].

Its emergence often occurs shortly after stroke onset, suggesting that neural plasticity changes contribute to its development. Although spasticity may appear at any stage post-stroke, it typically manifests between the first and sixth week [2].

Previous studies report an incidence of upper limb spasticity ranging from 17% to 38% at 12 months post-stroke, reaching up to 46% among patients with poor early upper limb recovery [3-5].

The present study aimed to determine the incidence, onset, and predictive factors of early spasticity among first-time stroke patients admitted for rehabilitation.

Materials and Methods

Study Population:A total of 342 consecutive inpatients with first-ever stroke were admitted to the Attica Rehabilitation Center between July 2023 and July 2024. All had experienced their first stroke 3–10 days before admission.

Assessment and Definition of Early Spasticity

Muscle tone was evaluated weekly by a rehabilitation physician using the Modified Ashworth Scale (MAS). Early spasticity form was defined by:

- Involuntary muscular overactivity during rapid passive movement ("catch" phenomenon)
- Preserved muscle elasticity and full joint mobility
- Absence of fully developed pathological movement patterns
- Gradual transition from flaccidity
- Focal spasticity in one muscle group and joint
- Low MAS grade (>1 up to 1)

Patients hospitalized 7–90 days after stroke onset (n=71) were included for analysis.

Associations between demographic/clinical factors and spasticity onset were analyzed. Predictive factors were identified using logistic regression [6].

Results

Of 342 patients, 89 (34.2%) developed spasticity. Seventy-one met inclusion criteria (mean hospitalization 17.8 days post-stroke).

- Sex: 41 men (57.7%), 30 women (42.3%)
- Stroke type: 57 ischemic (80.3%), 14 hemorrhagic (19.7%)
- Hemiplegic side: Left 34 (47.9%), right 37 (52.1%)
- Age distribution: >80 (22.8%), 71–80 (30.5%), 61–70 (25.7%), 51–60 (11.4%), 41–50 (4.4%)
- Comorbidities: 24.3%; smokers: 55.7%; obese: 13.0%
- Barthel Index: 2–24/100 (mean 9)

Thirty-eight patients (53.5%) received Botulinum Toxin type A, and 26 (36.6%) were treated with oral antispastic agents.

Predictive Factors: Spasticity onset was not associated with sex, hemiplegic side, or age. Lower Barthel Index, ischemic stroke, obesity, and smoking were independent predictors of early spasticity.

Discussion

This study found that one-third of first-stroke patients developed early spasticity, consistent with previous findings [7–8]. Predictors included functional dependence, ischemic stroke etiology, and modifiable risk factors (smoking, obesity).

Urban et al. reported similar results, identifying low Barthel Index and severe paresis as key predictors of post-stroke spasticity. The SALGOT study also demonstrated that sensorimotor dysfunction was the strongest predictor for both mild and severe spasticity at 12 months.

Our findings emphasize the importance of early recognition of at-risk patients, as prompt intervention—particularly with Botulinum Toxin type A—may limit the progression of hypertonia and improve functional recovery.

Conclusion

Early spasticity developed in approximately one-third of stroke inpatients during rehabilitation. Predictive factors included low Barthel Index, ischemic stroke, obesity, and smoking. Sex, age, and hemiplegic side were not associated with onset.

Early identification of high-risk patients may:

- Prevent or delay spasticity development
- Improve functional outcomes and rehabilitation efficiency
- Optimize timing and cost-effectiveness of interventions (e.g., BoNT-A)

Future research should investigate preventive or very early BoNT-A treatment compared with conventional post-onset administration [9–10].

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