Ambulatory Status Protects against Venous Thromboembolism in Acute Mild Ischemic Stroke Patients

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Introduction: Ischemic stroke patients are at high risk (up to 18%) for venous thromboembolism. We conducted a retrospective cross-sectional study to understand the predictors of acute postmild ischemic stroke patient's ambulatory status and its relationship with venous thromboembolism, hospital length of stay, and in-hospital mortality. *Methods:* We identified 522 patients between February 2006 and May 2014 and collected data about patient demographics, admission NIHSS (National Institutes of Health Stroke Scale), venous thromboembolism prophylaxis, ambulatory status, diagnosis of venous thromboembolism, and hospital outcomes (length of stay, mortality). Chi-square test, *t*-test and Wilcoxon rank-sum test, and binary logistic regression were used for statistical analysis as appropriate. *Results:* A total of 61 (11.7%), 48 (9.2%), and 23 (4.4%) mild ischemic stroke patients developed venous thromboembolism, deep venous thrombosis, and pulmonary embolism, respectively. During hospitalization, 281 (53.8%) patients were ambulatory. Independent predictors of in-hospital ambulation were being married (OR 1.64, 95% CI 1.10-2.49), being nonreligious (OR 2.19, 95% CI 1.34-3.62), admission NIHSS (per unit decrease in NIHSS; OR 1.62, 95% CI 1.39-1.91), and nonuse of mechanical venous thromboembolism prophylaxis (OR 1.62, 95% CI 1.02-2.61). After adjusting for confounders, ambulatory patients had lower rates of venous thromboembolism (OR .47, 95% CI .25-.89), deep venous thrombosis (OR .36, 95% CI .17-.73), prolonged length of hospital stay (OR .24, 95% CI .16-.37), and mortality (OR .43, 95% CI .21-.84). *Conclusions:* Our findings suggest that for hospitalized acute mild ischemic stroke patients, ambulatory status is an independent predictor of venous thromboembolism (specifically deep venous thrombosis), hospital length of stay, and in-hospital mortality. **Key Words:** Ischemic stroke—ambulation—ambulatory status—venous thromboembolism—deep vein thrombosis—pulmonary embolism—protection—odds ratio.

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Introduction

Deep vein thrombosis (DVT) and pulmonary embolism (PE), characterized as venous thromboembolisms (VTEs), are major preventable poststroke complications leading to prolonged hospital stay and increased in-hospital mortality.[1] Prophylaxis against VTEs encompasses pharmacological (unfractionated heparin, low-molecular-weight heparin) and nonpharmacological treatments (pneumatic compression devices, repetitive electrical stimulation, ambulation).[2] Among the myriad of VTE risk factors, nonambulatory status is a major concern for stroke patients.[3] A magnetic resonance direct thrombus imaging study by Kelly et al identified nonambulatory stroke patients as being at high risk for developing VTE.[4] With over 50% of stroke patients unable to walk immediately after stroke,[5,6] ambulation may be a key factor in preventing poststroke VTE.

However, ambulation during hospitalization may be underutilized as a VTE prophylaxis. Recent work showed that over 93% of hospitalized acute stroke patients are sedentary,[7] even though these patients had physician clearance to ambulate. Although there is current work under way for determining whether early mobilization should be conducted during acute stroke,[8] there is limited information concerning the relationship between in-hospital ambulation and the rates of postmild stroke VTE during index hospitalization.

We conducted a retrospective cross-sectional study to determine if ambulation has a protective benefit against VTEs in acute mild stroke patients admitted to an academic medical center. We hypothesized that ambulatory acute stroke patients would have lower rates of VTE, DVT, and PE compared to nonambulatory patients. Our secondary aims were to identify predictors of in-hospital ambulation and study the effect of ambulation on patient's length of hospital stay and in-hospital mortality.

Methods

We conducted a retrospective analysis of consecutive acute stroke patients who were admitted to the University of Kansas Hospital (UKH) between February 2006 and May 2014. This duration corresponds to the amount of time the Get with the Guidelines-Stroke (GWTGS)[9] initiative has been in use at UKH. The GWTGS is a quality improvement program voluntarily used in hospitals. University of Kansas Medical Center's (KUMC) Institutional Review Board approved the study.

We included patients aged more than 18 years and a diagnosis of acute mild ischemic stroke (defined as National Institutes of Health Stroke Scale [NIHSS] score less than 5) confirmed by neuroimaging (computed tomography or magnetic resonance imaging head). Patients without recorded NIHSS and with no match of medical records in the Healthcare Enterprise Repository for Ontological Narration (HERON) database were excluded.

KUMC established an i2b2-based HERON database, a clinical data repository derived from electronic medical records providing electronic access to all patients' clinical, laboratory, and nursing flowsheets. The HERON database is designed to integrate clinical and biomedical data for translational resource purposes, and is used for a variety of research purposes ranging from clinical trials to retrospective studies.[10] Data were obtained from the combination of the GWTGS database and the HERON database. Data included patient demographics, medical history, admission NIHSS, mechanical VTE prophylaxis (intermittent pneumatic compression device or venous foot pumps), chemical VTE prophylaxis (low-dose unfractionated heparin, low-molecular-weight heparin, or warfarin), VTE, DVT, PE, in-hospital mortality, length of hospitalization (based on the median value of 3 days, this data point was dichotomized as normal [less than or equal to 3 days] or prolonged [more than 3 days]), and ambulatory status (ambulated with physical therapy and without assistance) during hospitalization (yes/no). Right and left leg weakness was assessed based on the leg weakness component of the NIHSS. A score of 0 was considered no weakness, and a score of 1 or 2 was considered weakness.

Statistical Analysis

Data were analyzed using JMP version 11 (SAS Institute Inc., Cary, North Carolina, USA) for Windows. For univariate analysis, continuous variables were summarized using their mean and standard deviations or median and interquartile range, and categorical variables were summarized using their frequency counts and percentages. For univariable analysis, chi-square tests were used to test for associations between categorical covariates. Based on whether the normality assumption was valid or not, we used *t*-test or Wilcoxon rank-sum test to compare the continuous variables between ambulatory and nonambulatory groups. All significant variables ($P < .10$) from the univariable analysis were further assessed via binary multivariable logistic regression. We fit 6 separate regression models for the following outcomes: in-hospital ambulation; DVT and/or PE; DVT without PE; and PE without DVT, length of stay (LOS), and mortality. Odds ratios (ORs) along with their corresponding 95% confidence intervals (CIs) are presented to measure the effect size of ambulation on odds of having a VTE during hospitalization, as well as the odds of LOS and mortality. A P value below .05 was considered statistically significant.

Results

A total of 1908 acute ischemic stroke patients were admitted to UKH between February 2006 and May 2014. Seventy-seven percent (1474 of 1908) of the patients had a documented NIHSS in the GWTGS database. Fifty-three percent (781 of 1474) of the patients had NIHSS score less than 5. Sixty-seven percent (522 of 781) of the