

24/7 Neurocritical Care Nurse Practitioner Coverage Reduced Door-to-Needle Time in Stroke Patients Treated with Tissue Plasminogen Activator

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Background: Stroke centers with limited on-site neurovascular physician coverage may experience delays in acute stroke treatment. We sought to assess the impact of providing 24/7 neurocritical care acute care nurse practitioner (ACNP) “stroke code” first responder coverage on treatment delays in acute stroke patients who received tissue plasminogen activator (tPA). *Methods:* Consecutive acute ischemic stroke patients treated with intravenous tPA at a primary stroke center on Oahu between 2009 and 2014 were retrospectively studied. 24/7 ACNP stroke code coverage (intervention) was introduced on July 1, 2011. The tPA utilization, door-to-needle (DTN) time, imaging-to-needle (ITN) time, and independent ambulation at hospital discharge were compared between the preintervention period (24 months) and the postintervention period (33 months). *Results:* We studied 166 stroke code patients who were treated with intravenous tPA, 44 of whom were treated during the preintervention period and 122 of whom were treated during the postintervention period. After the intervention, the median DTN time was reduced from 53 minutes (interquartile range [IQR] 45-73) to 45 minutes (IQR 35-58) ($P = .001$), and the median ITN time was reduced from 36 minutes (IQR 28-64) to 21 minutes (IQR 16-31) ($P < .0001$). Compliance with the 60-minute target DTN improved from 61.4% (27 of 44 patients) in the preintervention period to 81.2% (99 of 122 patients) in the postintervention period ($P = .004$). The tPA treatment rates were similar between the preintervention and postintervention periods ($P = .60$). *Conclusions:* Addition of 24/7 on-site neurocritical care ACNP first responder coverage for acute stroke code significantly reduced the DTN time among acute stroke patients treated with tPA. **Key Words:** Stroke—nurse practitioner—thrombolysis—staffing models—outcomes.

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Introduction

Intravenous tissue plasminogen activator (tPA) has been proven to improve functional outcome in acute ischemic stroke if it is delivered in a timely manner.^{1,3} Although tPA can be beneficial up to 4.5 hours after symptom onset, multiple studies have shown that treatment delay reduces the chance of benefit.^{3,4} Within 90 minutes of symptom onset, only 4.5 patients need to be treated with tPA to benefit 1 patient, but, between 1.5 and 3.0 hours after symptom onset, the number of patients who need to be treated doubles to 9.^{3,5,6} An estimated 1.9 million neurons die every minute after intracranial large-vessel occlusion.⁷

The American Heart Association/American Stroke Association developed the Target Stroke guidelines, a set of best practices, to help institutions eliminate delays in treatment with tPA.⁸ Get With The Guidelines (GWTG)-Stroke has a target door-to-needle (DTN) time of less than 60 minutes.^{3,9} Despite this widely recognized target time, only about one third of acute ischemic stroke patients have tPA initiated within the first hour of hospital arrival.^{9,10}

For treatment of myocardial infarction, specially trained nurses have been shown to safely initiate thrombolytic medications with significantly shorter DTN times in several studies.¹¹⁻¹⁴ A single prior study that evaluated nurse practitioners to help facilitate the treatment of acute ischemic stroke patients showed decreased DTN time.¹⁵ We hypothesized that the introduction of around-the-clock, on-site coverage with neurocritical care-trained acute care nurse practitioners (ACNP) as first responders for acute "stroke code" would shorten DTN time and improve compliance with acute stroke time targets.

Methods

We performed a single-center retrospective cohort study of consecutive acute ischemic stroke patients before and after introduction of 24/7 ACNP first responder coverage for a hospital stroke code team (intervention). We included all consecutive patients with stroke code activations who were treated with intravenous tPA. We excluded patients who were treated with endovascular thrombolytic therapies without first receiving intravenous tPA. All data were obtained from The Queen's Medical Center (QMC), a 505-bed tertiary referral center located in Honolulu, Hawaii. During the study period, QMC was the only Joint Commission-accredited primary stroke center in Hawaii. A retrospective review of the institutional GWTG-Stroke database was performed for the 24-month period (from July 1, 2009, to June 30, 2011) before the introduction of ACNP coverage for stroke code compared to the 33-month period (from July 1, 2011, to March 31, 2014) after the introduction of ACNP coverage.

In the preintervention period, the hospital acute stroke code coverage was staffed by an on-call, board-certified vascular neurologist or neurointensivist but without on-

site neurovascular physician coverage overnight. The inpatient neurology services had no clinical coverage by residents or fellows and all stroke code evaluations were performed by the attending physician. In the preintervention period, the on-call vascular neurologist or neurointensivist had a 30-minute window for arrival to the bedside after the stroke code was activated.

Post intervention, the stroke code pages went to both the on-site ACNP who functioned as a first responder and the neurovascular attending physician on call for stroke code. The 5 ACNPs primarily provided around-the-clock coverage for the hospital neurocritical care unit. Before the intervention, the ACNPs underwent stroke training that included a lecture series, National Institutes of Health Stroke Scale (NIHSS) certification, and 6 months of proctored on-the-job training responding to acute stroke code. Emergency Neurological Life Support training was recommended but was not required.

The 24-month preintervention period was chosen because July 1, 2009, marked the beginning of an exclusive hospital-employed vascular neurologist or neurointensivist stroke code coverage. Before this date, stroke code coverage had been staffed by a hybrid model of hospital-employed neurologists and community neurologists. The hospital-employed vascular neurologists or neurointensivists functioned as the first responder to acute stroke code activations until July 1, 2011. After this date, the on-site ACNP became the first responder for acute stroke code activations.

The role of the ACNP was to take the initial history, obtain the NIHSS score, obtain and review imaging, review the indications and contraindications for tPA, and discuss tPA eligibility with the on-call vascular neurologist by telephone. For patients who were ineligible for tPA, the ACNP documented the clinical encounter. For patients who were eligible for tPA, the on-call vascular neurologist directly evaluated the patient and made the final decision regarding tPA administration. The 33-month postintervention period lasted until March 31, 2014, at which time the Emergency Medical Services began prehospital stroke code activation using the Los Angeles Prehospital Stroke Screen. No other systematic changes to staffing or stroke code care pathways were made during the intervention period.

The hospital policy for stroke code activation required evaluation by the emergency medicine physician after patient arrival to the emergency department (ED). Stroke code was activated for all patients with a new focal neurological deficit and time last known normal within 6 hours. Eligibility for tPA was determined by the stroke code team rather than the ED staff. Hospital policy required in-person evaluation of the patient and administration of the bolus dose of tPA by a provider on the stroke code team, which could be a physician or ACNP. The treatment window for intravenous tPA was 4.5 hours and that for mechanical thrombectomy was 6 hours. All of these policies were unchanged during the pre- and postintervention periods.

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