

Patient Safety Tip of the Week

April 27, 2021

Errors Common During Thrombolysis for Acute Ischemic Stroke

Thrombolytic therapy performed within a relatively narrow temporal window can significantly improve outcomes in patients with acute ischemic stroke. For years, we struggled as only a tiny fraction of patients potentially eligible for thrombolytic therapy were seen, evaluated, and treated within that narrow window. Stroke centers, hub and spoke stroke systems, community triage systems, and teleneurology have significantly helped increase the number of stroke patients eligible for thrombolytic therapy.

But thrombolytic therapy can have adverse consequences, particularly conversion to hemorrhagic stroke. And the risks of such complications increase when errors occur with thrombolytic therapy. A new study ([Dancsecs 2021](#)) assessed the occurrence and nature of errors during thrombolytic therapy with alteplase in regional hospitals and a Comprehensive Stroke Center (CSC).

Two-hundred-twenty-seven (34%) patients received alteplase at the CSC and 448 (66%) patients received alteplase at regional hospitals. Of the patients receiving alteplase at a regional hospital, 58 patients (12.9%) were at an acute stroke ready facility (ASR) while 55 (12.3%) were at a primary stroke center (PSC). The remaining 335 patients (74.8%) received alteplase at a regional hospital with no stroke certification. There were a total of five regional centers that were ASR hospitals and three regional centers that had a PSC designation.

19.8% of patients had an error associated with alteplase administration. 1.5% occurred at the CSC and 18.2% occurred at regional hospitals. Errors occurred at all 3 levels of stroke care at regional hospitals, though they were most frequent at undesignated centers. The most common error identified was receiving an over-dosage of alteplase, all of which occurred in patients receiving alteplase at a regional hospital. Under-dosing and infusion errors were also very common, as was administration of alteplase in patients with apparent contraindications. The most common contributing factor leading to a medication error with alteplase was an **incorrect calculation** (23%). **Incorrect programming of infusion pumps** was also common (20%) and **incorrect patient weight** being used to calculate the dose occurred in 16%.

There were patient impacts from the errors. Patients who had errors associated with alteplase administration more commonly experienced hemorrhagic conversion compared to those who did not have an error with administration (12.7% vs 7.1%). Fortunately, this did not appear to lead to a significant difference in neurologic outcome.

The authors stress that the most common contributing factor leading to a medication error in patients transferred from other facilities was a calculation error, primarily due to the use of incorrect patient weights rather than faulty computations. We discussed the problem of inaccurate weights in thrombolytic therapy in our December 8, 2015 "[Danger of Inaccurate Weights in Stroke Care](#)". Often, in the urgency to administer thrombolytic therapy in a timely fashion, staff do not formally weigh the patient on a scale. They either ask the patient how much they weigh or they estimate the patient's weight themselves. It turns out that estimating a patient's weight frequently results in erroneous weights being used in the dose calculation ([Barrow 2016](#)). Clinicians underestimated mean difference weight by 1.13 kg between estimated and actual weight, but disparities were most likely at the upper and lower extremes of weight. So, some patients will be underdosed, others overdosed. Though 80% of patients received a tPA dose within the acceptable range, 11.5% were underdosed and 8.1% overdosed. When they looked at improvement in NIHSS scores, those patients who received a dose in the acceptable range had the greatest improvement. But those in the "underdosed" range (corresponding to the heaviest patients) had less improvement than those in the "overdosed" range. That heavier, underdosed population accounted for about a third of all their stroke patients. Barrow et al. conclude that beds capable of weighing patients should be mandated in emergency rooms for patients with acute stroke.

Dancsecs et al. recommend that regional hospitals who administer alteplase should have a pharmacist involved in some capacity to handle the complexity of dosing administering alteplase. They also note that tenecteplase dosing (a one-time dose of 0.4 mg/kg) may reduce the rate of non-weight and non-calculation errors compared to alteplase. And they suggest use of a standardized infusion pump library in regional hospitals should also be considered in order to help standardize the rate at which alteplase is infused.

Of course, patient weight issues and infusion pump errors are not unique to thrombolytic therapy. We've listed below our numerous columns on both issues.

While education and training of personnel in regional hospitals on these issues makes sense, there are also important system implications. In many (or most) cases where thrombolytic therapy is administered in a non-stroke-certified hospital, a telemedicine consultation with a stroke center neurologist is undertaken. So, it is important that the stroke center neurologist be cognizant of the patient weight issue and the infusion pump programming issues and advise the regional personnel accordingly at the time of the consultation. Perhaps the stroke center pharmacist could even participate in those telemedicine consultations.

Timely use of thrombolytic therapy can significantly improve neurological outcomes in those patients with acute ischemic stroke who present within the therapeutic window. But we must ensure that thrombolytic therapy be administered safely. We've seen too many cases where past experience with a bad outcome makes regional hospitals hesitant to initiate thrombolytic therapy in patients who are good candidates for it.

Some of our other columns on errors related to patient weights:

March 23, 2010	“ISMP Guidelines for Standard Order Sets”
September 2010	“NPSA Alert on LMWH Dosing”
August 2, 2011	“Hazards of ePrescribing”
January 2013	“More IT Unintended Consequences”
December 8, 2015	“Danger of Inaccurate Weights in Stroke Care”
May 2016	“ECRI Institute’s Top 10 Patient Safety Concerns for 2016”
September 2017	“Weight-Based Dosing in Children”
January 2018	“Can We Improve Barcoding?”
June 2018	“Incorrect Weights in the EMR”
March 2021	“PPSA Reminder: Weigh Your Patients and Do It In Kilograms”

Our prior columns related to infusion pump issues:

- May 2010 [“FDA's Infusion Pump Safety Initiative”](#)
- April 27, 2010 [“Infusion Pump Safety”](#)
- August 2016 [“Home Infusion Therapy Pitfalls”](#)
- March 5, 2019 [“Infusion Pump Problems”](#)
- March 2020 [“ISMP Smart Infusion Pump Guidelines”](#)
- August 4, 2020 [“Intravenous Issues”](#)
- November 10, 2020 [“More on Infusion Pump Errors”](#)

References:

Dancsecs KA, Nestor M, Bailey A, et al. Identifying errors and safety considerations in patients undergoing thrombolysis for acute ischemic stroke. Am J Emerg Med 2021; 47: 90-94

<https://www.sciencedirect.com/science/article/abs/pii/S0735675721002291?via%3Dihub>

Barrow T, Khan MS, Halse O, et al. Estimating Weight of Patients With Acute Stroke When Dosing for Thrombolysis. Stroke 2016; 47(1): 228-231; Published ahead of print November 10, 2015

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