

Improvement in Thrombolytic Therapy Administration in Acute Stroke with Feedback

Esseddeeg Ghrooda, Susan Alcock, Alan C. Jackson

ABSTRACT: Background: The benefits of intravenous recombinant tissue plasminogen activator (rt-PA) in acute ischemic stroke is time dependent. Guidelines recommend a door-to-needle (DTN) time of less than 60 minutes. **Methods:** A retrospective audit of 730 stroke charts from 2008 – 2011 was conducted at Health Sciences Centre. 158 patients treated with IV rt-PA were identified. The time intervals between Emergency Department (ED) arrival, administration of rt-PA and uninfused brain computed axial tomographic scan (CT) were recorded. From this, CT to needle times were calculated. During November 2010 to January 2011 feedback was given to neurologists, ED physicians, ED nurses, and CT technologists. This raised awareness and emphasized the importance of this time driven protocol. **Results:** The median DTN times for 2008, 2009, and 2010 were 69, 71 and 76 minutes respectively. The median CT-to-needle time for this time period was 47 minutes. In 2011 (n =58) the median DTN time was 49 minutes and the median CT-to-needle was 18 minutes, which were marked improvements ($p < 0.00005$ and $p < 0.005$, respectively). In 2008-2010 only 31% of treated patients (n=100) received rt-PA within 60 minutes, whereas in 2011 this increased to 64%. **Conclusions:** Dramatic improvements in DTN times and in the percentage of patients receiving rt-PA treatment within 60 minutes were observed in 2011 after feedback was provided regarding the suboptimal performance. Prior to receiving feedback, DTN times were similar to national median DTN times. All centres administering rt-PA for acute ischemic stroke should monitor their clinical performance and give feedback on a regular basis.

RÉSUMÉ: Amélioration du délai de traitement thrombolytique dans l'accident vasculaire cérébral aigu et rétroaction auprès des soignants.

Contexte : Les bénéfices de l'administration intraveineuse de l'activateur tissulaire recombinant du plasminogène (rt-PA) dans l'accident vasculaire cérébral (AVC) ischémique aigu est fonction du temps écoulé depuis le début des symptômes. Les lignes directrices recommandent un délai de l'arrivée du patient à l'administration du traitement thrombolytique de moins de 60 minutes. **Méthode :** Nous avons effectué une révision de 730 dossiers de patients admis au Health Sciences Centre pour AVC de 2008 à 2011. Nous avons identifié 158 patients traités par rt-PA intraveineux. Le temps écoulé entre l'arrivée au service des urgences (SU), l'administration de rt-PA et la tomодensitométrie cérébrale sans contraste ont été colligés afin de calculer le temps écoulé entre la tomодensitométrie et la thrombolyse. Nous en avons informé les neurologues, les urgentologues, les infirmières du service des urgences et les techniciens entre novembre 2010 et janvier 2011, ce qui a contribué à les sensibiliser et a souligné l'importance de ce délai. **Résultats :** Le temps médian écoulé de l'arrivée du patient à la thrombolyse était de 69 minutes en 2008, 71 minutes en 2009 et 76 minutes en 2010. Le temps médian écoulé de la tomодensitométrie à la thrombolyse était de 47 minutes. En 2011, chez 58 patients, le temps médian écoulé de l'arrivée du patient à la thrombolyse était de 49 minutes et de 18 minutes de la tomодensitométrie à la thrombolyse, ce qui constitue une amélioration notoire ($p < 0,00005$ et $p < 0,005$ respectivement). En 2008-2010, seulement 31% des patients traités (n = 100) ont reçu le rt-PA en dedans de 60 minutes, alors qu'en 2011 64% de ces patients l'ont reçu en dedans de 60 minutes. **Conclusions :** Une amélioration importante du délai entre l'arrivée du patient et la thrombolyse et du taux de patients qui reçoivent le rt-PA en dedans de 60 minutes a été observé en 2011, après le retour d'information aux soignants concernant le traitement sous-optimal de ces patients. Avant ce retour d'information, les délais de l'arrivée à la thrombolyse étaient similaires aux délais médians nationaux. Tous les centres où le rt-PA est administré chez des patients atteints d'un AVC ischémique aigu devraient évaluer leur performance clinique avec retour d'information régulièrement au personnel concerné.

Can J Neurol Sci. 2012; 39: 789-792

The use of intravenous recombinant tissue plasminogen activator (rt-PA) has revolutionized the approach to the treatment of acute ischemic stroke.¹⁻⁵ Current evidence demonstrates a strong inverse relationship between treatment delay and clinical outcome.¹ Eligible patients should be treated without delay, regardless of when they present in the 4.5 hour treatment window.¹ Time to treatment with intravenous rt-PA is an important determinant of 90-day and one-year functional outcomes in acute ischemic stroke.⁶ The earlier that rt-PA is given in the therapeutic window to eligible ischemic stroke patients, the better their outcomes.⁷ Patients presenting with acute ischemic stroke who are eligible for thrombolysis

represent a group in which emergency department (ED) care is time-critical and rapid mobilization of resources is required.⁸ Reducing door-to-needle (DTN) times and increasing the portion of eligible acute ischemic stroke patients who receive rt-

From the Department of Internal Medicine (Neurology) (EG, ACJ), University of Manitoba and Health Sciences Centre (SA), Winnipeg, Manitoba, Canada.

RECEIVED MAY 8, 2012. FINAL REVISIONS SUBMITTED JUNE 26, 2012.

Correspondence to: Alan C. Jackson, Health Sciences Centre, GF-543, 820 Sherbrook Street, Winnipeg, Manitoba, R3A 1R9, Canada. Email: ajackson2@hsc.mb.ca.

PA within one hour of hospital arrival are important goals and these performance measures have been highlighted in the current Best Practice Recommendations by the Canadian Stroke Strategy.¹ Hyperacute stroke management protocols ensure rapid delivery of acute stroke victims to stroke ready hospitals. They also promote rapid assessment of acute stroke patients, appropriate and timely diagnostic investigations, and expertise in stroke neurology. Benchmarks from the American Stroke Association, which have been adopted in Canada, recommend that uninfused brain computed axial tomographic scan (CT) completion occur within 25 minutes, CT interpretation within 45 minutes, and administration of intravenous rt-PA within 60 minutes of arrival in the ED for eligible patients.⁸

The Canadian Stroke Strategy has developed core performance measures as a standardized means to measure best practice quality stroke care delivery across the stroke continuum.¹ In a variety of clinical studies, providing feedback on clinical performance indicators have been shown to improve clinical performance and patient outcomes.⁹⁻¹³ Using these performance measures can also demonstrate the impact of implementing best practice care practices at an institutional or regional level. Audit and feedback are widely used strategies in many professional practices.⁹ If a process measure and an outcome are linked, interventions that improve the process measure should theoretically improve the outcome.¹²

METHODS

This retrospective study was performed on patients presenting to Winnipeg Health Sciences Centre (HSC) as acute stroke emergencies. Patients were identified by the HSC stroke database, which captures all patients diagnosed with stroke that were admitted through the ED with or without rt-PA administration. After patients were identified, we performed our retrospective chart audit, which encompassed about 730 charts from January 2008 - December 2011 and 158 patients given intravenous rt-PA were identified. The following times and time intervals were obtained: (1) door time – arrival time was obtained from the ED record, (2) CT time – time of uninfused CT that was documented on the digital images, (3) needle time – time that administration of the rt-PA bolus was initiated, which was documented in nursing notes, (4) door-to-CT time: time interval from ED arrival to CT, (5) door-to-needle (DTN) time: time interval from ED arrival to time that administration of the rt-PA bolus was initiated, and (6) CT-to-needle time: calculated from DTN minus door-to-CT time. CT angiograms were completed in 86% of the cases and this activity took place during the CT-to-needle time.

Feedback on performance was given to the neurologists, ED physicians, ED nurses, ED unit assistants, ED unit clerks, laboratory technologists, and CT technologists. A PowerPoint presentation was developed reviewing the use of rt-PA in acute ischemic stroke at HSC. An overview of our stroke emergency protocol and feedback on performance during 2008, 2009, and 2010 were provided. Emphasis was placed on the importance of working quickly with this time driven protocol. The first presentation was given in November 2010 to performance naive neurologists and neurology residents. Four seminars were provided to the ED staff using the same format. The CT technologists and the laboratory technicians were given similar

seminars as well as basic information about stroke. Lastly, in June, 2010 stroke education was provided to all ED staff during annual education events. One hour sessions were delivered during May 2011 that included all nurses, nurse practitioners, unit assistants, unit clerks and community support workers who were employed in adult ED. They were provided with basic information about stroke, stroke recognition, an overview of the time driven protocol, and feedback on our suboptimal performance. Emphasis was placed on this being a time driven performance. In addition, two ambitious goals of care for 2011 were set and shared with all multidisciplinary team members: (1) a median DTN time of 50 minutes and that (2) 80% of eligible candidates would receive rt-PA within 60 minutes of arrival in the ED. Along with increasing knowledge of stroke recognition and stroke treatment protocols, our feedback and education motivated and engaged all team members involved with stroke emergencies.

Beginning in January 2011 we also developed an interdisciplinary HSC stroke committee. Membership includes representation from the Winnipeg Fire Paramedic Service (WFPS), the emergency department (nursing and physician), neurology program, CT scan technologists, neuroradiology, the clinical laboratory, and the admitting department. Meetings are held quarterly with ongoing feedback.

Changes in median times of performance measures were statistically compared using Student's t tests.

RESULTS

The median DTN times for 2008 (n = 28), 2009 (n = 33), and 2010 (n = 39) were 69, 71, and 76 minutes, respectively (Table below). In 2011 (n = 58) the median DTN time was 49 minutes. The median door-to-CT time for 2008 - 2010 was 27 minutes, whereas the median CT-to-needle time for this time period was 47 minutes. In 2011 the median door-to-CT time was 18 minutes and the median CT-to-needle was 34 minutes. Significant improvements were noted in all three time intervals: DTN time (p < 0.0005), door-to-CT time (p < 0.005), and CT-to-needle time (p < 0.0005).

Table: Data on cases given rt-PA at HSC from 2008 to 2011

Category	2008	2009	2010	2011
Number. of rt-PA cases	28	33	39	58
Median door-to-needle time	69	71	76	49
Median door-to-CT time	27.5	29	22	18
Median CT-to-needle time	50	43.5	48	34
Percentage of rt-PA cases less than 60 minutes	43%	18%	33%	64%

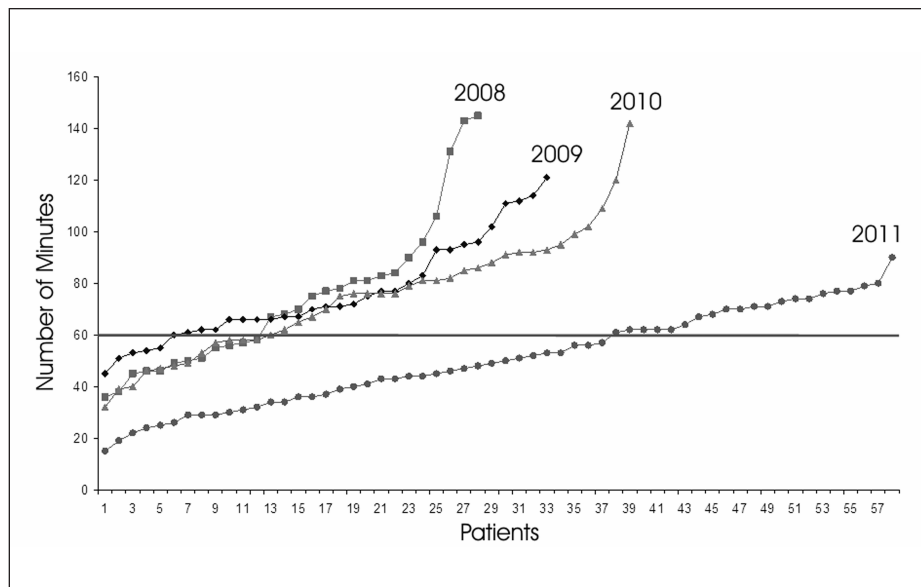


Figure: Graph showing door-to-needle times for all patients from 2008 – 2011, which indicates a marked improvement for 2011, showing the entire range of times arranged from shortest to longest.

In 2008 – 2010 only 31% of patients (n=100) treated with rt-PA received treatment within 60 minutes (Figure). The number of patients who received rt-PA within 60 minutes of arrival in 2011 (n=58) increased to 64%. All eleven cases with DTN times greater than 70 minutes were analysed. In two cases, blood pressure management prior to rt-PA administration accounted for the delay. In one case, the patient required intubation for airway protection prior to CT. In one case the delay was in part attributed to waiting for the INR result because the patient was on warfarin. In the remaining seven cases, the cause of the delay could not be clearly determined.

DISCUSSION

Due to the audit conducted and the feedback given to all key members of our stroke team, marked and statistically significant improvements were demonstrated in 2011 DTN times, door-to-CT times, and in the percentage of eligible patients who received rt-PA within 60 minutes of arrival in the ED. This reinforces the need for a program or institution to monitor core performance measurements in their practice while evaluating best practice care delivered by front line staff. Knowledge and adherence to benchmarks and indicators by staff improves patient outcomes. Benchmarks can be used in daily practice and they give staff a measurement or guide in which to evaluate their practice right at the time of delivery of care. The feedback given to our multidisciplinary team provided members with insights on their actual versus perceived performance. Many team members were completely unaware of the suboptimal performance prior to receiving feedback.

Compared to Canadian national DTN times reported by the Canadian Stroke Network, the median DTN times of 69, 71, and 76 minutes in 2008, 2009, and 2010, respectively, were similar

to the national figure of 72 minutes for 2008-2009.¹⁴ In 66% of Canadian cases where rt-PA was administered, DTN times were greater than one hour.¹⁴ Between 2005 and 2009 the median DTN times ranged between 79 and 82 minutes in all United States hospitals, indicating an even more suboptimal performance in the United States than in Canada.⁶ In 2009 in all United States hospitals 71% of patients had DTN times greater than one hour.⁶ The percentage of rt-PA candidates at HSC receiving rt-PA after one hour of arrival for 2008, 2009, and 2010 was 57%, 82%, and 67%, respectively, also indicating a similar performance with other sites. In 2011 the median DTN time at HSC dropped to 49 minutes and the percentage of patients receiving rt-PA after one hour of arrival decreased to 36%, indicating a performance much better than both Canadian and United States figures. Due to education regarding this time driven protocol and feedback demonstrating our suboptimal performance, there were highly statistically significant improvements in these core indicators. These improvements are likely due to the feedback provided to our multidisciplinary team regarding our suboptimal performance. Clinical chart audits and performance measures using evidence-based indicators are paramount when it comes to delivering best practice, and they help clinicians deliver evidence-based care. Our success can also be attributed to the high attendance rate at the mandatory education sessions, likely related to endorsement at senior management levels. We believe that the quality improvements have likely led to improved clinical outcomes, although this could not be assessed. A sense of pride and enthusiasm was observed in the ED staff in particular. There were no new direct costs incurred as a result of this initiative.

The beneficial effects of feedback on performance may decline over time.¹² The frequency or interval that feedback

needs to be given in order to maximize effectiveness needs to be studied.¹² We believe ongoing feedback and education will be important to maintain excellent DTN times in this time driven protocol, especially for new staff in the multi-disciplinary team. A HSC stroke committee has been formed, which will also provide a forum for ongoing feedback at regular intervals. The need for a prospective database has been identified by the authors, which will simplify data collection in the future.

This study provides strong evidence that collecting data on clinical performance of local practices and providing feedback to a hyperacute stroke care team can in itself, lead to marked improvements in DTN time and percentage of patients receiving rt-PA within one hour of arrival to hospital. Emphasizing the importance of working quickly in this time driven protocol and awareness of suboptimal performance can lead to marked improvements. Continued data collection and regular feedback will likely be required to maintain the improved performance of the stroke care team members.

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