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Publication Alert Newsletter

To continue to improve timely access to intravenous (IV) recombinant tissue plasminogen activator (rtPA) for more patients with acute ischaemic stroke (AIS), barriers to treatment are being addressed and new processes are being introduced.

Two recent articles have highlighted how implementing new processes to improve access to, and timeliness of, thrombolysis can lead to economic as well as societal benefits; with the costs of implementation being offset by savings from reduced dependency of patients.[1,2]

This issue of the Actilyse® Publication Alert Newsletter highlights studies that have successfully challenged known economic, organizational and educational barriers to thrombolytic therapy, together with publications that describe behavioural and other treatment barriers yet to be overcome.

Please be aware that the purpose of this Newsletter is to make you familiar with the most recent publications, and you must keep in mind that not all aspects are covered by the product label for alteplase in your country.
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Guideline-recommended early stroke care is associated with cost savings

Stroke care costs are a substantial healthcare burden. However, a new study demonstrates that hospital-based costs can be reduced by delivering guideline-recommended stroke care as early as possible, particularly by admitting patients early to a stroke unit.[1]

The more recommended processes of care a patient received (e.g. early admission to a stroke unit, early computed tomography [CT]/magnetic resonance imaging [MRI] scan), the shorter their hospital stay and the lower their hospital cost. IV rtPA use also increased with increasing adherence to guideline-recommended care.

'The relationship between receiving more relevant processes of early stroke care and lower hospital costs followed a dose–response relationship.'[1]

The authors conclude that early guideline-recommended stroke care, particularly early admission to a stroke unit and early mobilization, may be associated with hospital cost savings.

Study details

- Data from a prospective national stroke registry in Denmark (Jan 2005 to Dec 2010)
- 5909 adults hospitalized for a first acute stroke and discharged within 1 year
- Hospital costs estimated for acute care, intensive care, and rehabilitation during the first year after stroke
- Processes of care that were examined were: early admission to a stroke unit; early CT/MRI scan; early initiation of antiplatelet or anticoagulant therapy; early assessments for swallowing, constipation, and nutritional risk; early assessment by a physiotherapist and occupational therapist; early mobilization; intermittent catheterization; and thromboembolism prophylaxis
- **Greater use of guideline-recommended processes of care was associated with shorter hospital stays and potential cost savings**
- The largest potential savings were for:
    - early vs delayed stroke unit admission (adjusted difference −$18 428)
    - early vs delayed mobilization (adjusted difference −$18 783)
- Patients admitted to a stroke unit or university hospital generally received more processes of care

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Study details (continued)

Proportion of guideline-recommended processes received	Mean (SD) length of stay, days	Received thrombolysis	Costs, $	
			Mean (SD) adjusted	Adjusted difference (95% CI)*
0–24%	31.4 (33.4)	1.8%	41 278 (16 814)	Reference
25–49%	28.8 (33.9)	3.3%	35 548 (14 846)	−5729 (−2140 to −9318)
50–74%	24.5 (31.2)	6.6%	28 075 (11 920)	−13 203 (−10 070 to −16 335)
75–100%	16.3 (26.1)	15.0%	16 711 (7684)	−24 566 (−19 364 to −29 769)

*Adjusted for age, gender, marital status, housing, profession, alcohol intake, smoking habits, modified Rankin Scale Score prior to admission, atrial fibrillation, hypertension, hyperlipidaemia, Charlson comorbidity index, Scandinavian Stroke Scale Score upon admission, type of stroke, year of hospitalization, stroke unit setting, stroke unit volume, hospital university status, and treatment with thrombolysis

Strategies that increase access to thrombolysis by optimizing the care pathway for acute stroke will result in cost savings and improved patient quality of life

The cost-effectiveness and feasibility of seven different hypothetical strategies to optimize acute stroke care and increase thrombolysis rates have been explored in an economic model.[2]

All of the strategies increased the number of thrombolysed patients, and all were associated with cost savings and improved patient quality of life. The change with the largest potential benefit was better recording of onset time.

The authors conclude that a variety of interventions to increase thrombolysis rates for acute stroke in clinical practice would be cost-effective, and significant investment in implementation could be quickly repaid by savings made because of reduced dependency.

'…any strategy that increases thrombolysis rates will result in cost savings and improved patient quality of life.'[2]

Study details

- Decision-tree model based on current management of acute stroke from onset to outcome (death, dependency, or independency) populated with data from 488 patients admitted with suspected stroke to two UK hospitals (Aug 2010 to Jul 2011); 355 admissions confirmed as AIS; 33 (9%) received thrombolysis
- Assessed impact of hypothetical change strategies on patient outcome (QALYs), costs, and resource use
- **All proposed strategies reduced costs, improved outcomes, and increased thrombolysis rates**
- The best-performing achievable strategy was improving the recognition and recording of stroke onset
    - Per 100 000 population, an extra four patients would receive thrombolysis (from 21, by current practice, to 25; an increase of 21%)

Achievable change strategies	Lifetime costs per 100 000 population*, $	Incremental cost, $	Effectiveness, QALYs	Incremental effect, QALYs
Current practice	20 813 510	–	2251.08	–
Divert GP calls to EMS	20 781 204	−32 305	2253.34	2.26
Use imaging to estimate onset time for wake-up strokes	20 770 925	−42 584	2254.12	3.05
Improve recognition and recording of onset time	20 767 988	−45 521	2254.36	3.28
Reduce time to call EMS	20 797 357	−16 153	2252.21	1.14
Immediate CT scan	20 788 546	−24 963	2252.88	1.81
Better stroke recognition tools	20 773 862	−39 648	2253.88	2.81
Extend thrombolysis eligibility to >85 y	20 775 330	−38 179	2253.85	2.77

*Assumes 221 patients will have an ischaemic stroke and 99 a stroke mimic, per 100 000 population, per year

A policy of prehospital triage to primary stroke centres reduces treatment delays and increases rtPA treatment rates

A US study has shown that preferential triage of suspected stroke patients to the nearest primary stroke centre (PSC), bypassing closer hospitals, if necessary, reduced treatment delays by almost 30 mins and increased thrombolysis rates with no impact on patient safety.[3]

'Implementation of a prehospital stroke triage policy resulted in significant improvements in emergency medical services use and prenotification and more than doubled IV rtPA use at PSCs.'[3]

Implementation of the triage policy was accompanied by a significantly greater use of emergency medical services' (EMS) transport for suspected stroke patients, an increase in EMS prenotification, shorter onset-to-arrival times, and shorter onset-to-treatment times (OTTs). A significant increase in rtPA use occurred, which was sustained over the following 2 years.

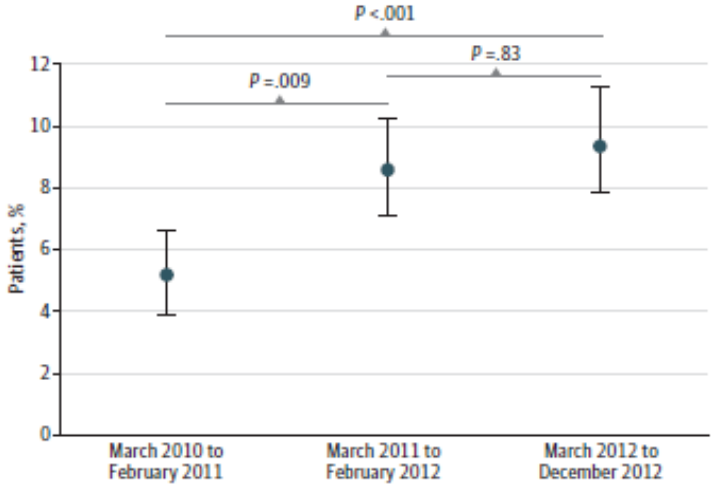
The authors conclude that a citywide stroke system of care that includes a preferential triage policy and paramedic/public education can have a **significant, immediate, sustainable impact on IV rtPA use**.

Study details

- Retrospective multicentre cohort study of all stroke or TIA patients discharged from 10 PSCs in Chicago
  - Comparison of rtPA use in the 6 months before (n=1075) and 6 months after (n=1172) implementation of a citywide policy to triage suspected stroke patients to the nearest PSC (Sep 2010 to Aug 2011)
- The post-triage period was independently associated with increased rtPA use for patients with ischaemic stroke presenting through the ED (adjusted OR: 2.21; 95%CI: 1.34–3.64; *p*=0.002)
- In-hospital mortality did not differ in the two measurement periods

Variable	Patients with ischaemic stroke	
	Pretriage (n=719)	Post-triage (n=787)
ED arrival via EMS	37.0%	46.6%**
EMS prenotification (patients arriving via EMS)	62.0%	78.5%**
Onset-to-ED arrival time ≤60 mins	7.5%	13.7%**
In-hospital mortality	4.2%	4.3%
IV rtPA use for ischaemic stroke	**3.8%**	**10.1%****
OTT, mean (SD)	171.7 (46.2) mins	145.7 (55.7) mins*
DNT, mean (SD)	102.9 (26) mins	89.5 (47.3) mins

**p*<0.5, ***p*<0.001 vs pretriage



Proportion of patients treated with rtPA:

- one year prior to policy implementation (Mar 2010 to Feb 2011; n=1181)
- first year after implementation (Mar 2011 to Feb 2012; n=1330)
- second year after implementation (Mar 2012 to Dec 2012; n=1147)

(point estimates and 95%CIs)

Implementation of Target: Stroke 10 best practices reduces treatment delays and increases rtPA treatment rates

Implementing a set of Target: Stroke best practices at a tertiary care hospital significantly reduced door-to-CT time and door-to-needle time (DNT) and doubled the percentage of patients who received rtPA.[4]

'…the rapid improvement in our timeliness of care is likely associated with the changes to our acute stroke protocol.'[4]

The percentage of patients who received a CT scan within the recommended timeframe also doubled, as did the proportion with DNT ≤60 mins. The authors conclude that implementation of the 10 best practices is not only feasible but also leads to faster treatment for patients with acute stroke.

Study details

- Retrospective analysis of prospectively collected data from the GWTG-Stroke registry
- Comparison of patients with AIS admitted directly to a tertiary care hospital ED, in the 3 years before and 3 years after implementation of a new acute stroke care model in 2007 (model included 10 best practices to lower DNT, all later incorporated into Target: Stroke Guidelines)
- Postintervention, treatment delays were substantially reduced and rtPA treatment rates almost doubled
- Similar findings in patients treated with rtPA who presented within 3 hours of last-known-well

Key characteristics	Preintervention (n=1413)	Postintervention (n=925)
Last-known-well to door time, median (IQR) hours	9.6 (3.0–36.1)	8.3 (2.0–26.3)
Arrival ≤3 hours, %	25.4	33.4
Door to CT, median (IQR) mins	71 (37–156)	59 (24–142)
Door to CT ≤25 mins, %	12.6	27.7
IV rtPA, %	8.2	15.4
Last-known-well to IV rtPA, median (IQR) mins	124 (100–162)	105 (75–148)
DNT, median (IQR) mins	70 (56–85)	47 (32–62)
DNT ≤60 mins, %	32.1	70.3

All $p \leq 0.002$ for postintervention vs preintervention

Neurohospitalist evaluation could improve the timeliness of rtPA administration

At a tertiary care PSC, DNT was significantly faster among patients with AIS who were evaluated by neurohospitalists compared with non-neurohospitalists.[5] Such patients were five times more likely to have a DNT ≤60 mins. The authors conclude that neurohospitalist evaluation could be a part of a multidimensional initiative to improve the timeliness of rtPA administration.

Study details

- Retrospective analysis of 107 consecutive patients with AIS who received IV rtPA within 4.5 hours at a tertiary care PSC ; comparison of patients evaluated by neurohospitalists vs non-neurohospitalists (community neurologists and additional locums neurologists; Jul 2009 to Sep 2011)
- DNT was significantly shorter in patients evaluated by neurohospitalists
- Independent factors associated with DNT ≤60 mins were:
  - time taken to complete an rtPA inclusion/exclusion criteria checklist (OR: 6.2; 95% CI: 1.7–19.6; p=0.022)
  - inpatient neurohospitalist evaluation (OR: 5.4; 95% CI: 2.4-10.1; p=0.03)

Key characteristics	Neurohospitalists	Non-neurohospitalists
rtPA administration rate, n/N (%)	47/484 (9.7)	60/745 (7.7)
DNT, mean ± SD (range) mins	68 ± 18	93 ± 24*
DNT ≤60 mins, n (%)	24 (51)	9 (15)*
Door-to-checklist time, mean ± SD mins	44 ± 6	71 ± 14*
Door-to-checklist time ≤45 mins, n (%)	30 (90)	37 (50)*
Door to CT time, mean ± SD mins	27 ± 5	28 ± 7

*p<0.05 for neurohospitalists vs non-neurohospitalists

An acute stroke care pathway simulation may be used to identify barriers and test solutions to improve thrombolysis treatment times

A computer simulation model that accurately reproduces the AIS care pathway from onset to rtPA administration was used to investigate strategies for improving thrombolysis treatment time.[6]

Two main time-related barriers to rtPA utilization were identified:

- time spent at pick-up location by EMS
- time to laboratory results

Two theoretical solutions were tested to overcome these unnecessary delays:

- a scoop-and-run protocol to shorten time at pick-up location
  - rtPA treatment rate increased by 1.4% and OTT decreased by 7 mins
  - 5% shift toward rtPA treatment within 90 mins (away from later time periods)
- a point-of-care (POC) diagnostic device
  - rtPA treatment rate increased by 3.2% and OTT decreased by 20 mins
  - 19% shift toward rtPA treatment within 90 mins (away from later time periods)

The authors conclude that their simulation-based approach is well suited to assessing barriers along the stroke care pathway and they were able to convincingly demonstrate the potential for improving thrombolytic treatment using two simple interventions.

'…introducing a scoop-and-run protocol for ambulance personnel and a POC device to reduce time to laboratory analysis may substantially improve rate and timing of rtPA treatment.'[6]

rtPA treatment delays can be reduced by a variety of prehospital and in-hospital strategies

Showing patients with AIS a short video illustrating how rtPA works and the risks and benefits of treatment, while they wait for their CT scan, could expedite and improve the informed consent process and reduce DNT.[7]

After introducing the video alongside several other organizational strategies in a community hospital in Taiwan, door-to-CT time decreased (from 32 to 20 mins), DNT decreased (from 93 to 57 mins) and thrombolysis rates increased (from 2% to 5%).

The video is available at: http://www.youtube.com/watch?v=v0kHeUHV_gs&feature=youtu.be

A number of recently presented abstracts describe reductions in DNT after implementing various changes to the stroke care pathway:

- a 'Code Stroke' algorithm[8]
- Target: Stroke strategies[9]
- weekly debrief of rtPA cases to identify areas for improvement[10]
- a 'nurse stroke specialist' model of care[11]
- streamlining ED processes[12]
- defining role responsibilities to ensure effective internal communication[13]
- value stream analysis to improve efficiency in processing patients with acute stroke[14]

The CLOQS (Countdown Lights to Optimize Quality in acute Stroke) study aims to determine whether a large red stopwatch attached to the stretcher of patients with acute stroke on their arrival at the ED, as a reminder that 'time is brain', will alter the behaviour of stroke care teams and reduce treatment times in hospitals in Toronto.[15]

'Reducing rtPA treatment times is the single most important modifiable factor to improve patient outcomes from hyperacute stroke care.'[15]

Promoting ambulance use for patients with AIS may increase rtPA use

In a retrospective database analysis of 114 194 patients admitted with AIS to 603 hospitals in Japan (Jul 2010 to Mar 2012), patients arriving by ambulance were four times more likely to receive rtPA than those who did not, even after adjustment for covariates.[16]

Financial and organizational barriers to rtPA use in Latin America have been overcome in Brazil

La Rosa and Broderick review the barriers to modern stroke care delivery that exist in emerging economies, where few to no patients receive thrombolysis.[17]

Stroke care barriers include cost (stroke prevention strategies are funded in preference to thrombolytic therapy); lack of access to EMS and to stroke units; lack of physician awareness of treatment guidelines; and lack of public awareness of stroke.

Nevertheless, steps are being taken to overcome such barriers. Martins et al. describe initiatives that have been implemented since 2008 to address stroke care barriers in Brazil.[18] The key elements of the 2012 National Stroke Policy Act include:

- definition of the requirements and levels of stroke centres (there are now at least 82 stroke centres in Brazil, all offering thrombolytic therapy)
- improved reimbursement for stroke care and rtPA treatment
- promotion of stroke telemedicine
- definition of the Line of Stroke Care (to integrate resources and other health programmes)
- increased funding for stroke rehabilitation
- funding for training of healthcare professionals
- initiatives to increase awareness about stroke within the population

Behavioural barriers adversely affect neurologists' thrombolysis decisions

Optimizing processes of care and orchestrating pre- and in-hospital systems is important to reduce treatment delays, but behavioural barriers to rtPA use also need to be overcome.

An online survey of neurologists in Canada showed that uncertainty, beliefs, and biases adversely influence clinical decisions regarding thrombolysis use in eligible patients.[19]

> *'…the management of acute stroke is affected by uncertainty, beliefs, and biases'*[19]

Neurologists experienced in providing acute stroke care were less likely to administer rtPA to patients with dementia, patients from a nursing home, patients aged >80 years, patients with more severe stroke, or following a large left middle cerebral artery stroke.

An accompanying editorial attributed these decisions to neurologists' assumptions about prognosis and quality of life, and concluded the following:[20]

> *'Keeping in mind that IV rtPA is a standard of care for acute stroke management, clinicians should recognize when and why they are making value judgments rather than clinical judgments about the role of rtPA in a specific stroke patient'*[20]

Diurnal variations in rtPA use influence patient outcome

Lorenzano et al. have shown that during day hours and weekdays, patients with AIS were treated more quickly and were more likely to receive rtPA compared with night hours or weekends, and treatment during daytime was an independent predictor of favourable outcomes.[21] They conclude that the frequency of rtPA treatment appears to follow the same circadian pattern of stroke incidence, whereas its correspondence to a weekly pattern was less clear.

Inaccuracies in weight estimation can lead to errors in rtPA dose

A prospective UK study of patients who received thrombolysis revealed the majority had their weight estimated inaccurately by the stroke team.[22] This resulted in dosing errors for 97 patients (64 underdosed and 33 overdosed), although the majority of errors were <10 mg. Clinical outcomes were largely favourable. Rather than estimating weight visually, the authors recommend obtaining patient weight directly from the patient or their family, estimating weight based on anthropomorphic measurements, or using a trolley or bed with a calibrated weighing scale.

Economic and legislative barriers to telestroke services can be alleviated

In reviewing existing barriers to telestroke implementation in the USA, Aita et al. make several recommendations to overcome these obstacles, which they believe will increase telestroke uptake.[23]

'Telestroke should be considered for full reimbursement in any location where the service is available.'[23]

The main obstacles to telestroke services are economic (cost-effectiveness, billing, compliance, and reimbursement) and legislative (state licensing). Aita et al. believe that updating healthcare policy and law, so that reimbursement is not constrained by geographic location and physicians are licensed to practice across state borders, will lead to

'…a broader acceptance and adoption of telestroke and thereby improve access of patients with acute stroke to expert neurological consultation and treatment in a timely fashion.'

'Telemedicine provides a means to increase access to limited specialty expertise and facilitate timely remote neurological assessment, neuroimaging evaluation, and therapeutic decision making for patients with acute stroke'

Novel 'mesh' telestroke model overcomes the challenge of too few specialists

A novel 'mesh' telestroke model has been developed in a region of Scotland.[24] In this alternative to a hub-and-spoke model, six stroke specialists from three separate hospitals cover all sites in a single rota. During normal working hours, the specialist assesses patients at their own site face-to-face and at the other sites via telestroke. Out-of-hours cover is via telestroke from the specialist's home.

'This model of telemedicine could be replicated to provide safe thrombolysis to areas with challenging infrastructure, geography or insufficient stroke specialist cover.'[24]

During model implementation (between 2008 and 2011), 51 of the first 100 patients treated with rtPA were assessed by telestroke. Telestroke patients generally presented in the afternoon and early evening.

Median DNT was 82 mins for face-to-face and 103 mins for telestroke assessments. The proportions of patients discharged home were similar.

Telestroke does not delay rtPA treatment

Similar mean DNT times were reported for patients with AIS who received IV rtPA at a Chicago community hospital whether the neurologist attended at the bedside during the day (76 mins) or via telestroke at night and weekends (83.5 mins).[25]

Research is ongoing into identifying patients who may benefit from rtPA

Two recent reviews discuss how advanced neuroimaging could be used to select patients who are likely to show a good response to thrombolytic therapy, based on penumbra size.[26,27]

CI, confidence interval; ED, emergency department; GP, general practitioner; GWTG-Stroke, Get With The Guidelines-Stroke; IQR, interquartile range; OR, odds ratio; QALY, quality-adjusted life-year; SD, standard deviation; TIA, transient ischaemic attack.

References

1. Svendsen ML, Ehlers LH, Hundborg HH et al. Processes of early stroke care and hospital costs. Int J Stroke 2013. NA Journal link
2. Penaloza-Ramos MC, Sheppard JP, Jowett S et al. Cost-effectiveness of optimizing acute stroke care services for thrombolysis. Stroke 2014;45:553-62. PubMed Link Journal link
3. Prabhakaran S, O'Neill K, Stein-Spencer L et al. Prehospital triage to primary stroke centers and rate of stroke thrombolysis. JAMA Neurol 2013;70:1126-32. PubMed Link Journal link
4. Ruff IM, Syed A, Rost N et al. Improving Door-to-Needle Times with Target Stroke. Stroke 44:A18, 2013 Journal link
5. Bhatt A, Shatila A. Neurohospitalists Improve Door-to-Needle Times for Patients With Ischemic Stroke Receiving Intravenous tPA. Neurohospitalist 2012;2:119-22. PubMed Link Journal link (free full text)
6. Lahr MM, van der Zee DJ, Luijckx GJ et al. A simulation-based approach for improving utilization of thrombolysis in acute brain infarction. Med Care 2013;51:1101-5. PubMed Link Journal link (free full text)
7. Hsieh C-Y, Chen W-F, Chen C-H et al. Efforts to reduce the door-to-needle time of thrombolysis in acute ischemic stroke: video-assisted therapeutic risk communication. J Formos Med Assoc 2014. PubMed Link Journal link
8. Gentry C, Baptistia J, Brown K et al. Implementation of an interdisciplinary code stroke protocol to facilitate consistent evidence based assessment and treatment of stroke patients. Stroke 2013;44:Abstr TP366. Journal link
9. Nair DS, Talkad A, McNeil C et al. Mehods to achieving a 9-minute door to TPA time. Stroke 2013;44. Journal link
10. Linzey J, Schilling-Brewer J, Thibodeaux M et al. Reducing door-to-needle time for acute ischemic stroke thrombolysis in a community hospital. Stroke 2013;44:Abstr WP339. Journal link
11. Tebbutt TD, Hammond L. tPA door to needle reduction: the impact of nurse specialists. Stroke 2013;44:Abstr P2.031.
12. Steiner NE, Wolber N, Robertson B et al. A team approach for improving door to needle time for IV t-PA in acute stroke. Stroke 2013;44:Abstr TP362. Journal link
13. Ashcraft S, Clark K, Mintmier R et al. The positive impact of role definition and communication on door to needle times in acute stroke patients receiving intravenous alteplase. Stroke 2013;44:Abstr WP334. Journal link
14. Bentaleb A, Golding L, Southee S et al. Value stream analysis reduces door-to-needle times in acute stroke. Stroke 2013;44:Abstr WP241. Journal link
15. Swartz RH, Sicard MN, Silver FL et al. The CLOQS trial protocol: a cluster-randomized trial evaluating a simple, low-cost intervention to reduce treatment times in acute stroke. Int J Stroke 2013. PubMed Link Journal link
16. Kunisawa S, Morishima T, Ukawa N et al. Association of geographical factors with administration of tissue plasminogen activator for acute ischemic stroke. J Am Heart Assoc 2013;2:e000336. PubMed Link Journal link
17. de Los Rios la Rosa, Broderick JP. Toward a modern delivery of stroke care in emerging economies. J Stroke Cerebrovasc Dis 2013;22:e1-3. PubMed Link Journal link
18. Martins SC, Pontes-Neto OM, Alves CV et al. Past, present, and future of stroke in middle-income countries: the Brazilian experience. Int J Stroke 2013;8 Suppl A100:106-11. PubMed Link Journal link
19. Shamy MC, Jaigobin CS. The complexities of acute stroke decision-making: a survey of neurologists. Neurology 2013;81:1130-3. PubMed Link Journal link
20. Boissy AR. IV tissue plasminogen activator use in acute stroke: What are neurologists thinking? Neurology 2013;81:1110-1. PubMed Link Journal link
21. Lorenzano S, Ahmed N, Tatlisumak T et al. Within-day and weekly variations of thrombolysis in acute ischemic stroke: results from safe implementation of treatments in stroke-international stroke thrombolysis register. Stroke 2014;45:176-84. PubMed Link Journal link

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22. Catangui EJ. Thrombolytic dosing in acute ischaemic stroke. Br J Nurs 2013;22:1056, 1058-6, 1060.
PubMed Link Journal link
23. Aita MC, Nguyen K, Bacon R et al. Obstacles and solutions in the implementation of telestroke: billing, licensing, and legislation. Stroke 2013;44:3602-6.
PubMed Link Journal link
24. Hill E, Whitehead M, MacInnes B et al. The first 100 thrombolysis cases in a novel Scottish mesh telestroke system. Scott Med J 2013;58:213-6.
PubMed Link Journal link
25. Khaja AM, Hoelzel SL, Shafi N et al. Telestroke is not associated with a longer door-to-needle time. Stroke 2013;44:Abstr WP249.
Journal link
26. Manning NW, Campbell BC, Oxley TJ et al. Acute ischemic stroke: time, penumbra, and reperfusion. Stroke 2014;45:640-4.
PubMed Link Journal link
27. Bivard A, Lin L, Parsons MW. Review of Stroke Thrombolytics. J Stroke 2013;15:90-8.
PubMed Link Journal link

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