

## PUBLICATION ALERT NEWSLETTER

**Please be aware that the purpose of this Newsletter is to make you familiar with the most recent scientific publications, and you must keep in mind that all aspects may not be covered by the label. Please always refer to the current prescribing information as in force in your country.**

Prompt evaluation and appropriate treatment of patients with AIS\* are dependent on the existence of efficient stroke care procedures, and on the expertise and experience of the stroke care providers. When developing strategies to improve stroke care, consideration should therefore be given to ongoing educational support and performance feedback.

In this issue of the Actilyse® Publication Alert Newsletter, we look at the benefits of educational initiatives in stroke care management. We also examine different ways in which pre-hospital and in-hospital delays may be reduced so that the proportion of eligible patients who receive rtPA within an hour of hospital arrival can be increased.

\*Abbreviations are defined at the end of the newsletter.

### EDUCATIONAL QUALITY IMPROVEMENT INITIATIVES CAN INCREASE TIMELY rtPA DELIVERY

Educational initiatives are vital components of efforts to achieve improvements in stroke care delivery. A multicentre study in the USA set out to examine whether a quality improvement initiative based on education and regular performance feedback could improve timely rtPA delivery in five rural hospitals.<sup>1</sup>

At the start of the initiative, surveyed clinicians overestimated the quality of past stroke care delivery: they believed that more than two-thirds of patients who received rtPA had it within an hour of ED arrival, when actually only one-third had.

Six months after a 1-hour educational presentation to each ED team and subsequent regular performance feedback, the proportion of eligible AIS patients who received rtPA increased to 6.8%. In addition, the proportion of eligible patients who were treated within an hour of ED arrival rose significantly to 5.2%. At the end of the initiative, more than three-quarters. The authors conclude that quality improvement initiatives have the potential to increase rtPA treatment rates. By encouraging stroke care teams to reflect on current treatment quality, make use of available education resources, and audit their performance regularly, continuous data-driven improvements in stroke care delivery can be achieved.

#### Study details

- Analysis of survey data and treatment metrics from five non-PSC rural hospitals in south-eastern USA to evaluate the impact on DNT of a four-phase quality improvement initiative conducted between May 2015 and May 2017:
  - Phase 1 (baseline assessment): survey of ED team members to identify potential areas for improvement of stroke care; retrospective analysis of hospital records to assess baseline rtPA treatment rates and DNT among patients with a discharge diagnosis of AIS (n=1651) in the 12 months prior to the intervention
  - Phase 2 (targeted education): a 1-hour Continuing Medical Education-certified presentation at each site with follow-up audioconference to discuss baseline data and barriers to timely rtPA administration
  - Phase 3 (ongoing data collection): audit and feedback on rtPA use at 2, 4, and 6 months after starting Phase 2
  - Phase 4 (follow-up): summary of changes in stroke care performance during, and on completion of, the initiative
- Baseline survey responders (n=45) cited stroke team coordination and AIS symptom recognition by triage staff as challenges to timely therapy, and suggested that ongoing education, improved staffing and better communication would improve DNT
- At baseline, clinicians overestimated the proportion of patients who had received rtPA within 60 min of ED arrival
  - Clinicians estimated that 54–92% (69% overall) of those who were treated had DNT  $\geq$ 60 min, whereas chart data indicated 0–60% (33% overall)
- In total, 266 patients with AIS who were eligible to receive rtPA were admitted to the five hospitals over a 6-month period
- The proportion of eligible patients who received rtPA with a DNT  $\leq$ 60 min increased significantly during the intervention, from 1.9% at baseline to 5.2% post-intervention ( $p < 0.01$ ) (see table)
  - The proportions of patients who received rtPA within 3 h of arrival, or in any timeframe also showed a general trend toward improvement during the intervention (see table)

### Study details (continued)

OUTCOME	BASELINE (n=1651)	POST-INTERVENTION (n=266)			p VALUE
		2 MONTHS	4 MONTHS	6 MONTHS	
DNT ≤60 min, %	1.9	2.2	2.5	5.2	<0.01
DNT ≤180 min, %	4.5	5.7	6.6	5.6	
Received rtPA in any timeframe, %	5.9	8.4	8.3	6.8	

**“Extensive clinical evidence demonstrates the importance of timely evaluation and initiation of treatment to optimal short- and long-term outcomes for patients with AIS.”<sup>1</sup>**

### EMS PRE-NOTIFICATION REDUCES IN-HOSPITAL DELAYS AND IMPROVES OUTCOMES IN PATIENTS WITH AIS

Ensuring patients are transferred as quickly as possible to the nearest hospital capable of administering appropriate stroke care is a key role of EMS responders. In addition, EMS can help to reduce in-hospital delays by notifying the receiving hospital that a patient with suspected AIS is being transported, and thus enabling the stroke team to prepare.

In a recent study at a stroke centre in China, EMS transfer was found to reduce pre-hospital delays significantly compared with non-EMS transfer.<sup>2</sup> Pre-notification resulted in significantly shorter in-hospital delays and was also associated with better patient outcomes: more than 60% of patients with EMS pre-notification had a good functional outcome at 3 months.

The authors conclude that pre-hospital notification shortens treatment delays and improves stroke outcome and is a feasible strategy for improving stroke care. Educational initiatives directed at the public and healthcare providers would help to increase the number of AIS patients who travel to hospital via EMS with pre-notification, and potentially improve access to timely care.

#### Study details

- Analysis of registry data from 182 patients with AIS who received rtPA at an urban stroke centre in China (Mar 2015–Mar 2016), to evaluate the impact on in-hospital delays and patient outcomes of an EMS pre-hospital notification protocol
  - Patients arriving with pre-notification were transferred to the imaging room immediately after blood draw by ED nurses, whereas all other patients with suspected AIS underwent ED triage while awaiting stroke team preparation
  - 105/182 patients (58%) arrived by non-EMS transfer
- The decision to use pre-notification for EMS-transported patients was made by on-ambulance paramedics
  - 36 EMS-transported patients arrived without pre-notification, whereas 41 arrived with pre-notification
- Patients arriving by EMS (with or without pre-notification) had significantly shorter onset-to-door time, ONT, DNT, door-to-imaging time and ED duration than non-EMS patients (all  $p \leq 0.001$ )
- EMS with pre-notification was associated with significantly shorter in-hospital delays than EMS without pre-notification
  - DNT, door-to-imaging time and ED duration were all reduced (see table)
- EMS with pre-notification was associated with good neurological outcome in multivariate analysis (OR: 2.6; 95% CI: 1.1–6.4;  $p=0.04$ ); this association was driven by the shorter ONT in this group

OUTCOME	NON-EMS (n=105)	EMS WITHOUT PRE-NOTIFICATION (n=36)	EMS WITH PRE-NOTIFICATION (n=41)	p VALUE*
Time metric, mean (SD) min				
Onset-to-door	175 (105)	130 (83)	133 (90)	n.s.
ONT	231 (109)	182 (98)	175 (93)	n.s.
Duration in ED	21 (14)	16 (10)	9 (6)	<0.001
Door-to-imaging	30 (16)	26 (12)	18 (7)	0.001
Imaging-to-needle	16 (9)	17 (13)	15 (8)	n.s.
DNT	57 (18)	52 (24)	41 (11)	0.017
Neurological outcome, n (%)				
3-month mRS score 0–2	58 (55)	15 (42)	26 (63)	n.s.
SICH	1 (1)	2 (6)	1 (2)	n.s.
Death	12 (11)	6 (17)	3 (8)	n.s.

\*EMS with pre-notification vs EMS without pre-notification

**“Prehospital notification procedure significantly improved stroke outcome by shortening the time from stroke onset to treatment.”<sup>2</sup>**

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## NURSE-DRIVEN STROKE CARE MANAGEMENT CAN REDUCE IN-HOSPITAL TREATMENT DELAYS

Adding nurse case managers to stroke care teams can reduce in-hospital treatment delays and improve thrombolysis outcomes. A hospital in Thailand compared outcomes among patients with AIS who received standard stroke team care with those whose care was managed by a designated nurse.<sup>3</sup> When nurse case managers were involved in acute care, mean DNT was reduced by 20 minutes (to less than 40 minutes) and post-stroke outcomes were substantially better.

The authors conclude that nurse case management provides some benefits in acute stroke care and may improve patient outcomes, and they recommend its implementation in stroke care systems.

### Study details

- Prospective, controlled study of 76 patients with AIS who received rtPA within 4.5 h of symptom onset at a university hospital in Thailand (after March 2014), to assess the impact on clinical outcomes of nurse case management
  - Patients received either standard stroke team care or additional nurse case management
- The nurse case manager was added to the stroke care team to improve the efficiency and effectiveness of patient care
  - Nurse case managers were involved in each step of the stroke care protocol, starting from stroke team alert and ending (for patients eligible for rtPA) with patient transfer out of the stroke unit
  - Roles included: assisting the stroke team physician with data gathering and interpretation; reducing delays in CT scanning; liaising with the patient and their family; facilitating assessment of rtPA eligibility (completing indication and contraindication checklists); administering rtPA; and monitoring vital/neurological signs during and after thrombolysis
- Compared with standard stroke team care, nurse case management was associated with shorter in-hospital delays and better outcomes at 24 h post-treatment (see table)
  - No cases of SICH were detected
  - The effect of nurse case management was not dependent on patient age, risk factors, onset time or stroke severity

OUTCOME	NON-NURSE-MANAGED (n=38)	NURSE-MANAGED (n=38)	p VALUE
Onset-to-door time, mean (SD)	113 (51)	119 (49)	0.994
DNT, mean (SD) min	59 (0.8)	39 (0.7)	<b>0.001</b>
ONT, mean (SD) min	179 (16.5)	163 (16.0)	<b>0.013</b>
Pre-treatment NIHSS score, mean (SD)	14.2 (6.68)	13.2 (6.23)	0.513
Post-treatment (24-h) NIHSS score, mean (SD)	12.4 (7.67)	6.7 (6.39)	<b>0.001</b>

## INNOVATIVE IMAGING PROTOCOLS CAN REDUCE IN-HOSPITAL TREATMENT TIMES

Streamlining in-hospital processes can successfully reduce treatment delays for patients with AIS. For example, performing imaging and treatment in the same room can lead to improvements in door-to-CT, DNT and door-to-reperfusion times.

Psychogios *et al.* implemented a 'one-stop management' protocol that improved in-hospital treatment times in patients with acute large-vessel occlusion by bypassing conventional CT imaging in favour of performing flat-detector CT imaging and administering treatment (rtPA and/or mechanical thrombectomy) in the angio suite.<sup>4</sup> Using this protocol, door-to-CT time was reduced to less than 10 minutes, DNT to 20 minutes, door-to-groin puncture time to 21 minutes, and door-to-reperfusion time to 65 minutes.

The authors conclude that combining imaging and treatment of patients with suspected large-vessel occlusion in one room, using a one-stop management protocol, is feasible, safe and shortens in-hospital treatment and reperfusion times.

### Study details

- Retrospective, observational study of 30 consecutive patients admitted to a US hospital with suspected large-vessel occlusion (AIS onset within 5 h and NIHSS score  $\geq 10$ ) (Jun–Dec 2016), to assess the effect of a 'one-stop management' protocol
  - Under the new protocol, patients bypassed conventional multidetector CT imaging and were instead transported directly to the angio suite for flat-detector CT imaging and treatment (if indicated) in the same room
  - Outcomes were compared with those of 44 patients who received conventional CT imaging in the 6 months before the new protocol being implemented (Jan–Jun 2016)
- The one-stop management protocol was associated with significant reductions in a variety of in-hospital metrics (see table)
  - Door-to-CT time was reduced to <10 min, while door-to-groin puncture or -reperfusion times decreased by >30 min
- Rates of SICH were similar after conventional CT (7%) and one-stop management (4%)

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## Study details (continued)

TIME METRIC, MEDIAN (IQR) MIN	CONVENTIONAL CT (n=44)	ONE-STOP MANAGEMENT (n=30)	p VALUE
Door-to-CT	14 (9–21)	9.5 (6–12)	<b>0.008</b>
Door-to-rtPA	26 (17.5–40.5)	20 (14.5–21)	0.06
Door-to-groin puncture	54.5 (45–66)	20.5 (17–27)	<b>&lt;0.001</b>
Door-to-reperfusion	106 (88–121)	65 (53–96.5)	<b>&lt;0.001</b>
CT-to-reperfusion	86 (70–104)	55 (42–79)	<b>0.006</b>

## MOBILE STROKE UNITS ADVANCE PRE-HOSPITAL STROKE CARE BY ENABLING HYPERACUTE TREATMENT

The use of mobile stroke units (MSUs) for hyperacute stroke treatment was first proposed in 2003. The subsequent worldwide development of MSUs has been reviewed by Calderon *et al.* Their review summarizes the implementation, staffing, technology, costs and clinical outcomes associated with MSUs.<sup>5</sup>

- 14 MSUs have been launched successfully worldwide since 2010 (3 in Europe, 10 in North America and 1 in South America)
- Integration of MSUs into existing EMS chains requires multidisciplinary cooperation and training; test periods are useful
- On-board teams typically include a paramedic, an emergency medical technician, a critical care nurse and – in person or via telemedicine – a vascular neurologist
- On-board technology includes a CT scanner, point-of-care laboratory system and telemedicine capability
- MSUs have large start-up costs but may be cost-effective over the long term
- Available data suggest MSUs reduce ONT and DNT; more evidence regarding functional outcomes is needed

The authors conclude that implementation of MSUs is feasible around the world. Shortened time metrics are expected as MSUs continue to improve their methods, resulting in more patients who will benefit from faster treatment in the pre-hospital field.

**“Providing treatment as early as possible, including within the prehospital phase of stroke management, improves patient outcomes.”<sup>5</sup>**

AIS, acute ischaemic stroke; CI, confidence interval; CT, computed tomography; DNT, door-to-needle time; ED, emergency department; EMS, emergency medical services; IQR, interquartile range; mRS, modified Rankin Scale; MSU, mobile stroke unit; NIHSS, National Institutes of Health Stroke Scale; n.s. not significant; ONT, onset-to-needle time; OR, odds ratio; PSC, Primary Stroke Centre; rtPA, recombinant tissue plasminogen activator; SD, standard deviation; SICH, symptomatic intracranial haemorrhage.

## References

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