



## ORIGINAL ARTICLE

### Factors associated with in-hospital delays in treating acute stroke with intravenous thrombolysis in a tertiary centre<sup>☆</sup>



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#### KEYWORDS

Intravenous thrombolysis;  
Door-to-needle time;  
Computed tomography angiography;  
Ischaemic stroke;  
Three-hour effect;  
In-hospital delays

#### Abstract

**Objective:** This study aims to determine which factors are associated with delays in door-to-needle (DTN) time in our hospital. This will help us design future strategies to shorten time to treatment with intravenous thrombolysis (IVT).

**Methods:** Retrospective analysis of a prospective cohort of patients with ischaemic stroke treated with IVT in our hospital between 2009 and 2012. We analysed the relationship between DTN time and the following variables: age, sex, personal medical history, onset-to-door time, pre-hospital stroke code activation, blood pressure and blood glucose level, National Institutes of Health Stroke Scale (NIHSS), computed tomography angiography (CTA) and/or doppler/duplex ultrasound (DUS) performed before IVT, time to hospital arrival, and day of the week and year of stroke.

**Results:** Our hospital treated 239 patients. Median time to treatment in minutes (IQR): onset-to-door, 84 (60–120); door-to-CT, 17 (13–24.75); CT-to needle, 34 (26–47); door-to-needle, 52 (43–70); onset-to-needle, 145 (120–180). Door-to-needle time was significantly shorter when code stroke was activated, at 51 vs. 72 min ( $P=0.008$ ), and longer when CTA was performed, at 59 vs. 48.5 min ( $P=0.004$ ); it was also longer with an onset-to-door time <90 min, at 58 vs. 48 min ( $P=0.003$ ). The multivariate linear regression analysis detected 2 factors affecting DTN: code stroke activation (26.3% reduction;  $P<0.001$ ) and onset-to-door time (every 30 min of onset-to-door delay corresponded to a 4.7 min increase in DTN time [ $P=0.02$ ]). On the other hand, CTA resulted in a 13.4% increase in DTN ( $P=0.03$ ). No other factors had a significant influence on door-to-needle time.

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**PALABRAS CLAVE**

Trombólisis intravenosa;  
 Tiempo puerta-aguja;  
 Ictus isquémico;  
 Efecto de las 3 horas;  
 Angio-TC;  
 Retraso intrahospitalario

**Conclusions:** This study enabled us to identify CTA and the ‘‘3-hour effect’’ as the 2 factors that delay IVT in our hospital. In contrast, activating code stroke clearly reduces DTN. This information will be useful in our future attempts to reduce door-to-needle times.

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### Identificación de los factores que influyen en el retraso intrahospitalario del inicio de trombólisis intravenosa en el ictus agudo en un hospital terciario

**Resumen**

**Objetivo:** Identificar los factores que influyen en el tiempo puerta-aguja (tiempo P-A) en la administración de trombólisis intravenosa (TIV) en un hospital terciario para diseñar futuras estrategias que acorten los tiempos.

**Métodos:** Estudio retrospectivo de pacientes tratados con TIV entre 2009 y 2012. Analizamos la relación entre el tiempo P-A y los siguientes factores: edad, sexo, antecedentes personales, tiempo inicio-puerta, activación de código ictus extrahospitalario (CIE), glucemia y presión arterial basal, NIHSS basal, realización de angio-TC o estudio neurosonológico previo, hora de llegada al hospital, día de la semana y año del ictus.

**Resultados:** Hubo un total de 239 pacientes tratados. Tiempos de actuación en min (mediana [rango intercuartílico]): tiempo inicio-puerta 84 (60-120); tiempo puerta-TC 17 (13-24,75) tiempo TC-aguja 34 (26-47); tiempo puerta-aguja 52 (43-70); tiempo inicio-aguja 145 (120-180). El tiempo P-A fue significativamente menor con la activación del CIE: 51 vs. 72 ( $p=0,008$ ), y mayor con la realización de angio-TC: 59 vs. 48,5 ( $p=0,004$ ) y con tiempo inicio-puerta <90 min: 58 vs. 48 ( $p=0,003$ ). En el análisis de regresión lineal múltiple 2 factores redujeron significativamente el tiempo P-A: la activación de CIE (reducción = 26,3%;  $p < 0,001$ ) y el tiempo inicio-puerta (por cada 30 min de tiempo inicio-puerta, el tiempo P-A se acortó 4,7 min;  $p=0,02$ ). Por el contrario realizar una angio-TC aumentó un 13,4% el tiempo P-A ( $p=0,03$ ). Los demás factores no influyeron significativamente en el tiempo P-A.

**Conclusiones:** La realización de angio-TC y el «efecto de las 3 h» son 2 factores que retrasan el inicio de la TIV en nuestro hospital. Por el contrario el CIE reduce claramente los tiempos P-A. Los resultados de este estudio nos han permitido identificar qué factores retrasan nuestra actuación y servirán en un futuro para intentar disminuir los tiempos P-A en nuestro hospital.

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**Introduction**

Clinical trials have shown that early administration of intravenous thrombolysis (IVT) with recombinant tissue plasminogen activator (rt-PA) for acute ischaemic stroke results in better outcomes than a placebo.<sup>1,2</sup>

The established therapeutic window for this drug is 4.5 hours<sup>2</sup>; however, the effectiveness of this treatment is time-dependent and decreases as time from symptom onset to treatment administration increases (onset-to-needle time, OTN time). Researchers have shown that the number needed to treat to obtain an optimal functional outcome (scores on the modified Rankin Scale of 0 to 1) increases by 1 for every 20 minutes elapsed from symptom onset to treatment administration.<sup>3</sup> Therefore, thrombolytic treatment should be administered as early as possible avoiding unnecessary delays. Every minute may be decisive for the patient's functional outcome, as we gather from the aphorism ‘time is brain’.<sup>4</sup>

The time elapsed between the patient's arrival at the hospital and receiving IVT (door-to-needle time [DTN time]) depends directly on each hospital's specialists and set protocols. According to the latest recommendations from the

American Heart Association (AHA), DTN time should not exceed 60 minutes.<sup>5</sup> In the past few years, several studies analysing the reasons for in-hospital delays in IVT administration have been published. We also find results from protocols that have managed to safely and significantly reduce times to well below the recommended 60-minute threshold.<sup>5</sup> Healthcare systems currently consider DTN time a quality control parameter for in-hospital care.<sup>8</sup> Reducing these times depends not only on a trained, coordinated multidisciplinary team for stroke care, but often on technical and administrative improvements in the hospital as well.

Our aim is to analyse the factors impacting in-hospital delays in IVT administration at our centre. These data could be instrumental in the design of a protocol to reduce DTN times in the future.

**Patients and methods**

We conducted a retrospective analysis of a prospective registry of patients treated with IVT between January 2009 and December 2012 in the stroke unit of a tertiary-care hospital in Madrid which provides care to a population of

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