



## ORIGINAL ARTICLE

### Code stroke in Asturias<sup>☆</sup>



L. Benavente<sup>a,\*</sup>, M.J. Villanueva<sup>b</sup>, P. Vega<sup>c</sup>, I. Casado<sup>d</sup>, J.A. Vidal<sup>e</sup>, B. Castaño<sup>f</sup>,  
M. Amorín<sup>g</sup>, V. de la Vega<sup>h</sup>, H. Santos<sup>i</sup>, A. Trigo<sup>b</sup>, M.B. Gómez<sup>b</sup>, D. Larrosa<sup>a</sup>,  
T. Temprano<sup>d</sup>, M. González<sup>a</sup>, E. Murias<sup>c</sup>, S. Calleja<sup>a</sup>

<sup>a</sup> Servicio de Neurología, Hospital Universitario Central de Asturias, Oviedo, Spain

<sup>b</sup> Servicio de Asistencia Médica Urgente de Asturias, Spain

<sup>c</sup> Servicio de Radiología, Hospital Universitario Central de Asturias, Oviedo, Spain

<sup>d</sup> Sección de Neurología, Hospital de Cabueñes, Gijón, Spain

<sup>e</sup> Sección de Neurología, Hospital San Agustín, Avilés, Spain

<sup>f</sup> Sección de Neurología, Hospital Valle del Nalón, Langreo, Spain

<sup>g</sup> Sección de Neurología, Fundación Hospital de Jove, Gijón, Spain

<sup>h</sup> Sección de Neurología, Hospital Álvarez Buylla, Mieres, Spain

<sup>i</sup> Servicio de Medicina Interna, Sección de Neurología, Hospital de Jarrio, Coaña, Spain

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#### Abstract

**Background:** Intravenous thrombolysis with alteplase is an effective treatment for ischaemic stroke when applied during the first 4.5 hours, but less than 15% of patients have access to this technique. Mechanical thrombectomy is more frequently able to recanalise proximal occlusions in large vessels, but the infrastructure it requires makes it even less available.

**Methods:** We describe the implementation of code stroke in Asturias, as well as the process of adapting various existing resources for urgent stroke care in the region. By considering these resources, and the demographic and geographic circumstances of our region, we examine ways of reorganising the code stroke protocol that would optimise treatment times and provide the most appropriate treatment for each patient.

**Results:** We distributed the 8 health districts in Asturias so as to permit referral of candidates for reperfusion therapies to either of the 2 hospitals with 24-hour stroke units and on-call neurologists and providing IV fibrinolysis. Hospitals were assigned according to proximity and stroke severity; the most severe cases were immediately referred to the hospital with on-call interventional neurology care. Patient triage was provided by pre-hospital emergency services according to the NIHSS score.

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\* Corresponding author.

E-mail address: [lb.f.benfer@gmail.com](mailto:lb.f.benfer@gmail.com) (L. Benavente).

**PALABRAS CLAVE**

Código ictus;  
Áreas sanitarias;  
Gravedad-tiempo;  
Fibrinólisis;  
Trombectomía

*Conclusions:* Modifications to code stroke in Asturias have allowed us to apply reperfusion therapies with good results, while emphasising equitable care and managing the severity-time ratio to offer the best and safest treatment for each patient as soon as possible.

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**El código ictus de Asturias****Resumen**

*Introducción:* La trombólisis intravenosa con alteplasa es un tratamiento efectivo para el ictus isquémico si se aplica dentro de las primeras 4,5 horas, pero al que acceden <15% de los pacientes. La trombectomía mecánica recanaliza más obstrucciones proximales en las grandes arterias, pero necesita una infraestructura que la hace menos disponible.

*Métodos:* Se detalla la evolución del código ictus en el Principado de Asturias y la adaptación del mismo a los sucesivos recursos para la atención urgente al ictus en la región. Teniendo en cuenta dichos recursos, las circunstancias poblacionales y geográficas de nuestra región, se plantea la reorganización del código ictus buscando la optimización del tiempo y la adecuación a cada paciente.

*Resultados:* Reparto de las ocho áreas sanitarias de Asturias para derivar los pacientes candidatos a tratamientos de reperusión hacia los dos hospitales donde se dispone de Unidad de Ictus y guardia de Neurología, con posibilidad de aplicar la fibrinólisis IV. Este reparto se realizó en función de la proximidad y la gravedad de los mismos, derivando todos los casos más graves directamente al hospital que dispone de guardia de Neuroradiología Intervencionista. El cribado del paciente se realizó por los Servicios de Emergencias Extrahospitalarias según la escala NIHSS.

*Conclusiones:* Las modificaciones en el código ictus de Asturias permiten ofrecer tratamientos recanalizadores con buenos resultados, buscando la equidad y optimizando el manejo del binomio gravedad-tiempo para ofrecer a cada paciente el tratamiento óptimo en el menor plazo de tiempo posible y en condiciones de seguridad.

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**Introduction**

Stroke is the most frequent cause of permanent disability in adults and one of the leading causes of death both in Spain and throughout the Western world, resulting in enormous personal suffering and a high cost to society.<sup>1</sup> In the case of Spain, the cumulative incidence of cerebrovascular disease per 100 000 people older than 24 years has risen to 218 new cases in men and 127 in women.<sup>2</sup>

Intravenous thrombolysis with tissue plasminogen activator (tPA) is an effective treatment for acute ischaemic stroke if administered within 4.5 hours from symptom onset.<sup>3</sup> In the case of proximal large-vessel occlusion, however, mechanical thrombectomy appears to be more effective, although until now no studies have provided conclusive evidence.<sup>3–10</sup> In any case, the sooner these treatments are administered, even within the time window, the greater their effectiveness.<sup>11</sup>

Code stroke is a system of patient identification and follow-up whose objective is to ensure that acute stroke patients have access to a cerebrovascular reference centre in the minimum time possible. This system requires that emergency services, primary care centres, and local hospitals of a specific area work in close coordination with the

stroke reference centre, where specialised seamless care is offered to patients.<sup>12</sup>

Occasionally, treatments directed towards rapid and effective arterial recanalisation are based on advanced interventional neuroimaging or neuroradiology techniques, which are only available at tertiary centres. Therefore, code stroke should include several levels of care, or types of healthcare centres, to provide the most suitable treatment for each case.<sup>13</sup>

Code stroke has been proven to be effective, reducing time from symptom onset to diagnosis and specialised treatment, as well as increasing the number of patients attended in stroke units and those treated with fibrinolytics.<sup>14</sup>

**Public healthcare resources in Asturias**

Asturias is a single-province autonomous community with a total area of 10 603.57 km<sup>2</sup> and 1 068 165 inhabitants (according to 2014 data from Spain's National Statistics Institute). This region has the highest mortality rate in Spain (11.77 deaths per 1000 population) and the lowest birth rate (6.91 births per 1000 population), which results in a negative growth rate and progressive population ageing. The

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